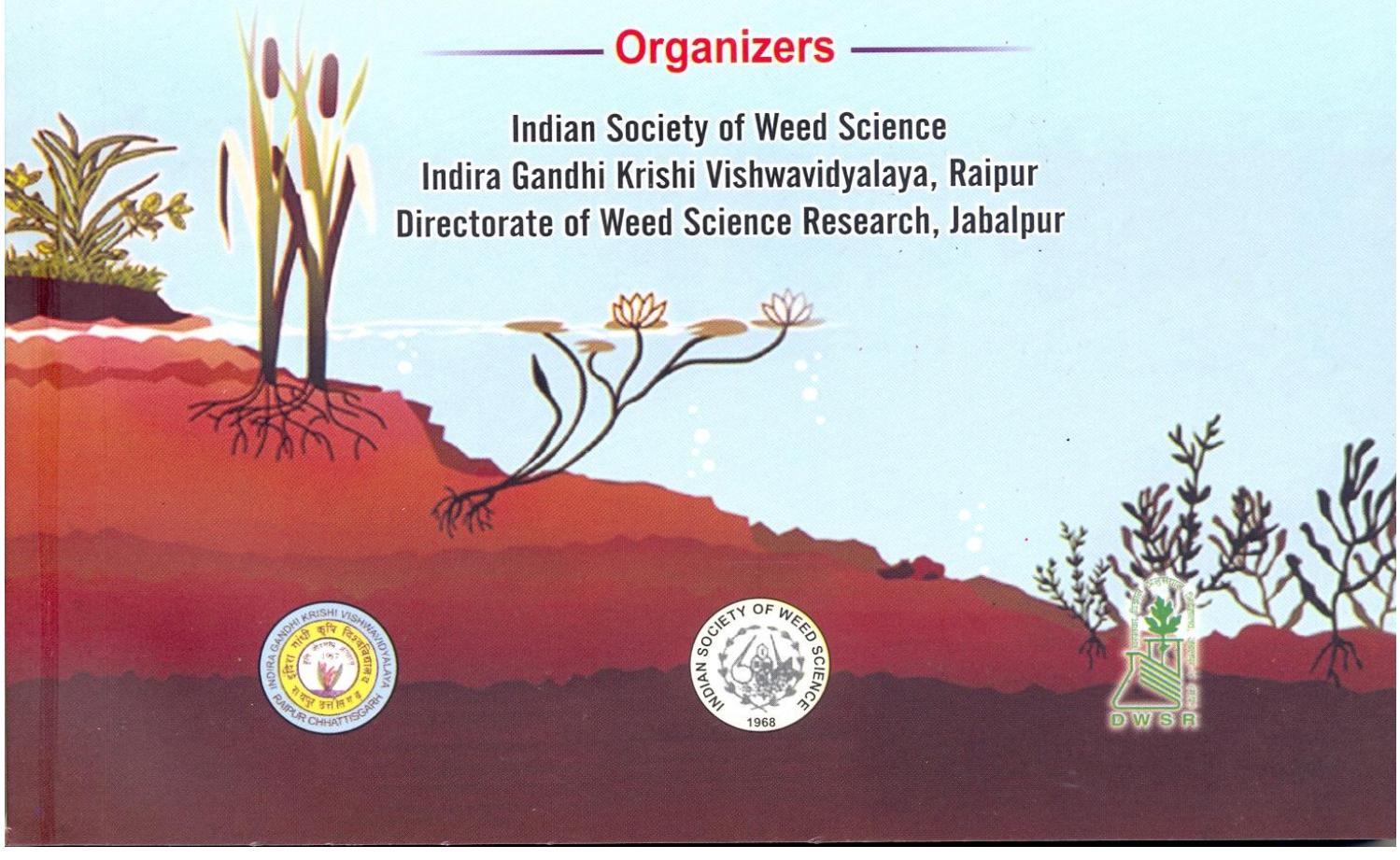
Biennial Conference on

Recent Advances in Weed Science Research-2010

25-26 February, 2010

Venue : Indira Gandhi Krishi Vishwavidyalaya, Raipur

Extended Summaries / Abstracts



Organizers

Indian Society of Weed Science
Indira Gandhi Krishi Vishwavidyalaya, Raipur
Directorate of Weed Science Research, Jabalpur

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Editors

Jay G. Varshney
Sushilkumar

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Indira Gandhi Krishi Vishwavidyalaya, Raipur
Directorate of Weed Science Research, Jabalpur

Content

Invited Lectures

L-1 Current status of quarantine weeds detected in imported wheat

Jay G. Varshney and V. S. G. R. Naidu
Directorate of Weed Science Research, Jabalpur (M.P.)
e-mail : varshneyjg@gmail.com

Many regions of the country have flora that contain a high proportion of introduced species. Some of them become aggressive weeds in their new surroundings and succeed rapidly in invading particular habitat and replacing indigenous species. This can lead to loss of biodiversity. The weed problems will likely to increase due to increased emphasis on high input agriculture. Globalization may bring new weed problems while importing or exporting agricultural commodities as per the WTO agreement which may endanger the biodiversity. Alien invasive species as per Convention on Biological Diversity are biggest threat to biodiversity next only to human resettlement. These species seem to invade habitats that have been already altered by humans, such as agricultural fields, grazing lands, human settlements and roadways. In the past alien or non-native plant species were intentionally introduced for direct benefits without proper risk assessment regarding their becoming invasive under favourable conditions. On introduction, exotic weeds such as *Lantana camara* in the early 19th century from Central America, *Parthenium hysterophorus* from central and South America, and *Phalaris minor* from Mexico in mid 20th century into India turned into endemic sources of threat to our crop production and environment. These facts bring home strikingly the significance of plant quarantine in order to restrain or regulate the introduction of exotic plant species and other pests in new areas. Government of India through a Gazette notification listed the weeds of quarantine significance and placed a prohibition on the import of commodities contaminated with those weeds and/or alien species. To be classified as a quarantine weed, a weed species needs to be "*a pest of potential economic importance to the area endangered thereby and (either) not yet present there, or present but not widely distributed and being officially controlled*" (FAO, 1993). Being under "*official control*" in this context is taken to mean that they are on a published list of Declared or Noxious Plants or Prohibited Plants and are subject to control by or under the legislated instruction of government. To prevent entry of exotic weeds GOI has notified 31 quarantine weeds in **Schedule-VIII** of ***Plant Quarantine (Regulation of Import into India) Order, 2003*.** The import of wheat in India for consumption purpose is regulated from phytosanitary point of view under Plant Quarantine (Regulation of import in India) order, 2003. Imported wheat should be free from quarantine weeds listed in schedule VIIIth of this order. To meet the food security in the country Govt. of India has permitted import of wheat with relaxed phytosanitory conditions**.**

The Govt. of India has imported 6.2 million tons of wheat from different countries during the year 2006-07. In the consignments, seeds of several exotic weeds, including five weeds notified as quarantine weeds in India, were intercepted. These weeds were identified as *Cenchrus tribuloides, Solanum carolinense, Cynoglossum officinale, Ambrosia trifida* and *Viola arvensis*. Based on the risk assessment reports some of these weeds are found to have high level of introduction, establishment and spread potentials and economic consequences. As the imported wheat has been distributed for public consumption in non-wheat growing areas, A National Invasive Weed Surveillance (NIWS) Programme is being implemented with the join efforts of Department of Plant Protection, Quarantine and Storage (DPPQS) of Ministry of Agriculture, GOI and Directorate of Weed Science Research (DWSR) of ICAR. Implementation of this programme is necessitated because the unrestricted distribution of wheat through public distribution system with multiple rural outlets may pose serious threat to the wheat growing areas; Import of wheat by private traders is not movement restrictive; understanding by the private traders on Phytosanitary issues related to spread of exotic pests is almost negligible and majority of quarantine weed seeds intercepted through imported wheat consignment (even within the permissible limit) have the capacity of germination in non wheat growing areas also and further spread to wheat growing areas through air, water, transport, planting materials, etc. This programme has been initiated during 2008 and is being carried out in ten states viz. Andhra Pradesh, Tamil Nadu, Karnataka, Kerala, West Bengal, Orissa, Gujarath, Maharashtra, Chattisgarh and Madhya Pradesh involving extensive surveys

and rigorous monitoring to detect the establishment of the intercepted quarantine weeds such as *Cenchrus tribuloides, Solanum carolinense, Cynoglossum officinale, Ambrosia trifida* and *Viola arvensis* besides giving emphasis to create awareness among the people about effects caused by the Invasive alien plant species. After the commencement of the programme the DWSR, the head quarter of the programme, organized trainings to the personnel working in the programme to educate them regarding the importance of the programme, details about the intercepted exotic weeds, methodologies and protocols of survey and awareness programmes.

Within less than two years after the initiation of the programme, some of these five weeds were detected at certain locations. The detection and identification of *Solanum carolinense* was reported by TNAU, Coimbator, UAS, Bangalore and Vishwabharathi, Sriniketan and the identity of the species was confirmed by Botanical Survey of India. In addition detection of the species similar to *Solanum carolinense*, *Cenchrus tribuloides*, *Cyanoglosum officinale,* and *Ambrosia trifida* was also reported and these specimen need to be identified by BSI. The tough task of handling this mega project was taken up by DWSR with the confidence of having efficient team of scientists and associated personnel and the trusted team has delivered the output beyond the expectations. But, we have to be prepared to take up a great challenge of finding ways and strategies to contain the detected quarantine weeds.

L - 2

Herbicide tolerant genetically modified crops-retrospect and prospects in India

N. P. Singh and Indu Singh Yadav
Indian Institute of Pulses Research, Kanpur (U.P.)
e-mail : aicrpciipr@yahoo.co.in

A genetically modified (GM) crop is a plant used for agricultural purposes into which one or several genes coding for desirable traits have been inserted through the process of genetic engineering. The basic techniques of plant genetic engineering were developed in the early 1980s, and the first GM crops became commercially available in the mid-1990s. Since then, GM crop adoption has increased rapidly. In 2008, GM crops were being grown on 9% of the global arable land. The commercial application of GM crops began in the mid-1990s. Since then, the technology has spread rapidly around the world, both in industrialized and developing countries. In 2008, GM crops were being grown on 125 million ha in 25 countries. The countries with the biggest share of the GM crop area were the United States (50%), Argentina (17%), Brazil (13%), India (6%), Canada (6%), and China (3%) (James 2008). Strikingly, among the countries of the European Union (EU), only Spain grows GM crops on a significant scale. Although a few other EU countries have approved individual GM technologies, the commercial area is still negligible, because of public acceptance problems and unfavorable regulatory frameworks. Genetically modified crops are the most rapidly adopted technology in agricultural history due to the social and economic benefits these crops may offer. Crops that are genetically altered to be tolerant to herbicide, followed by crops resistant to insects, were the first agricultural biotechnology inventions successfully commercially exploited worldwide. Until the emergence of genetically modified crops, selective herbicides (herbicides that only kill a specific weed) were the answer. Resistance to broad-spectrum herbicides depends upon the genes that have been inserted into the crop plant. The herbicide tolerance (HT) in soybeans, made up 53% of the global GM crop area in 2008. HT soybeans are currently grown mostly in the United States, Argentina, Brazil, and other South American countries. This technology accounts for 70% of worldwide soybean production. GM maize is the second-most dominant crop and covered 30% of the global GM area and 24% of total maize production in 2008. GM maize involves HT and insect resistance.HT crops are tolerant to certain broad-spectrum herbicides such as glyphosate and glufosinate, which are more effective, less toxic, and usually cheaper than selective herbicides. In terms of the yields achieved, no significant difference between HT and conventional crops is seen in most cases. Only in a few examples when certain weeds were difficult to control with selective herbicides did the adoption of HT and the switch to broad-spectrum herbicides result in better weed control and higher crop yields. Currently, the agricultural GM market is dominated by a single company, Monsanto. Monsanto produces approximately 90% of genetically engineered crops worldwide. This most likely reflects the ownership by Monsanto of patents on the *bar* gene which confers herbicide resistance as well as patent ownership of various *Bt* toxin genes for insect resistance. Another four companies, Syngenta, Bayer Crop Science, Dow and DuPont produce the remaining 10% of transgenic crops. All major herbicide companies have research programs to incorporate herbicide tolerance through genetic engineering in crops. Success has been achieved with several herbicides. In major crops like: corn, soybean, wheat, rice, cotton, canolla and tobacco.

Overall, HT technology reduces the cost of production through lower expenditures for herbicides, labor, machinery, and fuel. Yet, because HT crops were developed and commercialized by private companies, a technology fee is charged on seeds, which varies among crops as well as countries. The average gross margin gains through HT soybean adoption are in a magnitude of more than $20 per ha for Argentina.Thus, herbicide resistance will require reducing reliance on herbicides as the primary tool for weed management and developing integrated weed management systems that require the substitution of human intellect and skill for chemical technology. At present, there is no HT-GM commercialized in India. However, there is ample of opportunities for developing and commercializing HT-GM in crops like soybean, wheat and rice in India due to heavy losses incurred because of weed problem, high cost of weedicide and increased labor cost in mechanical/manual weed control.

L - 3

Current status of zero tillage in weed management

V. Pratap Singh

G.B. Pant University of agriculture and Technology, Pantnagar (Uttarakhand)

e-mail : vpratapsingh@rediffmail.com

Rice-Wheat systems provide the staple grain supply for a large portion of the world's population, mainly these systems critically important for global food security. In South Asia, rice–wheat systems produce more than 30% of the rice and 42% of wheat consumed and cover about 14 mha of cultivated land, with most of the area located in India and the Indo-Gangetic Plain (IGP). Twenty five per cent of the total rice area of the country is grown in rotation involving wheat, whereas 40 per cent of wheat is grown in rotation with rice. Recent studies indicate a slow down in the productivity of growth in the rice-wheat system of India and delayed sowing and weeds are the main constraint out of others. In general, season long competition from major weeds culminates in yield reduction to an extent of 15-40% (Singh *et al.,* 1997).

The innovation of zero tillage devices advances the wheat sowing 15 to 20 days and also cuts the production cost of wheat in rice-wheat cropping system. Zero tillage adopted by the farmers can saves Rs. 2000 to 2500 per hectare compared to conventional tillage, which can make savings and stabilize profits for farming community (Bharadwaj *et a*l., 2004, Singh *et al.,* 2007). Zero tillage of wheat may lead to early emergence of wheat and no or less soil disturbance in the uncropped area resulted in less and late emergence of weeds (especially *P. minor*). Malik *et al*., (1998) reported that in fields with problematic weeds the saved time in ZT could be used for stimulating weed emergence followed by effective control with a nonselective or selective herbicide. The success of zero tillage technology will greatly improve the chances of increasing cropping intensity. Reluctance on the part of farming community in adoption of zero tillage wheat in a large area is mainly due to associated with management of weeds. Bhardwaj *et al.,* 2004, found that the potential yield of wheat was increased up to 8 % at pantnagar. ZT and CT have been compared in number of field experiments over the years. When the crop under the two systems is sown on same date, yield is at par or slightly higher under ZT. Trials conducted at 5 locations in IGP under NATP show yield at par at Ludhiana and higher under ZT at other four locations (Fig. 1).

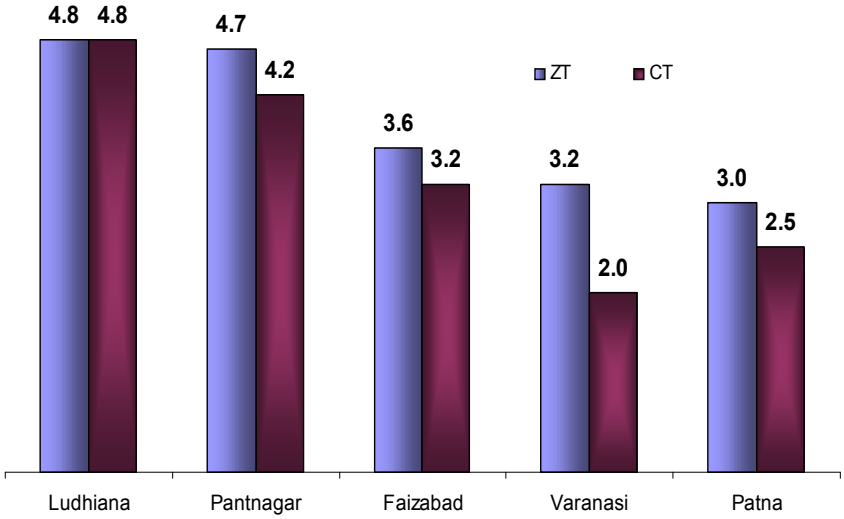

Fig.1: Wheat yield (tha^{-1}) under two tillage systems at five different locations

Both long-term trial and farmers' field surveys suggest a change in the weed spectrum in ZT wheat fields. Malik *et al.,* (1998) found a change in the weed spectrum in ZT wheat fields particularly an increase in the population of broad leaved weeds. Singh *et al.,* (2002 b) found in his long tem experiment in Karnal (Haryana) that the intensity of *P. minor* decreased by 30-40% in ZT when compared to conventional tillage, while the intensity of broad leaved weeds increased. Laxmi *et al*., (2003), reported that 51% of farmers in Haryana and 85% of farmers in Bihar perceived that weed infestation had decreased due to adoption of ZT in Wheat. The lower *P.minor* population and dry weight was recorded under ZT and higher under conventional tillage system of wheat cultivation. The less weed problem under ZT may be due to less soil disturbance helping in keeping the weed seeds at depth from where it could not germinate. Unchecked weed growth during crop season caused maximum yield loss in conventional tillage.

Chemicals used in Zero tillage (ZT)

In zero tillage, herbicides functions are extended and the herbicides use for weed control in conventional tillage is not expected to be essentially suitable for zero tillage also in view of varying weed intensity and flora. Hence, it is of paramount importance to work out weed management technology in zero tilled wheat.

Bio-efficacy of different herbicides was tested under ZT condition Recommended herbicide isoproturon 1 kg/ha was compared with its higher rates and other herbicides *viz.*, clodinafop, sulfosulfuron and manual weeding. Application of any of the herbicides, isoproturon, clodinafop or sulfosulfuron effectively controlled the weeds. Wheat yield was obtained at par with application of isoproturon 1kgha^{-1}, clodinafop 60 g ha^{-1} and sulfosulfuron 25 g/ha^{-}. Thus weed management ZT sown wheat was same as crop sown after conventional tillage.

Thus, ZT primarily has positive environmental impacts and this would enhance the social returns to the research and development investment. However, further research, some of it already initiated, is needed to substantiate these impacts more rigorously. At the same time, the current use of ZT only for wheat limits the extent of some of the potential environmental gains. Environmental gains are likely when the whole rice-wheat system converts to year round conservation agriculture.

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Weed management in organic farming research

Kamta Prasad, Chandra Bhanu and B. Gangwar
Project Directorate for Farming Systems Research, Modipuram, Meerut (U.P.)
e-mail : kamta_pdfsr@rediffmail.com

Weeds are one of the most difficult and cost-consuming pest problems in case of organic farming. Management of weeds is regarded as the main technical problem after nitrogen management, which affects economic viability of the system. Hand weeding is still a predominant method for managing the weeds in organic farming in developing countries, but it is effective only on small scale. Weeds can always be cut and pulled out, but the question is simply how much time and money can an organic farmer spend to reduce weed pressure. As the organic farm size increases, the cost and time consumed in weeding increases and this finally increases the cost of produce.

Weed control in organic farming depends much on the understanding of their biology, the role of whole production system, as well as on environmental factors. There is not a single control tool, but it must involve the use of many strategies and techniques, all with the goal to achieve economically acceptable weed management and crop yields. Identification of problem weeds and their knowledgebase is key to improve efficiency of weed management in organic farming. Any reduction in weed and in the amount of weed seed or other propagules reaching the soil will make subsequent weed control operations less expensive. The goal is for the crops to out-compete weeds and reduce the availability of resources (light, water, nutrient etc.) to them. The cultural practices used in organic crop production often provide opportunities for the crop to gain those advantages. These cultural practices include crop rotations, intercropping, use of weed free planting materials, closer planting, transplanting, growing competitive and smothering crops/crop cultivars, cover crops (live mulch), stale seed bed (pre-sowing irrigation), mulching (plastic or organic materials), green manuring etc. Night tillage may help to reduce weed germination to a significant extent. Many weeds require a flash of microseconds of red light in order to germinate. After night tilling, only those seeds left on the soil surface will germinate, which are lesser in number as compared to their active seed bank in soil. Many of the important annual weeds including *Chenopodium album* and *Echinochloa* spp. have been found to respond favorably to night tillage.

Mechanical weeding is probably the most widely used technique after the hand weeding for organically grown crops in developing countries. These machines are used for uprooting, cutting and burial, slicing and turning of weeds depending upon the type and stage of weeds. Mechanical weeding is effective against almost all the weeds except some parasitic forms like *Cuscuta* spp. Shallow intercultural operation in relatively dry soil are best, since they bring only fewer weed seeds to the soil surface and further extended dry condition does not allow weeds to re-root or germinate. Developments of 'intelligent weeders', with computer assisted smart vision system to identify and destroy the weeds is on the way. Once these new generation machines become commercially available, the weed management in organic farming will become easier.

Propane based 'flame weeders' are getting much popularity in some of the developed countries to control herbaceous weedy species. Directed treatments are given for post emergence control of weeds at their early stage (2 true leaves) in wide spaced crops, bunds, and irrigation channels etc. But high consumption and burning of fossil fuels limit its uses due to environmental concerns.

Efficient water management can play a key role for controlling the weeds in wide spaced crops supporting drip irrigation. Drip lines buried below the soil surface can provide moisture to root zone of crops and minimize the amount of moisture that is available to weeds on the surface. A properly managed drip irrigation technique can provide significant level of weed control during the non-rainy seasons of the year.

Soil solarization is another good technique to control many annual weed species along with added benefit of disease and nematodes control. It is suitable on small scale for raising high value crops and nurseries of costly hybrid seeds. Some of the troublesome weeds like *Medicago denticulata* and other hard coated weed seeds, *Cyperus rotundus*, *Cuscuta* spp., *Striga* spp. are not controlled by soil solarization.

The development of organic herbicides is on the way and still requires long way to reach up to the level of commercialization. In the recent years, some contact type organically accepted chemicals i.e. acetic acid, clove oil products, citric acid products etc. have shown some potential in this direction. Some of the newer technologies like laser weed cutters are still in their infancy stage and may become a potential weed management tool in the future. Biological control agents (insect and microbes) have been exploited well for the management of alien invasive species of weeds but, their use is limited in case of native agricultural weedy species. However, the microbial agents targeted to soil weed seed bank is shining area of research.

Despite the serious threat of weeds to organic crop production, relatively little attention has so far been paid to research on weed management in organic agriculture. The economic costs of weed management in organic farming in general, could not yet be covered by the market prices of organic products. Therefore, keeping in view the increasing demand for organic product, weed control projects for organic farming needs a positive financial support both from public and private sectors.

L-5

Current status of herbicide use in vegetable crops

R. P. Dubey
Directorate of Weed Science Research, Jabalpur (MP)
e-mail : dubeyrp1@yahoo.co.in

More than 40 types of vegetables are grown in different parts of India. India is next only to China in world vegetable production. During the year 2007-08, India produced about 122 million tonnes of vegetables from an area of 7.73 million ha with an average productivity of 15.8 tonnes per hectare. However, according to one estimate the production needs to be increased to 250 million tonnes by the year 2025 to meet the country's demand. Looking into various constraints in bridging the gaps to achieve the production targets, weed infestation emerges as an important one. The problems of weed management in vegetable crops are different from other field crops. They are usually grown in input intensive systems characterized by heavy doses of manures and fertilizers and more number of irrigations. These conditions also favour luxuriant growth of weeds in associated crops. Losses in the yield of vegetable crops can be as high as 80%. Herbicides are an effective tool for weed management in commercial vegetable production. Control of weeds through herbicides is easier, less time consuming and less costly in comparison to mechanical methods. Approximately 20,000 tonnes of active ingredients of herbicides are being used in India, of which less than 10% are used in vegetable crops. A review indicated that the major herbicides applied in vegetable crops are pendimethalin, fluchloralin, trifluralin, metolachlor, alachlor, metribuzin, oxyfluorfen etc. Herbicide recommendations in major groups of vegetable crops are discussed in the paper. Selective herbicides, if applied timely at correct dose following proper methods of application do not pose much of a residue problem. Residual effects of some herbicides applied to field crops e.g. sulfonyl ureas may adversely affect sensitive vegetable crops grown in rotation. In India, at present options for selective herbicides in vegetable crops are limited. Herbicide industry has to play a greater role in developing selective herbicides for vegetable crops which are safe to the food chain and environment.

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Current status of aquatic weeds – problems and their management in India

T. V. Ramachandra Prasad, C.T. Abraham[2], Sushilkumar[3], M.T. Sanjay and Ramulu
DWSR Centre, University of Agricultural Sciences, Hebbal, Bangalore, (Karnataka)
KAU, Thrissre (Kerela)[2], DWSR, Jabalpur (M.P.)[3]
e-mail : tvramachandraprasad@rediffmail.com

Aquatic weeds are those weeds growing in aquatic habitat, complete their life cycle in water, cause harm to aquatic environment directly and to related eco-environment relatively. Water is one of the most important natural resources required by all life forms of this world. Aquatic weeds are classified as free floating weeds, emergent weeds/ditch bank weeds, rooted weeds with floating leaves, submersed weeds, algae, etc. Losses caused by aquatic weeds have not been made under Indian conditions. In Sri Lanka, Salvinia molesta is reported to cause annual loss of Rs. 24.7 to 56.7 millions in 1987

Problems posed by aquatic weeds: Aquatic weeds multiply very fast and cover the water bodies posing various problems–interfere with the use of water bodies in terms of navigation, fishing, domestic and industrial water supplies, livestock, irrigation, transportation, communication, sports, recreation, tourism, pollute water bodies, blocking water-intake points, causing turbidity in shallow waters used for domestic purposes, interfering with water flow in irrigation channels, affects other useful plants and health problems to human beings – mosquito menace - vectors of malaria, harbours poisonous snakes, causes skin rashes and can host agents of amoebic dysentery and typhoid, etc. The weed increases the rate of water loss, interferes with agricultural and hydroelectric-power schemes and poses serious environmental problems in many water bodies. In addition, it prevents oxygenation of water and the establishment of phytoplankton and much of the zooplankton, making areas unsuitable for fish-feeding and fish-breeding. Human interference has caused spread of aquatic weeds from the original habitat, *Eichhornia crassipes* (Mart) Solms, *Salvinia molesta* Mitchell (from Souther America), *Hydrilla verticillata* (L.f.) Royale (from Asia), *Elodea canadensis* Michs. (from Canada), to other regions of the world including India (Willoughby, 1993; Orach-Meza, 1996; Lancar & Krake, 2002, Abraham et al., 2008).

Management of Aquatic Weeds:

a) **Prevention:** Effort should be made to contain the weed completely in the initial stages of introduction of the aquatic weeds.

b) **Physical and mechanical methods –** Use of manual labour for pulling or cutting and removal of aquatic weeds is till in practice in some cases. It is costly, tedious and many times impracticable, because of non-availability of labors and high cost of wages. Due to repeated occurrence of aquatic weeds, continuous adoption of this method is not possible and cause rapid growth of weeds causing rampant loss, in the absence of mechanical methods – machinery. In many parts of India, this is being practiced (Singh, 1989, Abraham et al., 2008).

c) **Use of herbicides:** Herbicides are cheaper and effective but herbicides may affect ecology of aquatic weeds due to direct effect on target and non-target organisms by affecting the target macrophytes. The decaying of aquatic plants in the water bodies depletes dissolved oxygen and affects aquatic animals. This could be practiced to a limited extent on small scale where other methods are not feasible. Some herbicides recommended elsewhere for aquatic weeds management are glyphosate 1.0 to 2.0 kg/ha, paraquat 0.5 to 1.0 kg/ha, 2,4-D Na salt or EE or Amine salt 0.5 to 1.0 kg/ha for emergent, floating and ditch bank weeds. For control of algae, copper sulfate at 0.5 to 2.0 mg/liter of water is used. Dichlobenill 10% G at 5.0 kg/ha is spread on water surface to control of water lilies (*Nymphaea* spp).

d) **Biological control:** Biologicl conrol may be cheaper, environmental friendly nut takes time to suppress the weeds. Triploid White Amur – grass carp, vegetative eating fish, can be introduced to the aquatic system which can be consume weeds, ten times the body weight. They grow up to 20 kg or more in size. For

control of submerged weeds *Hydrilla, Ceratophyllum* and *Najas*, grass carp *Ctenopharyngodon idealla, Osphoronemus goramy* and silver carp - *Tilapia mossambia* have been successful. Snails – *Pomade canaliculata* Lamer and *Marisa comuarietis* in South America and Florida have been tried and have good control of weeds – *Certophyllum*, *Najas* and *Potamogeton* sp, partially on *Pistia stratoites*, *A. philoxeroides* and *E. crassipes*. The utility of these snails to our environment could also be explored.

Two exotic weevils *Neochetina eichhorniae* and *N. bruchi* and a leaf mining mite, *Orthogalumna terebrantis* Wallwork were imported in 1982-83 and releases were made after host specificity studies. Good control of water hyacinth with these bio-control agents has been achieved in Bengaluru, Kerala, Central India and North East India. Similarly excellent control of *Salvinia molesta* has been achieved in Kerala after import and release of *Cyrtobagous salviniae*, (Gangavisalakshi and Sushilkumar, 2008, Abraham *et al.*, 2008). Most of the water bodies in southern Kerala have been cleared by the use of this weevil (Singh 1989, Abraham *et al.*, 2008). Biological control will be cheaper than other methods and these bio-agents multiply on their own as soon as build up of host aquatic weeds occur. Two natural enemies reported to contain *Ludwigia* spp weed in rice fields are pod borer *Nanophytes nigritulus* and a leaf feeder *Altica aerula* on *L. adcendens; Altica cynea, A. foveicollis* and *Morphae ludwigiae* on *Ludwigia adcendens* and *L. perenis* (Gangavisalakshi and Jayanth, 1995). estimated that the annual benefits gained from successful biological control of *Salvinia* worldwide were $ 150 million. Thus biological control is cheaper, safe, eco-friendly and sustainable over years.

e. **Utility of weeds:** Aquatic weeds produce huge biomass and possess good content of nutrients similar to traditional green manure plants. Thus weeds like water hyacinth can be composted very well and recycle the nutrients requirement equal to that of Farm yard manure in crops – maize, finger millet, coconut in Karnataka. Water hyacinth is used as mulch in coconut gardens, fed to milch animal as feed. In the production of paper, pulp, fiber in some parts of Europe, Indonesia, weeds like *Typha, Phragmites, Cyperus papyrus* and water hyacinth can also be used. Water hyacinth can also produce bio-gas equivalent to 70,000 m^3 per ha or one kg dry weight basis can yield 370 liters of bio-gas containing 69% methane.

f. **Integrated method:** There is need to practice all these methods including prevention to check the menace of aquatic weeds in the water bodies. Integration of herbicides and bio-control agents have also been successful in some areas in USA.The use of 2,4-D along with Flea beetle for successful control of Alligator weed; 2,4-D + weevil or *Cercospora rodmanii* + weevil or grass carp + weevil in water hyacinth (Abraham *et al.*, 2008).

In India, aquatic weeds are assuming importance in many water bodies belonging to different domains. There is no concerted effort on the part of individual stakeholders to contain the weeds in the initial stages itself rather than testing methods to contain weeds immediately when they cover huge areas of water bodies. Need for coordination among different water dwellers to adopt technologies relevant to them to avoid recurrence of aquatic weeds on large stretch of water bodies are required to conserve our fragile water bodies which will be precious, required for future, apart from maintaining biodiversity.

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Weed shift in long-term cropping systems

C. Chinnusamy, J. Bhuvaneswari, C. Nithya and P. Muthukrishnan
DWSRC, Department of Agronomy, T.N.A.U., Coimbatore
e-mail: chinnusamy@hotmail.com

Rapid intensive and extensive cultivation of lands for increased productivity of crops made lot of changes in the ecological environment of the cultivated fields. Due to these manipulations in the field, a group of weeds or a specific weed flora dominant in a situation or locality will get changed or shifted. This phenomenon is called shift in weed population. Diversity within a weed community is indicative of the success of weed management practices and habitat use. The shift of weeds to a few dominant species is an indication that the cropping systems are providing opportunities that adapted species can exploit. Diversity in crops and cropping systems, as well as diversity in weeds and weed management systems, can result in the most efficient exploitation of available resources. (Bradford *et al.,* 2006). Continuous presence of crop cover, residual toxicity of herbicides applied to the previous crop on the succeeding crop and changing weed flora with the seasons all need a different approach in weed management. With intensive cultivation of land round the year, the weed floras show a shift towards more persistent perennials. Green foxtail and wild oat densities increased in continuous mono cropping of wheat (Fay, 1990). Similarly, Hume *et al.* (1991) reported that continuous cropping with wheat could result in built of certain weed species such as green foxtail. Biswas and Das (1993) reported that shift of weed flora from annuals to perennials (*Cyperus rotundus*) in Jute when it was rotated with rice-wheat system. Dense infestation of downy brome was observed in the continuous winter wheat rotation than wheat-fallow, wheat - canola systems (Blackshaw *et al*., 1994). Shift of weed flora from dicots (*Trianthema monogyna*, *Commelina bengalensis*) in the first year to monocots (*Phalaris minor*) in second year was noticed by Ahuja and Yaduraju (1995), in pigeonpea - wheat system. Saikia and Pandey (1999) reported weed flora shift from dicots like *Trianthema portulacastrum* in first year to monocots like *Digitaria sanguinalis* in the second year during rainy season in maize - chick pea cropping system. In long-term continuous herbicide application in rice - rice wetland cropping system (1996-98), repeated use of the same selective rice herbicides to control diverse weed flora of rice ecosystem may result in the dominance of monocot weeds especially grasses and shift in grassy weeds from *E. crusgalli* to *L. chinensis* which is not controlled effective by such herbicides (Chinnusamy *et al*., 2008).

In permanent herbicide trial in transplanted lowland rice-rice cropping system, Kandasamy (2005) stated that, in eleventh crop of rice, butachlor 0.75 + 2,4-DEE 0.4 kg/ha with 75% inorganic + 25% organic and rotational use of herbicide with 100% inorganic recorded shift in *Echinochloa crusgalli* to *Panicum distachyon* and *Ludwigia parviflora* to *Marselia quadrifoliata* in the later croppings. Hand weeding treatments recorded dominance of *Ludwigia parviflora*, *Eclipta alba* and *Marselia quadrifoliata* in 16th and 17th crops when compared to first crop (DWSRC-Annual report, 2008). Continuous use of butachlor 0.75 kg + 2, 4-D EE 0.4 kg/ha (3 DAP) both during kharif and summer paved way for dominance of sedges (particularly *C. difformis* and *F. miliacea*) and grasses (*E. glabrascens*) during fourth summer crop of rice-rice system. (Ramachandra Prasad, 2008) In rice-wheat cropping system of Raipur, dominant weed flora in the base year (2003) are *Echinochloa colona, Ischaemum rugosum, Alternanthera triandra, Cynotis axillaries, Croton banplandianum, Cyperus iria* and *Fimbristylis miliacea* in the first crop of rice. The shift in *Fimbristylis miliacea* was recorded during 2007-08. In the second crop of wheat the dominant weeds flora were *Alternanthera triandra, Melilotus indica* and *Chenopodium album* during the base year. In the year 2007-08, the occurrence of *Rumex dentatus* was recorded. At Pantnagar, the shift of *Chenopodium album* and dominance of *Coronopus didymus* during 2007-08 (Varshney *et al*., 2008) During 2007-08, rice - water fallow of Kerala, maximum count of grasses, broad leaf weeds and sedges are present in the plots receiving conventional tillage, and the least in the zero tillage plots. In the zero tillage plots there is a shift to perennial weeds, mainly *Eleocharis* sp. In the plots receiving tillage, predominance of annul weeds associated with rice is noticed (Varshney *et al*., 2008).

At Ludhiana, the trend of weed infestation under zero and conventional tillage systems were statisti-

cally similar at 60 and 120 days of record except *Phalaris minor* at 60 days which exhibited higher population in alternate as compared to continuous conventional or zero tillage systems during 2007-08.

At Palampur, in first crop of maize, the dominant weed flora were *Echinochloa* colona, *Cyperus iria, Commelina benghalensis, Ageratum conyzoides* and *Panicum dichotomiflorum* during the base year of 2003. In the year 2007-08, the shift of *Ageratum conyzoides* and occurrence of *Polygonum sp., Elusine indica* and *Digitaria sanguinalis.* were recorded. In the second crop of wheat, *Phalaris minor, Avena ludoviciana, Lolium temulentum, Vicia sativa, Anagallis arvensis, Coronopus didymus* and *Polygonum alatum* were observed during base year of 2003. But during 2007-08, there is a shift in weed species *Coronopus didymus* and dominance of *Poa annua* was observed (Varshney *et al*., 2008).

In the first crop of maize, at Coimbatore, predominant grassy weeds were *Dinebra retroflexa, Dactylactenium aegyptium, Cynodon dactylon, Panicum repens and Chloris barbata. Cyperus rotundus* was the only sedge weed found in abundance. With regard to broad leaved weeds *Trianthema portulacastrum, Digera arvensis, Amaranthus viridis* were the predominant weeds in the year 2003. The shift in *Dinebra retroflexa* to *Echinochloa colonum*, *Setaria verticiliata and Rotobella cochinsinensis* under grasses, *Boerhaavia diffusa*, *Datura metal* and *Parthenium hysterophorous* under broad leaved weeds were dominant during 2007-08. In the second crop of sunflower, during 2007-08, the occurrence of weed like *Echinochloa colonum*, *Setaria verticiliata* and *Rotobella cochinsinensis* under grasses, *Amaranthus viridis, Boerhaavia diffusa, Datura metal, Euphorbia prostrata, Corchorus trilocularis* and *Portulaca quadrifida* under broad leaved weeds (Varshney *et al*., 2008). Leela (2002) reported that in sunflower-maize cropping system, shift in grassy weed density to broad-leaved weeds were observed in shallow tillages. But in deep tillages the weed flora shift from broad-leaved weeds to grassy weeds. Subbulakshmi (2007) observed that continuous zero tillage resulted in shift in weed flora from broad-leaved weeds to grasses. There was no shift in weed flora was observed due to conventional tillage practices. *Dinebra retroflexa* was shifted to above fifth place and it was replaced by *Panicum repens* from sunflower-I onwards.

Bhuvaneswari (2009) reported that stale seedbed technique resulted in shift the weed flora from sedge and broad-leaved weeds to grass weeds. Crop residue mulching recorded lower grasses and higher sedge and *Parthenium hysterophorus* weeds. Non-chemical weed management methods resulted a shift in weed flora from broad-leaved weeds to grasses. In Anand during base year (2003-04), the monocot weeds observed were *Cyperus rotundus, Digitaria sanguinalis, Eragrostis major, Dactyloctenium aegyptium, Eleusine indica* and dicot weeds were *Phyllanthus niruri, Oldenlandia umbellate, Euphorbia hirta, Euphorbia geniculata, Oldenlandia umbellate* and *Digera arvensis* in the first crop of Pearlmillet. The shift in weed species *Digitaria sanguinalis*, *Phyllanthus niruri*, *Euphorbia hirta* and *Digera arvensis* were observed during 2007-08.

In the second crop of wheat, Dicot weeds like *Cyperus rotundus, Eragrostis major, Eleusine indica, Asphodelus tenuifolius* and monocot weeds like *Chenopodium album, Digera arvensis, Melilotus indica, Chenopodium mural* and *Phyllanthus niruri* were dominant weed flora of the experimental field. The shift in weed *Cyperus rotundus, Eragrostis major* among monocots and *Chenopodium mural* and *Phyllanthus niruri* among dicot weeds were observed (Varshney *et al*., 2008). Kandasamy *et al*., (2000 a) reported that, the weed species composition after 26 years in the 68th crop in the finger millet - maize - cowpea cropping sequence as influenced by long term continuous application of a fixed fertilizer schedule. Application of 150 % optimum dose of N, P and K chemical fertilizers encouraged the dominance of *Trianthema portulacastrum* (30.4 %) followed by *Digera arvensis* (17.0 %) and *Cyperus rotundus* (14.5 %), while in the unfertilized plot *Digera arvensis* (20.3 %) was most abundant followed by *Cynodon dactylon* (17.6 %) and *Flavaria australasica* (11.0 %). In the second crop of cotton, heavy infestation of *Chloris barbata* was noticed under intercropping, hand weeded and unweeded plots during 1993. The population of *Trianthema portulacastrum* and *Cynodon dactylon* were also not reduced. Application of herbicides to both the crops reduced the population of these weeds to a greater extend (Chinnusamy *et al*., 2008).

Dactyloctenium aegyptium population increased after the application of a single nutrient (N, P or K), while all the fertilizer schedules except N, NPK and cattle manure residue promoted the density of *Panicum* sp.

compared to control. The perennial weed *Cynodon dactylon* was lower after balanced fertilizer application compared to the application of a single nutrient. The weed species *Phyllanthus maderaspatensis* and *Amaranthus viridis* were totally eliminated after the application of P or K alone, while *Corchorus olitorius* and *Commelina benghalensis* were found to be introduced along with cattle manure in long term application of manure and fertilizer in the 138th cropping (sorghum) under rainfed condition (Kandasamy *et al*., 2000 b).

To overcome the problem of weed shift through integrated weed management methods, rotation of different control methods or herbicide rotation for the same crop, use of certified and quality seeds for better germination, adopting different cultural practices for better crop growth and productivity avoiding multiplication of new weeds in the environment.

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L - 8

Current status of weedy rice in India and strategies for its management

C. T. Abraham, T. Girija and Smt. Nimmy Jose
DWSRC, Kerala Agricultural University, Thrissur (Kerala)
e-mail : ctabraham@yahoo.com

Weedy rice is a complex of *Oryza* morphotypes widely distributed in the commercial rice fields in more than 50 countries of Asia, Africa and Latin America, especially in areas were farmers have switched to direct seeding due to labour shortage and high cost. Wild and weedy forms of different species coming under the genus *Oryza* are also known as wild rice, red rice etc. India is the centre of origin of rice, and many wild and weedy relatives are seen in the rice growing areas of India. The Indian weedy rice belongs to the indica group. Variations in height, tillering, colour and length of awn and grain are noticed in the wild rice types of India. In India *Oryza sativa f. spontanea* is considered as a weedy species in cultivated rice. Wild and weedy relatives are a problem in Eastern India (Eastern U.P., Bihar, Orissa, Manipur and West Bengal) and Southern India. Whereas, in North Western states like Haryana and Punjab wild rice is not seen.

It is difficult to manage the infestations of weedy rice because of its morphological similarities which makes it difficult to distinguish weedy rice from cultivated rice till it comes to flowering, variable dormancy, early seed shattering and high competitiveness. They come to flowering much earlier than cultivated rice and produce grains having awns, with varying colouration for ear head. The seeds mature within a short period and shatter immediately facilitating the build up of weed seed bank before the farmer gets a chance to remove the seeds along with the harvest of rice crop. Studies have shown that seeds often germinate between 15 to 40ºC and many seeds decay between long periods of flooded condition. Most of the seeds germinate from the upper 0-4cm layer of soil. Dormancy in weedy rice is highly correlated with awnness, black hull and red pericarp. Dormancy is due to presence of inhibitors in seed coat and seed may remain dormant and viable for three years. Puncturing or removing the hull and pericarp can break dormancy.

Different methods of control are being tried by farmers and scientists for managing wild rice. Best method for preventing the infestation is using clean seeds. In already infested fields the strategy is to deplete the weedy rice soil seed bank by various methods like stale seed bed technique (removing the germinated weedy seeds mechanically or using non selective herbicides before planting), burning of straw left after the harvest of rice to destroy the seeds lying on the surface or by contact application of nonselective herbicides like paraquat, glufosinate, glyphosate etc., using special applicators to the ear heads of wild rice which will come above the rice canopy before the rice flowers. Surface application of pre emergence herbicides like Thiobencarb, Butachlor (after land preparation and one or two days before sowing of rice crop) is also effective. Rotation of rice crop with other crops for a few season can also free the field from wild rice infestations.

Biotechnological approach using genetically modified herbicide tolerant rice varieties may be an efficient strategy. A non transgenic rice variety 'Clearfield' tolerant to herbicide imazethapyr has been in use in red rice infested fields of United States of America from 2002. However, possibility of out crossing of resistant variety with wild rice is suspected to taint the advantage of this technology. As it is a difficult-to-manage weed problem, intensified and diversified strategies for management have to be developed for sustainable rice production under the changing environment of high labour cost and increased adoption of direct seeding in crop establishment.

L-9 Current status of herbicide residues in soil, water and commodities

R. B. Patel and K. M. Durga Devi[1]

DWSR Anand Centre, B. A. College of Agriculture, [1]A.A.U., Anand (Gujarat)

[1]KAU, Thrissre (Kerala)

e-mail : rbpatel33@yahoo.com

One of the significant developments in agricultural technology in recent years is the herbicide usage for the management of weeds in agriculture. In fact, the use of herbicides as a techniques in modern farming has resulted in increased productivity through prevention of various losses estimated to go in million of rupees caused by weeds and reduced the wastage of resources and human energy. Among various group of pesticides, the growth rate of herbicides is much higher in the course of last 20 years in India. Herbicides has been successfully employed for keeping the weeds under check but indiscriminate use of herbicides poses environmental hazards and affects the soil. The environmental fate of herbicide in soil depends on soil properties, chemical nature of herbicide and agronomic as well as environmental factors. Herbicides break down requires sufficient time under adequate moisture and soil temperature to support the growth of microbes that degrade herbicide molecules. Studies revealed that the majority herbicides had a relatively short life in the soil. Pre plant application of fluchloralin @ 0.67, 0.90 and 1.35 kg/ha showed longer persistence in the loamy soil as compared to sandy loam soil under chicory crop at Anand. Half life was 25.9 days in sandy loam soil having higher organic carbon, while it was 43.6 days in chicory field. The half life values for pendimethalin and oxadizon were 21.9 and 32.4 days in sandy loam soil in onion field, respectively. Behaviour of various herbicides varies with the soil conditions, organic carbon status of the soil, methods of application and dose of application. Irrigation and season climatic condition also influence the persistence of the herbicide in soil. It has been observed that herbicides like 2,4-D, isoproturon, oxyfluorfen, butachlor, pretilachlor leave little or no residual effect on the crops.

Herbicides applied to soil undergo chemical and bio-chemical degradation, some portion of it may be removed from the site of application to far of places or below root zone of field crops. A portion may be taken up by plant and accumulated in the edible parts as original compounds. Herbicide residue estimated carried out at various DWSR centres revealed that herbicides applied at recommended dose of fluchloralin in chicory, pendimethalin in onion, chicory, cumin and potato, butachlor in rice, oxadiazon in onion and cumin, clodinafop-propargyl in wheat, pretilachlor and trifluralin in rice and atrazine in sorghum did show herbicide residues below MRL.

Downward movement of herbicides in different soil and residues in water revealed that most of the herbicides applied at recommended dose retained only upper surface and leached maximum up to 20 cm and there was no contamination of applied herbicides in groundwater. Studies carried out at Thrissur revealed that 2,4-D was detected in all the water samples collecting from submerged paddy fields of Kuttanad area. At recommended dose of application, paraquat, 2,4-D and glyphosate residues dissipated from water to below detection levels by 60 days after spraying, overall, herbicide residues below the MRL in most of the cases at recommended dose of application of herbicide when applied for weed management in soil or water.

L -10

Present status of herbicide resistance to wheat herbicides in India

S. S. Punia, Dharambir Yadav, Samunder Singh, Rupa Dhawan and Ashok Yadav
Department of Agronomy, CCS HAU, Hisar (Haryana)
e-mail: jagir@hau.ernet.in

Herbicides are an integral part of agricultural production system. Use of herbicides has increased the productivity of crops but evolution of herbicide resistance has been its worst by-product which is threatening the sustainability of agricultural production system. Herbicide resistance is the inherited ability of a weed or crop biotype to survive an application rate of herbicide to which the original population (wild type) was susceptible.

The first case of herbicide resistance was confirmed in common groundsel (*Senecio vulgaris*) in 1964 in Washington, USA. Until 1980 the rate of increase of herbicide resistance cases was not so high, but after 1980 it has increased dramatically. Obviously the increase was due to increased use of herbicides in this era. Currently there are 340 resistant biotype belonging to species (114 dicots and 80 monocots)in the whole world. More than sixty countries are affected by resistant weeds. USA has the highest cases of resistance followed by France and Australia. The highest number of triazines followed by ALS inhibitors (Anonymus, 2009).The resistance in *P.minor* was confirmed against clodinafop-propargyl, fenoxaprop-P-ethyl and diclofop-methyl in Iran (Gherekhloo *et al*., Unpublished data)

Continuous use of isoproturon for 10-15 years without breakage in rice-wheat cropping system evolved resistance in the *P.minor*, a troublesome weed of wheat. The first case of the herbicide resistance in India and for the first time in world in this weed aws reported by scientists from CCS HAU, Hisar during 1992-93 (Malik and Singh,1995).This was the most serious case of herbicide resistance in the world, resulting in total crop failure under heavy infestation. The resistance mechanism was metabolic in nature (Singh,1998), Kaundun (2007) also reported the first case of target site resistance in one biotype from Punjab. The resistant *P.minor* infested area in the country is about 0.8-1.0 m ha, which is on increase. Resistance was also reported against metoxuron and methabenzthiazuron (Yadav *et al.,*2002). An adhoc recommendation of diclofop-methyl was given but again withdrawn after two years due to its erratic performance.

In 1997-98, four alternate herbicides, sulfosulfuron, clodinafop-propargyl, fenoxaprop-P-ethyl and *tralkoxydim* were recommended for management of isoproturon resistant *P.minor* but the efficacy of these herbicides has also decreased considerably. Dhawan *et al.,* (2009a) under a long term trial confirmed the reduced efficacy of these herbicides in resistant *P.minor* infested area. Chhokar & Sharma, (2008) also reported resistance to above herbicides in *P. minor*. To overcome this problem, RM. Of sulfosulfuron,meos+iodosulfuron and pinoxaden- ACCase herbicide were found very effective (Punia *et.al.*, 2008) but Dhawan *et al.,* (2009b) reported reduced efficacy of pinoxaden against some resistant biotypes in pot studies.

Flash back of the history of herbicide resistance development in India reveal that searching and recommending the new herbicides alone for the management of resistant *P.minor* is not going to solve the problem. .In India, share of the agrochemicals in the carbon emission is 40%.At Copenhagen, India has promised to cut its carbon emission cropping system for food security in India ,it will be wise to integrate weed biology, agronomic practices like use of clean seed adjustment in date of sowing, tillage manipulation (zero/bed planting), crop rotation ,etc. for the management of herbicide resistance(Singh,2007)

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L-11

Utilization- a way of weed management

Sushilkumar
DWSR, Maharajpur, Adhartal, Jabalpur(MP)
e-mail : sknrcws@gmail.com

The impact of weeds on development of agriculture, fishery, animal husbandry, tourism and recreation are very important. Hence, weeds are managed through various management practices. Amongst the different control options, management through utilization is the best way because this tactic instead of spending money on management, help the users to earn money by utilizing them and simultaneously to achieve control too. The genesis of utilizing weeds is that many weed although they are problematic also possess useful properties. There are many uses of terrestrial as well as aquatic weeds (Gogei *et al.* 1996; Joglekar, 1996; Watt, 1966; Varshney and Sushilkumar 2009).

Animal feeds: Most of the grassy weeds infesting agriculture fields after removal from the field may provide fodder to animals. Many grass weeds prevalent in crops like *Cyperus* spp., *Physalis minima*, *Medicago hispida*, *Dactylon, Alternanthera sissilis, Commelina bengalensis*, Napier grass *etc* are extensively used as animal feed by the farmers. In Jabalpur, it was observed that during April to June, *Alternanthera philoxerodies* vernacularly called as 'Pulla chara' are cut from the aquatic form and sold in market. One heap of weed containing about 15 kg costs Rs 8-15/-. Owners of milk dairy were observed to purchase 50-100 heaps of weeds daily for giving to their milking animals during April to June. Many families livelihood was depend on cutting and selling this of this weed. The aquatic weeds utilised by different animals for fodder purposes are – *Enhydra, Ipomea, Ludwigia, Commelina, Cyperus, Eichornia, Panicum, Phragmatis* and *Typha.*

Fish feed: Amongst the fishes, the grass carp (*Ctenopharyngodon idelia*) is the fast growing fish that feeds voraciously on many aquatic plants, Many submerged weeds as *Hvdrilla, Najas, Ceratophyllum, Ottelia, Potamogeton, vallisnaria, Chara etc.*are used as feed by the grass carp. Similarly, silver carp (*Hypothalamicthys molitrix*) and common carps (*Cyprius carpio*) also utilises aquatic weeds, usually algae. Duck weeds are relished as food by hHerbivorous ducks, geese and swans, and other wild fowl.

Supplement of vegetables : Many terrestrial and aquatic plants are used by poor man in developing countries as alternative of vegetables. Fresh and young leaves of *Cassia tora* are plucked by tribal in Madhya Pradesh to prepare leafy vegetable. *Chenopodium album* is extensively used in leafy vegetable preparation in combinations with other vegetables or alone. Fruits of *Carrissa* sp. a woody shrub are extensively used in pickle and 'chutani' preparations in north India. This suggests that in food scarcity, weeds can be utilized as supplement of food. Among aquatic plants *Ipomoea aquatica, Neptunica aleracea* and *Otelia glismoids* are used as leafy vegetables. In south India, leaves of *Alternanthera philoxeroides* are sold in market as ' kozuppa'.

Use as fencing material : Many weed species are used by tribal and farmers as live fencing to protect their home and fields from wild animals. In Rajasthan, wild cactus species have been found to erect as live fencing to protect house and agricultural. In many areas, bushes of *Lantana camara* are used as live fence. Every year, appreciable quantities of stems of *Ipomea fistulosa (I. carnea*)are cut, collected and transported to village to made fencing to protect house by the farmers. The stems while remain green and flexible are weaved together to form strong fencing.

Used as a source of fuel: The stems of woody weeds like *Lantana camara* and *Ipomea fistulosa* are cut and dried before use to cooking food by poor man and banjaras. During winter season, dried grasses, dried stems of *Cassia* spp. and *Parthenium* are collected to burn them during night to keep the body warm. Efforts were made to use parthenium biomass as biofuel. The dried biomass of parthenium was fed to a pyrolyser for obtaining pyrolytic coal which gave no smoke when burnt after compacting it into pellets in a briquetting machine.

Weeds use in medicine: The use of weeds as a source of drug was an integral part in the indigenous practice of medicine by Vaidhyas and Hakeems Many weeds are used extensively as an ingredient in standard preparations manufactured by pharmaceutical companies. Systematic and scientific investigation of the properties of weeds in medicine started about 40 years back. The consumption of weeds as raw material for preparations of drugs has been increased by many folds and today it is a million rupee business in many states

of India. Some of the following weeds are used extensively in different preparations by the pharmaceutical companies:

Source of energy: Aquatic weeds are converted to biogas by decomposing waste decay by anaerobic bacteria. Methane producing bacteria are common in nature and if they are cultured on water hyacinth in a tank, they produce a biogas composed of 70 % methane and 30 % carbon-dioxide. Water hyacinth thus converted into a gas rich methane can be used for cooking heating, generating, electricity. Based on NASA's (National Aeronautics and space Administration) findings, it is estimated that the amount of water hyacinth harvested from one hectare of water will produce more than 70.000 m3 of gas.

Source of pulp, paper and fibre: As synthetic materials become increasingly expensive, weeds may be used as source of paper, pulp and fibre in future. There is various fibre yielding weed. Mention may be made of lantana, *Saccharum spontaneum*, water hyacinth, *Typha angusta, Phragmitis communis, Panicuum* sp. *Phragmitis karka*, a commonly occurring reed of north eastern region of India is utilized in large scale in different paper mills of the north-east India. Typha species are other commonly weed which contain good quantity of fire and suitable for paper making.

Waste treatment (pollution abatement): Some aquatic weeds, like water hyacinth, bulrush. duck weeds, hydrilla *etc*. can extract nitrogen and phosphorus from water and thus can abate pollution to a certain extent. Water hyacinth can be used for pollution abatement. It has been found to remove 22 - 44 kg. nitrogen, a similar amount of potassium, 18 - 34 kg. of calcium, and 2 - 4 kg of magnesium per day per hectare from water. It also removes compounds that produce bad odour. The duck weeds e.g. *Wolfia* and *Lemna etc* are also promising weeds for use in recovering nutrients from waste water.

Soil additives: Many aquatic weeds contain appreciable quantities of nitrogen, phosphorous and they are applied to farm land to benefit crops. In addition, they improve soil structure also. Recently FAO has stressed the urgency in reassessing organic fertilization. Aquatic weeds can be used as green manure by applying them directly as a surface mulch. For example, water hyacinth can be used as mulch which checks evaporation and rainfall runoff besides erosion. In Assam, use of water hyacinth in potato field as mulch is prevalent. Studies have shown that *Eupatorium, Mikania, Chromolana odorata*, *Ipomea, salvania* and water hyacinth can be used as manure to supplement the organic matter and nutrients either through direct incorporation or composting. Weeds can provide good source of compost if proper and scientific process is adopted.

Use as bio fertilizer: *Azolla* has been recognized as potential source of nitrogen. This species has great potential to be used as biofertiizer as *Azzola/Anabaeba* complex is reported to fix 1.4 -10.5 kg n/ha/day depending upon the species and growing conditions.

Source of bio-pesticides: Many weeds have the properties of antifeedant, repellent and insecticidal properties besides allelopathic effects on other crops and weeds. These properties can be exploited for development of bio-pesticides. For examples, leaf extracts of *Ipomea fistulosa, Parthenium hysterophorus, Ageratum conyzoides, Achyranthes asper etc* have been found to possess antifeedant and insecticidal properties.

Source of ethanol production: Ethanol can be produced commercially from many weeds. Water hyacinth was considered to be the best source of ethanol. The substrate can be saccharified by acid and cellulase. Maximum hydrolysis can be achieved by 15% sulphuric acid at 15 lb/in2 for 15 minutes.

Prospects: At present, maximum use of weed is being done in compost making by the farmers followed by vegetable, very little use of weeds are being done by man for various purposes in spite of vast weed biomass available in India. For effective utilization of weed, we have to develop cost effective technology to process weed biomass for various useful purposes.

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Weed management in transplanted and direct seeded rice in india

R. K. Ghosh

Department of Agronomy, Faculty of Agriculture, (BCKV), Mohanpur(WB)
e-mail: rkgbckv@yahoo.com

To meet the growing needs of the food security an annual growth rate of at least 2% in foodgrain production is essential. A likelihood of 41 % shortfall in foodgrain production (255 mt) by 2020 (Rice 112 mt) is projected by IFPRI, Washington (Paroda and Kumar, 2000). In India rice is growing in an area of 42.41 m ha aand rice production is 91.2 mt with an average productivity of nearly 3 t (Rao, 2008). On an average 50 % of the World rice area is affected by drought stress besides 28% of the world's rice is grown under rainfed condition and frequently affected by uneven rainfall distribution, another 13 % of the rice area is under upland cultivation and subjected to water stress. In Asia, 75 % of the total rice production is from irrigated lowland. It has also been estimated that 22 m ha of dry season rice in South and S-E Asia is experiencing economic water scarcity, 2 m ha of Asia's dry season rice and 13 m ha of its wet season rice would suffer from 'Physical water scarcity by 2025' (Tuong and Bouman, 2002). Therefore, to meet the demand the improved technology is needed where weed management is one of the key management factors.

Rice is cultivated with various methods and practices. The aerobic miracle rice (SRI), drum seeding, direct seeding, ratooning, direct sown puddle, transplanted and rain fed rice are growing in the plain, hill, saline – alkali, deep water etc. ecosystem with AWD or SSC methods.). However,rice is cultivating in both aerobic and anaerobic ecosystem. For lowering the rice productivity competition of weed pests is another important reason. The economic impact of weeds in Indian agriculture estimated in two decades ago was only Rs. 20-28 billion and now nearly 50 % in foodgrains and pulses and 33.3% in oilseeds(Varshney and Prasad Babu, 2008) , Weed, the major pest, causing yield reduction to the tune of 65% (Yaduraju *et. al.,* 2006). In direct sown puddle the yield reduction due to weeds is estimated 30-45 % .Weed infestation is more severe in upland ecosystem (71%) than in wetland. In direct seeded rice crop a tune of 5- 100% damage was observed. In Gangetic alluvial soil the yield loss is hovering around 40-45% . Thus, the most important objective to increasing rice production and productivity is proper management of weed flora in both aerobic and anaerobic rice ecosystem. Many new invasive alien weeds (IAWs) are moved from their native habitat to a newer location (IUCN, 2000). Importing of seeds is one of the major sources. *Oryza rufipogon* is the classical example of invasive alien weed and now, like *Phalaris minor* is expecting to create problems in rice cultivation besides the other IAWs throughout India. In aerobic culture the weed infestation is severe and various monocot and dicot weed plants are observed. Among monocots *Cynodon dactylon, Echinochloa colona, Paspalum conjugatum ,Brachiaria mutica, E/eusine indica, Digitaria sanguinalis, Dactyloctaneum aegyptium, Panicum repens , Cyperus rotundus, Cyperus difformis, Cyperus esculentus etc.* are common while *Eclipta alba, Ammania baccifera, Physalis minima, Alternanthera sessilis, etc.* among dicot weed flora are coomonly observed. In anaerobic culture *Echinochloa crusgalli, Echinochloa formosensis, Echinochloa colona, Paspalum conjugatum,Paspalum distichum, Brachiaria platyphylla, Leersia hexendra, Leptochloa chinensis, Panicum repens, Ischaemum rugosum,Cyperus difformis, Cyperus iria, Cyperus microiria, Fimbristylis littoralis, Fimbristylis dichotoma, Scripus maritimus, Scirpus juncoides* among monocots while *Eclipta alba, Ammania baccifera, Stellaria media , Alternanthera philoxeroides, Mersilea quadrifolia, Cyanotis axillaris* Sphenoclea zeylanica, Lemna minor, Ludwigia octovalvis, Drymeria cordata *Oldenlandia corymbosa, Oldenlandia diffusa, Monochoria haestifolia, Azolla pinnata, Lindernia ciliate, Ipomoea aquatic* are dominant dicot weed flora.

Hand weeding is very common among the Physical method though because of gradual higher labour wages besides unavailability of labours in critical crop weed competition period of rice (3- 4 weeks) in present agriculture its use is gradually declining. The mechanical methods are becoming popular in AWD system with the objective to create more aeration through higher oxygen entry in to the soil which enables rice crop for profuse growth. Ecological methods are very useful as it increases the soil health by crop diversification technology, more particularly using the legumes with rice either as intercrops or as mixed crop or as Guard crop

etc. Use of farmers' ITK in this method is very common. Biological methods, using bio-agents or bio - herbicides are also gaining popular with regards to organic farming and pesticide pollution (Sushilkumar and Varshney, JG, 2008). Chemical weed control are now a days becoming more acceptable to farmers among all other pesticides (Barman and Varshney, 2008). Many Experiments have been conducting in various states of India under the AICRP–WC, DWSR, ICAR programmes as well as under SAU System and particularly for new molecules, mostly in collaboration with various NGOs including the multinational corporate industries. A number of safer chemicals have been tested since last two decades for management of weed flora in both direct (aerobic) and transplanted (anaerobic) rice ecosystem or rice based crop sequences with different times of application like pre-emergence (PE); early post emergence (EPOE) or Post emergence (POE). Some experimental reports also showed that continuous uses of same chemical herbicides in rice ecosystem or rice based cropping sequence ecosystem have been causing shifting of weed flora and weed pest resistance. Therefore, it is advocated to use of crop diversification as well as rotation of chemical herbicides. Persistence of herbicides residues in long –term herbicidal trials with several chemical herbicides revealed that the soil residues at harvest were found below detectable limit in soil and though in paddy grains and straw some residues were detected but these were below MRL. Weed plants, the major pest of rice, as is causing yield losses to the tune of around 42% (average of different rice ecosystems) and proper management of this major pest of rice could able to reduce this yield losses. Therefore, for increasing the productivity of the rice without causing much harm to soil and environment, the mechanical followed by lesser toxic organic herbicides applied with low dose and with proper time, could be used in rice plant. This will enable to reduce the input cost of traditional hand weeding and increase the production and productivity of rice. More emphasis for weed management is needed to be given on Direct seeded rice ecosystem.

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Current weed problems of hill eco-system and their management

N. N. Angiras and Suresh Kumar
Department of Agronomy, CSKHPKV, Palampur (HP)
e-mail : angirasan@yahoo.com.in

Hilly regions of India comprising western hills/mountain, western highlands, N.E. hills, Eastern mountains and shivaliks of North plain zone constitute 17.7, 15.6, 10.7, 8.0 and 1.7 million hectares, respectively representing 16.4 per cent of the total geographical area of our country. These areas are located at an elevation between 400->8498 meter above mean sea level and physiographically have gentle to steep slopes. In Himalayan regions, resources are limited and finite and are confronted with many constraints. Such type of situations are very conducive for the invasion and spread of many alien invasive weeds in cropped and non-cropped situations. Based upon altitudes the hill ecosystem in general and of Himachal Pradesh in particular can be broadly divided into four agroclimatic zones: i) Sub mountain low hills sub tropical zone (350-650 m above mean sea level),ii) Mid hills sub humid zone (651-1800m amsl),iii) High hills temperate wet and iv) High hills temperate dry (more than 1800 m amsl). The variable soil and climatic conditions in these areas cause variation in type of crops and associated weed flora.

Current weed problems

The current weed problems of cropped and non cropped situations in different hilly zones of the country have been listed as follows: In cropped areas under high hills temperate dry zone major wed problems are *Equisetum typhoides Digitaria sanguinalis,Chenopodium botrys, Stellaria media, Malva rotundifolia, Digitaria sanguinalis, Capsella bursa-pastoris, Gallinsoga parviflora, Cirsium arvense, Cyperus aristatus* while in high hills temperate wet zone major weed problems are *Digitaria sanguinalis, Echinochloa crussgalli, Commelina benghalensis, Setaria glauca, Ageratum conyzoides, Brachiaria* spp*., Cyperus iria, Phalaris minor, Lolium temulentum, Avena sterilis, Stellaria media, Capsella bursa-pastoris, Veronica persica, Rumex acetocella, Rhoes papave.* Major weeds of sub-montain low hill sub- tropical zone are *Echinochloa colona, E. crus-gilli, Cyperus rotundus, Brachiaria ramosa, Sorghum halepense, Ageratum conyzoides, Parthenium hysterophorus, Commelina benghalensis, Cyperus rotundus, Ipomoea pestigridis, Cyperus iria, Eleusine indica, Dactyloctenium aegypticum, Digera arvensis, Celosia argentea.*

In Non-cropped area in orchards and plantation crops, the dominant weeds are *Conyza stricta, Erigeron* canadensis, Equisetum typhoides, Gallinsoga farviflora, Rhoes papaver, Circium arevnse, Galium aprine, *Rumex* sp. *Ageratum houstonianum, Bromus mollis, Veronica persica, Stellaria* spp*., Parthenium hysterophorus, Chromolaena adenophorum, Imperata cylindrica, Rubus* sps., *Zizyphus rotundifolia* etc. The major weed problems of the grasslands are *Lantana camara, Parthenium hysterophorus, Chromolaena adenophorum, Ageratum houstonianum, Bidens pilosa,Erigeron canadensis, Zizyphus rotundifolia etc.* The major weeds of forest ecosystem are *Lantana camara, Chromolaena adenophorum, Rosa indica, Rubus* sp*., Parthenium hysterophorus, Ageratum houstonianum etc.*

The major weeds of aquatic system which have invaded lakes and water bodies in the hills are *Eichornia crassipes, Typha angustata, Ipomoea carnea, Cyperus* sp*., Scirpus* sp*., Phragmites commurnis, Acorus calmus.*

Management of weeds

No single method of weed control is exclusively effective to manage different weeds under variable ecosystems. An integrated weed management method have been approach comprising combinations of chemical, mechanical, good husbandry methods have been standardized in different ecosystems. But because of low temperatures, high organic matter, high rainfall and heavy textured soils in hills, comparatively higher doses of herbicides are required than the plain areas to manage weeds in cropped and non cropped situations. The technologies to manage weeds in cropped and non-cropped ecosystems is given below:-

Cropped lands:

Crop	Weed management technologies	Refrences
Kharif crops:	Butachlor(Pre.) 1.5 kg/ha fb. *halod*/beushening fb. 2,4-D 1.0 kg/ha.	Angiras and Sharma (1998)
Rice		Kumar *et. al*. (2008)
	Or	
Direct seeded upland		Chaudhary *et. al*.(1992)
	Cyhalofop butyl 90 g/ha (15-20 DAS) fb. *halod* fb. 2,4-D 1.0 kg/ha	
Transplanted rice	Butachlor 1.5 kg/ha (5 DAT)/ Pretilchlor 0.75 kg/ha / cyhalofop butyl 90 g/ha (15-20 DAT) fb. 2,4-D 1.0 kg/ha	Saini and Angiras(1998)
Maize	Atrazine 1.5 kg/ha (Pre) /pendimethalin 1.5 kg/ha (Pre) *fb*. atrazine 0.75 kg/ha at 1-2 leaf stage of Ageratum.	Angiras and Singh(1988)
Maize+Soybean	Pendimethalin 1.5 kg/ha / Alachlor 1.5 kg/ha/ Metolachlor 1.5 kg/ha(Pre)	Kumar and Angiras(2005)
Urd-bean / Rajmash	Pendimethalin 1.0 kg/ha (Pre) + one hand weeding	Angiras and Rana(1995), Kumar et.al. (2008)
Soybean	Imazethapyr 100g/ha (Pre)/ Pendimethalin 1.5 kg/ha/ Quizalofop butyl	Angiras et. al. 2008
		Rana and Angiras (1995)
Rabi crops:	Isoproturon 1.0 kg/ha + 2,4-D 0.75 kg/ha (30 DAS)/ Clodinafop 60 g/ha fb. 2,4-D (40-45 DAS)	
Wheat		
Gobhi sarson	Pendimethalin 1.5 kg/ha / hand weeding twice	Angiras et. al. (1991)
Flax	Isoproturon 1.0 kg/ha(Post)	Kumar et. al. 2008
Potato	Pendimethalin 1.5 kg/ha (Pre) /metribuzin 0.5 kg/ha (Pre)	Saini and Angiras(1998)

Non-cropped Ecosystems: Integrated technologies to manage *Lantana camara, Ageratum houstoniaum, Imperata cylindrical, Saccharum spontancum* and *Parthenium hysterophorus* have been explained by Angiras (1998),Angiras (2000) and Angiras and Rana (2005).

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O - 1 Weeds as major production constraints in direct-seeded rice under rainfed situation

Sahadeva Singh[1], V. P. Singh[2] and M. S. Raghuvanshi[3]

[1]Ministry of Agriculture, National Rainfed Area Authority, NASC Complex, New Delhi

[2&3]Directorate of Weed Science Research, Jabalpur

e-mail : sahadeva73@yahoo.co.in

Constraints in rice production vary state to state and area to area. The major rice growing areas are concentrated in Eastern and southern parts of India and some of these regions are generally experience high rainfall and severe flood almost every year. The loss to the rice crop is considerably very high. Besides, in upland areas, direct-seeded rice gets setback either from high rainfall or drought condition. It has also been observed that certain category of soils do not give the desired yield response to the balanced application of fertilizers. The main reasons for this lack of response to the application of balanced fertilizers are associated with certain inherent characters of the soil where undesirable plants like weeds thrive well under these situations. All these problems/constraints are affecting the productivity of the rice crops in different growing zones. In certain areas, farmers are small and marginal and they are poor in resources. Therefore, they are not in a position to use optimum quantity of inputs (availability of suitable high yielding varieties and quality seeds) in their crops which are essential for increasing the productivity. Continuous use of traditional varieties due to the non-availability of seeds to the farmers, lack of awareness about high yielding varieties (Upland, rainfed lowland and deep water areas) are major factors effecting the productivity of rice in these areas.

Often rice crop suffers with soil moisture stress due to erratic and inadequate rainfall. In upland soils rain water flows down quickly and farmers are not able to conserve the soil moisture. Farmers face difficulty in providing life saving irrigation particularly in upland and drought prone rainfed lowland areas. If proper attention is not paid for conservation of soil moisture and controlling of heavy infestation of weeds in upland and rainfed lowland areas, production will adversely be effected. Poor adoption of improved crop production technology due to economic backwardness of the farmers (upland and lowlands) and use of single herbicide in the same areas, are the major constraints in production. Weed shift may take place immediately after the application of a single compound, compelling farmers to look for new control methods and/or additional herbicides. Knowledge of the behaviour of weed species is lacking in the basic information available for weed control in most developing countries. Nevertheless, the interaction of weeds as a complex and their seed bank is an important aspect requiring attention. Control measures have always been adopted to reduce weed infestation at certain phases of the crop cycle, but never in order to bring about a sustainable reduction of the infestation. The scope for expansion of area under rice cultivation has almost been exhausted. Only way to sustain production for meeting the growing demand by 2020, is to increase the productivity per unit of area including intensive use of land by increasing the cropping intensity. Suitable integrated weed management (IWM) strategies must be adopted to increase the productivity of rice in various states. Emphasis may be given on a cropping system approach rather than a single crop development approach. Dispersal of location specific weed management technologies in different agro-climatic zones should be through demonstrations on farmers' fields and organizing of trainings to farmers. Emphasis on replacement of low potential/pest susceptible old varieties by new high yielding varieties with promising yield potential and weed smothering rice varieties be given for boosting the productivity of rice. Popularization of line sowing in upland rice areas through suitable seeding devices for establishment for desired level of plant population would be easy in weed control and may help in application of other management techniques. Use of crop rotation with allelopathic crops and rice cultivars, inclusion of fodder crops before the rice crop in a rice-wheat rotation may provide satisfactory weed control and can minimize the use of herbicides. IRRI research findings have shown wide variation in allelopathy among rice cultivars which can suppress both monocot and dicot weed species. Planting of barnyard grass (*Echinochloa crus-galli*) together with various varieties of rice in the greenhouse has shown the potential of some varieties to inhibit weed growth by up to 40 percent. Competitive rice cultivars such as Vandana, Kalinga-III and RR-151-3 have shown better weed competitive ability and higher yield potential under sub-optimal weed management condition at DWSR, Jabalpur. Rice may be successfully intercropped with legumes, such as *Crotalaria juncea, Vigna sinensis, Glycine max* and *Sesbania rostrata* which smother weed stand composed of *Echinochloa colona, Panicum* spp., *Ischaemum rugosum*, *Cyanotis* spp. and *Eclipta prostrate*.

O - 2

Discriminating *Phalaris minor* and *Avena ludoviciana* from wheat (*Triticum aestivum L.*) crop through their spectral reflectance characteristics under natural field conditions

Ramanjit Kaur and R. K. Mahey
Deptt. of Agronomy, PAU, Ludhiana, Punjab
e-mail : ramaan180103@yahoo.com

Remote sensing, the process of acquiring information about object from remote platform such as ground based booms, aircrafts or satellite is a potentially important source of data for site specific crop management, providing spatial and temporal information. For site specific application of herbicides, automatic detection and evaluation of weeds is desirable. Since reflectance of crop, weeds and soil differs in the visual and near infra-red wavelengths, there is a potential for using reflection measurements at different wavelengths to distinguish between them. Weed spatial variation offers the potential for more cost and input efficient weed management. An attempt was made through field experiment on the hypothesis to differentiate between wheat crop and two weed species *viz*., *Phalaris minor* and *Avena ludoviciana*. The two experiments were conducted during *Rabi* 2006-07 and 2007-08 with five weed control treatments each *viz*; control, where no herbicide was applied for controlling weeds (T_1), partial control means half of the recommended dose of herbicide was applied (T_2), recommended dose of herbicide was applied (T_3), partial but manual control (T_4) and complete manual control of *P. minor* (T_5) and *Avena ludoviciana*. The meteorological data recorded at Meteorological Observatory of Punjab Agricultural University, Ludhiana during crop growing seasons indicated that almost normal weather conditions prevailed during the two crop seasons except for rainfall, which was highly variable during two years of study. Maximum temperature ranged between 19.5 to 36.8°C during first year and 16.9 to 34.1°C during second year against the normal range of 18.3 to 34.2°C from November to April. Minimum temperature ranged between 4.2 to 19.4°C during first year and 4.5 to 17.7oC during second year against a normal range of 4.2 to 16.9°C. First year received 185 mm rainfall during November to April, whereas the second season received 89 mm of rainfall against a normal value of 111 mm. The soil of the experimental fields had normal soil reaction and electrical conductivity, was low in organic carbon and available nitrogen and medium in available phosphorus and potassium. Spectral reflectance in two wave bands i.e. Red (625-689 nm) and Infrared (760-897 nm) was recorded at fortnightly intervals with hand held ground truth radiometer to determine the spectral signature characteristics of *Phalaris minor* and *Avena ludoviciana* throughout the crop growth cycle and Red reflectance (%) and Infrared Reflectance (%) were calculated. Radiance ratio (RR) and Normalized difference vegetation index (NDVI) were derived from Red and IR band reflectance.

The results postulated a decreasing trend in Red reflectance (%) from 34 DAS to 95 DAS and thereafter a sharp increase was observed in all the treatments during both the years of investigation in both the experiments. On the other hand, infra-red reflectance (%) showed a reverse trend to that of red reflectance for both the years of study in both the experiments. The Radiance ratio (RR) and Normalized difference in vegetation index (NDVI) increases with the advancement of crop growth and reached maximum between 95-100 days after sowing i.e. the grand growth period of the crop and afterwards decreases till maturity during both the years for both the experiments conducted. The highest Radiance ratio (RR) and Normalized difference in vegetation index (NDVI) values were obtained in the pure wheat crop or in complete control of *Phalaris minor* and *Avena ludoviciana* (T_3 and T_5) as compared to other three treatments during 2006-07 and 2007-08.The control treatment recorded the least RR value among all the treatments. Differences in RR and NDVI values between the treatments are mainly due to dark green colour of wheat, more Leaf area index (LAI) and biomass as compared to two weed species. We can discriminate the pure wheat crop from two weed species just after 34 DAS, but it is difficult to distinguish amongst the weed control treatments. After 52 days after sowing, very clear differences in the RR and NDVI of different weed control treatments were observed. So from such type of studies, farmers can take decisions for taking preventive measures for controlling weeds in the infested areas only for economic and efficient use of herbicides and for ecofriendly too.

O - 3

Weed utility- a concept and practice for sustainability

Ramesh Babu, Aravinda Kumar B. N. and R. Y. Katti
Professor (Agronomy) & Head, DWSR Centre, UAS, Dharwad (Karnataka)
e-mail : rameshbabu.niws@gmail.com

In India, conservation agriculture is gaining momentum for achieving food security through sustainable crop production. Of the various components of conservation agriculture, weed control is one of the important practices. It is evident that use of broad-spectrum herbicides take a major share in no till/ conservation tillage systems. In the long run, the frequent use of broad-spectrum herbicides may create an imbalance in the agro-ecosystems in relation to soil health, flora and fauna, dominance of troublesome weeds and also development of resistance by weeds. In this context, weed control through utilization is a possible option to achieve goals aimed at sustainable livelihood. Weeds support high species diversity in agro-eco systems as they sustain birds and bees- key crop pollinators. It is imperative to maintain a balance between biodiversity and crop yield. In such a situation many studies reveal removing of weeds based on their relative importance in the food chain. In shifting agriculture practices of NE states of India, removal of weeds manually and leaving about 20% untouched is widely seen. Crop rotation and selective removal of weeds would be the suggested remedies rather than use of broad-spectrum herbicides in view of consequential adverse effects.

Weeds have invariably been considered unwanted by modern agriculturalists who have always laid emphasis on their control, eradication and removal. Every year about 30 per cent of crop yield in India is lost on account of weed menace. Despite this fact, it is interesting and surprising to know that weed removal has adverse impacts on the entire food web of a given agro-eco system. An attempt has been made in this paper to focus mainly on the usefulness of weeds as per their dominance in a given situation.

There is wealth of literatures available on ancient uses of weeds for food, medicines, extraction of leaf protein for human and animal consumption, water hyacinth for animal fodder, compost and mulch, removal of heavy metals, industrial uses like paper making, basket work, soap, gas and alcohol production, gas, proteins, chemicals, fodder, compost, fish, food, pulp, paper, yeast culture, antibiotics, pollution abatement have been well documented. The common weed flora found in the field can be put to several multiple uses like food (eg. *Portulaca oleracea*), medicines (eg. *Argemone mexicana, Momordica cymbalaria*); and paper, pulp, firewood (eg. *Prosopis juliflora*), mulch, compost (eg. *Eichhornia crassipes*) etc. Obnoxious weeds like *Parthenium*, also finds a place on account of several useful alleopathic properties. Beneficial extracts of *parthenium* can be utilized for crop production (Oudhia and Tripathi, 1999). Allelopathy could be used to increase crop production and to diminish the current reliance on synthetic agrochemicals that degrade the environmental quality. Weed species need to be identified especially for phytochemical and pharmacological studies that may contribute to development of important pharmaceutical products in future. The in depth knowledge is needed as to how many weed species, especially those which grow in profusion, may be usefully converted to human food, because this is obviously more efficient and rewarding than having first to feed the plant material to an animal for conversion into edible products. The Opportunities and prospects related to commercial and non-commercial uses of weed species are discussed in this paper with a special emphasis on 'Control though Utilization'.

O - 4

Increasing resistance in *Phalaris minor* against recommended herbicides

R. K. Bhatia, Tarlok Singh and S. K. Randhawa
Department of agronomy, Punjab agricultural university, Ludhiana (Punjab)
e-mail : rohitkbhatia@rediffmail.com

After development of resistance in *P. minor* against isoproturon in mid nineties some alternate herbicides namely clodinafop, sulfosulfuron and fenoxaprop-p-ethyl were recommended. Farmers immediately shifted from isoproturon to these recommended herbicides. Recently two new herbicides pinoxaden (Axial 5EC) and mesosulfuron+ iodosulfuron (Atlatis 3.6 WDG) have been recommended for control of P. minor in wheat. Once the phenomenon of resistance has set in against one herbicide, there is always a possibility that the weed may develop cross or multiple resistance against the other herbicides too involving similar or different mode of action. Therefore, research experiments were conducted to monitor the possibility of development of resistance in *P. minor* against recommended herbicides. A field experiment has been running for last ten years where *P. minor* populations are subjected to same herbicide (recommended dose) year after year using the progeny seed. In another experiment populations of *P.minor* were collected from different places in the state and treated with herbicides at 0,1/2 X, X and 2 X doses. Here also the inheritance of resistance was confirmed by planting progenies of the survivors in the next season and exposing them to same herbicide. The research experiments indicated that fenoxaprop- p- ethyl after few years was not able to induce any mortality in *P. minor* even at double the recommended dose (0.2 kg/ha). Sulfosulfuron and clodinafop were the only two most commonly used herbicides in wheat. It was observed from last 3-4 years that the control *P. minor* has been very poor with these herbicides, particularly clodinafop and these failed to induce any meaningful mortality. Some populations of *P. minor* showed resistance against clodinafop at 2x dose and this is increasing from the year to the next. From the recently two recommended herbicides, pinoxaden has been more effective against *P. minor* than mesosulfuron + iodosufuron . Pinoxaden is the only herbicide which induced complete mortality in *P. minor* and had GR50 value (14.99 g/ha) much less than the recommended dose (50.0 g/ha). In rest all the herbicides the GR50 value was either near to the recommended dose or higher, indicating loss of efficacy against the weed. Pinoxaden recorded the lowest RGRvalue 0.0046 g/g/day followed by mesosulfuron + iodosulfuron 0.0295 g/g/day, sulfosulfuron 0.0388 g/g/day, fenoxaprop 0.0416 g/g/day, clodinafop 0.0448 g/g//day and isoproturon 0.0554 g/g/ay. It was 0.0529 g/g/day in control. Since clodinafop, fenoxaprop and pinoxaden are all Acc'ase inhibitors and *P. minor* has already showed resistance against first two herbicides, the chances are that it may soon develop cross resistance against pinoxaden also but its chemistry (den group) is different than fop (clodinafop and fenoxaprop) group of herbicides (Chhokar and sharma,2008). Now experimental evidences here in Punjab and elsewhere show that *P. minor* exhibits resistance involving all three major mechanisms namely PS II, Acc'ase and ALS inhibition, thus has developed both multiple and cross resistance. Therefore, it warrants a thoughtful approach to reduce the seed bank of *P. minor* in soil using some integrated weed management and crop rotation practices thereby reducing its exposure (selection pressure) to herbicides against which it has started showing resistance (Hofer *et al*.2006).

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O - 5 Weed management practices in rice based cropping system in Chhattisgarh : a farmers perspective analysis

M. L. Sharma, A. L. Rathore, A. P. Singh and J. D. Sarkar
Department of Agricultural Extension, IGKV, Raipur (Chhattisgarh)
e-mail : apalsingh@yahoo.com

Weed is becoming major problem these days in Chhattisgarh mainly due to fast urbanization, industrialization, ever increasing wages of agricultural labour as well as their scarce availability at critical crop stages like weeding. With the result, either farmers are unable to control the weeds in time and loosing the yield substantially or they are giving weeding operation on contract at higher rates, which are not viable in log term. Since, number of new and effective herbicide molecules is available these days especially for rice; therefore, if these molecules are properly demonstrated and popularize in scientific manner among farmers, the problem of weeds may be minimized up to the bearable levels.

The study was conducted in three villages i.e. Tarra village from Raipur, Hingna from Durg and Kotanpali village from Mahasamund district of the Chhattisgarh state. These villages were selected purposively because the on farm research activities of the IRRI-IGAU collaborative CURE-WG1 project work were carried out in the same villages and the villages are almost representative to all the existing cropping as well as social environment of the state. For each selected village, a list of farmers was prepared and 50 farmers (Including direct beneficiaries of the project) from each village were selected randomly. In this way, a total of 150 farmers were taken as the respondents for this study. The data were collected through personal interview technique with the help of structured questionnaire. In addition to individual survey, closed observations, Focus group Discussions (FGDs), Group interviews and village level field functionaries were also utilized for collection of data.

The result indicated that majority of the farmers (53%) belonged to OBC followed by ST, Scheduled Cast (SC) and only few farmers are belonged to General cast. The majority of respondents were residing in the joint families system having 5-10 members in their families. Television and Radio were used by the 53 per cent of the respondent farmers for gaining agricultural and allied information. However, Rural Agricultural Extension Officer (RAEO) and progressive farmers/local leaders are the most popular communication media for dissemination of agricultural technology among the respondents. Rice is the major wet season crop in all the sites. Pigeonpea, blackgram, maize, vegetables etc. were some of the other crops being cultivated by the farmers during winter season mostly in small scale. Grasspea, chickpea, lentil, linseed etc. are the major dry season crops which were generally grown as relay crop by the respondents in rice based cropping system. Wheat, sunflower, vegetables etc. dry season crops were grown by limited respondents under the irrigation facility. The farmers of all the sites feels that weeds are one of the major hindrances for increasing rice productivity, the affect of which ranges from 5-20 percent. Some of the respondents gave high to very high severity weightage to these problems. Bunds/field and un-decomposed FYM were the major sources of weeds to the rice fields as reported by the respondents. Some other reasons were also uttered by the respondents for causing weed problem in rice fields. In all the selected sites, farmers were controlling the weeds by hand weeding and some of the weeds were controlled during *biasi* operation and only few respondents were adopting chemicals control of weeds. Among various reasons for not utilizing the herbicides by the farmers, lack of awareness, non significant / visible affect of herbicides, poor economic condition of the farmers, etc. were most important. However, the up scaling of post emergence herbicides at large scale in the farmers field have build up the confidence of farmers towards the technology. In the light of views of farmers, close observation of the sites by the scientists, it was found that sincere efforts are required through strategic extension activities for increasing the adoption of recommended weed management practices among the framers to increase their productivity and improvement in socio-economic status.

O - 6 Weed management in maize for higher production and returns on farmer's field in Shivalik foothill region

Pratap Singh, S. L. Arya and Ram Prasad

Central Soil and Water Conservation Research and Training Institute, Research centre, Sector, 27-A, Madhya Marg, Chandigarh

e-mail : dr.pratapsingh@yahoo.co.in

Research based field crop demonstrations on effect of weed management practices on the yield of maize (*Zea mays L.*) were conducted in two watersheds during *Kharif* cropping seasons of 1996 (NWDPRA, Perch, district Nawan Shahar, Punjab) and 1997 (IWDP, Bhagwasi, district, Patiala, Punjab). Five weed control treatments comprising of i) control, ii) Atrazine spray @ 1.25 kg/ha as pre emergence, iii) two manual weeding, iv) Atrazine + one manual weeding and v) halod, were studied in RBD replicated five times. Two treatments i.e, i) one weeding and ii) Atrazine + one weeding + halod were included and two hand weeding were treatment was removed during 1997 under Bhagawasi watershed. High yielding maize variety was sown at 60 cm row to row spacing with recommended doses of fertilizer. The experiments were laid out on farmer's field and treatments were imposed by the farmers themselves as per instructions and treatments requirement. Results obtained from the study indicate that adoption of various weed management practices significantly increased grain, stover and yield attributing characters of the maize crop during both the years of study. During 1996, application of atrazine + one hand weeding treatment recorded significantly higher grain yield (3463 kg/ha) over all other treatments. This treatment also gave higher values of yield of stover, length and width of cobs along with test weight. The values of these characters increase by 69.8, 24.0, 11.8 and 23.5 percent respectively as compared to control. The pronounced effect of increase in grain yield during 1997, was observed under treatment atarzine + one hand weeding + halod 30 days after sowing (3498 kg/ha). This treatment resulted in increase in grain, stover, cobs length & width and test weight by 175, 52.5, 19.7, 7.85, and 7.14 percent respectively over control. Maximum net returns of Rs.12618 / ha was also recorded under this treatment and control treatment resulted in minimum net returns of Rs. 2089/ha. The increase in grain yield of maize under various weed management treatment may be attributed to reduction in weeds quantity, thereby, reduction in crop weed-weed competition which provided congenial environment to the crop for better expression of vegetative and reproductive potential. It was concluded from the study that effective weed control at early growth stage of maize crop not only resulted in higher yield and net returns but also helps in reducing nutrients loss and to conserve sufficient moisture in soil profile for crop use at later crop growth stages.

O - 7 Weed seed bank as influenced by conventional and zero tillage as well as weed management practices

S. S. Kolhe, A. P. Singh, N. Pandey and G. K. Shrivastava
Department of Agronomy, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh
e-mail : apalsingh@yahoo.com

Continuous adoption of a particular crop/cropping system leads to serious problems of specific and crop associated weeds. Similarly, adoption of tillage methods and weed management practices play an important role in the development of weed seed bank in the soil. It also determines the depth and quantity of weed seeds of various species at a particular soil depth and its germination ability from different soil layers. Weed seed study also enables to have estimates of probable competition of weeds in the area in next growing season. Such study is also helpful in monitoring the effectiveness of treatments applied for weed management which ultimately helps in developing weed management system for specific crop/cropping system of the region. With this view, an experiment on weed seed bank study was conducted at University farm of Indira Gandhi Krishi Vishwavidyaylaya, Raipur, Chhattisgarh. Weed seed bank studies were carried out in an experiment laid out in split plot design having four tillage operations i.e. two each in conventional and zero tillage and three treatments of weed management practices i.e farmer's practice (two hand weedings at 20 and 35 DAS), application of recommended pre and post emergence herbicides and a weedy check. Rice variety MTU-1010 was the test crop sown directly in lines at a spacing of 20 cms. apart. Recommended dose of fertilizer was applied. Soil samples from two depths i.e. 0-5 and 5-10 cm. were collected treatment wise after the harvest of rice in 2007. Five random soil samples from each treatment were drawn and mixed thoroughly. The air dried soil samples were spread in shallow pots followed by regular watering to facilitate early emergence of weeds. Species wise weed emergence was recorded. *Echinochloa colona, Ischaemum rugosum, Cynotis axillaris, Alternanthera triandra, Commelina benghalensis,* Croton *banplandianum, Cyperus iria* were the main weeds emerged from different soil layers. Total number of weeds emerged was slightly higher under zero tillage as compared to conventional tillage at 0-5 cm depth, whereas, at 5-10 cm depth, the weed emergence was slightly higher under conventional tillage than zero tillage. Among the weed control treatments, weed emergence at both the depths was lowest under hand weeding treatment and was highest under weedy check treatment. Overall emergence of *Echinochloa colona* was highest as compared to other weed species.

O - 8

Weed management studies in autumn planted sugarcane based inter cropping system

Jaidev, A. K. Singh and Raj Kumar

Dept. of Agronomy, N.D. University of Agriculture and Technology, Kumarganj, Faizabad (U.P.)
e-mail: jdsnduat@gmail.com

Field experiment was carried out during autumn season of 2007-08 and 2008-09 at Agronomy Research Farm of N.D. University of Agriculture and Technology, Kumarganj, Faizabad (U.P.) in split-plot design with three replication having plot size of 5.4 m x 10 m. In the main plot, three intercrops (wheat, mustard and potato) along with sugarcane as sole crop while in sub-plot four weed control treatments (pendimethalin and isoproturon at 1.0 kg/ha each as pre-emergence along with farmers practice (5 weeding and hoeing) and weedy were taken. Three budded cane sets of sugarcane cv. CO98231 were planted on November 1, 2007 at a row spacing of 90 cm while during second year, after the harvesting of the planted sugarcane crop on 28th October, 2008, the same treatments were executed in the ratoon crop of sugarcane. In between the two rows of sugarcane, two rows of potato (cv. Kufri Badshah) and mustard (cv. NDR-8501) at 45 cm and wheat (cv. PBW-343) at 22.5 cm apart were sown. The prominent weeds found in the experimental field during both the years were *Phalaris minor, Chenopodium album, Rumex spp., Melilotus indica* and *Medicago denticulata*, however, at harvest stage of sugar cane *Cynodon dactylon, Cyperus rotundus, C. auxillaries, Commelina benghalinsis* and *Digiteria sanguinalis* were invaded the crop. Both the herbicides applied at 1.0 kg/ha as pre-em. and farmers practice (weeding/hoeing at 30, 60, 120, 180 and 240 DAH of sugarcane) being at par recorded significantly lower weed density and dry matter of total weeds and higher sugarcane yield. Among the different intercrops, potato accelerated the cane yield significantly as compared to mustard and wheat which was at par with pure sugarcane crop. Similar trend was observed with cane yield equivalent (CYE) also. More over, about 60, 13 and 23% higher CYE was recorded with the intercropping of potato, wheat and mustard, respectively over sole crop of sugarcane.

P-1 Weed flora in Raipur district of Chhattisgarh : scientific survey

Shweta Gupta, Nirmodh Prabha, Nitin Sharma and A. P. Singh
Department of Agronomy, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.)
e-mail : apalsingh@yahoo.com

Import of food grains had always been the entry of alien weed species as evidenced in case of *Parthenium hysterophorus, Eichhornia crassipes*, etc. In recent past, government of India has imported 6288890 metric tones of wheat during 2006-07 from 11 countries and this wheat has been distributed in Chattisgarh along with other 9 states (namely Tamil Nadu, Andhra Pradesh, Kerela, Karnataka, West Bengal, Maharashtra, Gujarat, Orissa and Madhya Pradesh) through public distribution system. Along with this wheat, seeds of more than 30 weed species have also entered in our country, of which 5 weeds are of alien nature, namely, *Ambrosia trifida, Cenchrus tribuloides, Cyanoglossum officinale, Solanum carolinence* and *Viola arvensis*. Initial control of these alien weeds is of utmost importance to avoid their epidemic spread as has happened in case of *Parthenium hysterophorus.* With this view a surveillance programme had been initiated in 2008, so that, identification of 5 new suspected entries of alien weeds be done timely and strategies be evolved to control these weeds at the initial period of spread in the state.

Initially, a grid map of Raipur district was prepared to conduct an effective surveillance of 5 alien weeds and survey of prevalent weed flora of *kharif, rabi* and summer seasons in the district. Ten blocks and 51 villages were covered in 2008-09. Fields of three farmers from each village were chosen for study. With each farmer, three locations *viz*. cropped area, non-cropped area and garbage area were considered the best places for conducting the survey, so that all types of weed species may be covered. At each point of survey, for taking weed observation through quadrate method, quadrate of 0.5 m (i.e. 0.25 sq.m. area) was used. This quadrate was dropped randomly at five different places in cropped area, non cropped area and garbage area. Total number of all types of weed species occurring in each quadrate was recorded. The weed species uprooted during the observation were dried at room temperature initially and finally were dried in the oven and dry weight was recorded accordingly for each species of weeds surveyed at different locations. Accordingly, density of weed per sq.m., dominance, frequency %, relative density, relative dominance, relative frequency and IVI were calculated.

A total number of 27 weed species were identified during the survey in cropped area of Raipur district. The main crop in the area during *kharif* was rice, vegetables and during *rabi*, the main crops in the district were Rice, Vegetables, Wheat, Chickpea, Mustard, Mango orchard. *Echinochloa colona* registered with highest density, dominance, frequency, relative density, relative frequency, relative dominance and IVI among the 27 weed species. *Echinochloa colona* registered with highest density (3.2), dominance (3.04), frequency (25.88), relative density (17.48), relative frequency (16.06), relative dominance (0.47) and IVI (34.01) among the 27 weed species. The order of IVI of other weed species was followed by *Cynodon dactylon* (23.67), *Cyperus rotundus* (18.73), *Ageratum conyzoides* (13.26) and *Cyperus iria* (12.6) in descending order but with differed order of other ecological parameters. However, IVI of weed *Spilanthes calva* was found to be lowest (i.e. 0.21).

A total number of 25 weed species were identified during the survey in non-cropped area of Raipur district. *Cynodon dactylon* registered highest density/ m^2 (4.56), frequency (38.43), relative density (17.36), relative frequency (19.37) and IVI (37.08) among the 25 weed species whereas, highest dominance and relative dominance was recorded for *Parthenium hysterophorus* (6.48 and 0.73, respectively). Other weed species with higher IVI were *Alternanthera sessilis* (23.38)*, Parthenium hysterophorus* (21.71), *Cassia tora* (16.53) and *Abelmoschus moschatus* (14.01), in descending order, but with differed order of other ecological parameters. *Ludvigia parviflora,* on the contrary, had the lowest IVI (0.13) amongst the 25 weed species. A total number of 23 weed species were identified during the survey in garbage area of Raipur district. *Cynodon dactylon* registered with maximum density (4.68), frequency (34.51), relative density (20.87), relative frequency (20.32) and IVI (41.63). Whereas, *Parthenium hysterophorus* registered highest dominance (4.74) and relative dominance (0.67). This trend of IVI was closely followed by *Alternanthera sessilis* (34.66), *Cassia tora* (20.10)*, Parthenium hysterophorus* (19.61) and *Tridax procumbense* (18.51), in descending order, but with differed order for other ecological parameters. *Cyperus rotundus,* on the contrary had the lowest IVI of 0.34 amongst the 23 weed species.

P - 2

Weed survey in Raigarh district of Chhattisgarh

Vivek Tripathi, S. Malaiya, Shweta Gupta, Nirmodh Prabha and A. P. Singh
Department of Agronom, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.)
e-mail : apalsingh@yahoo.com

In recent past, government of India has imported 6288890 metric tones of wheat during 2006-07 from 11 countries and this wheat has been distributed in Chattisgarh also along with other 9 states (namely Tamil Nadu, Andhra Pradesh, Kerela, Karnataka, West Bengal, Maharashtra, Gujraat, Orissa and Madhya Pradesh) through public distribution system. Along with this wheat, seeds of more than 30 weed species have also entered in our country, of which 5 weeds are of alien nature, namely, *Ambrosia trifida, Cenchrus tribuloides, Cyanoglossum officinale, Solanum carolinence* and *Viola arvensis*. Initial control of these alien weeds is of utmost importance to avoid their epidemic spread as has happened in case of *Parthenium hysterophorus*. With this view a surveillance programme had been initiated in 2008, so that, identification of 5 new suspected entries of alien weeds be done timely and strategies be evolved to control these weeds at the initial period of spread in the state.

Initially, a grid map of Raigarh district was prepared to conduct an effective surveillance of 5 alien weeds and survey of prevalent weed flora of *kharif*, *rabi* and summer seasons in the district. Two blocks and 35 villages were covered in *kharif*, 2009. Fields of three farmers from each village were chosen for study. With each farmer, three locations *viz*. cropped area, non-cropped area and garbage area were considered the best places for conducting the survey, so that all types of weed species may be covered. At each point of survey, for taking weed observation through quadrate method, quadrate of 0.5 m (i.e. 0.25 sq.m. area) was used. This quadrate was dropped randomly at five different places in cropped area, non cropped area and garbage area. Total number of all types of weed species occurring in each quadrate was recorded. The weed species uprooted during the observation were dried at room temperature initially and finally were dried in the oven and dry weight was recorded accordingly for each species of weeds surveyed at different locations. Accordingly, density of weed, dominance, frequency %, relative density, relative dominance, relative frequency and IVI (Importance Value Index) were calculated.

In Raigarh district, a total 41 villages of 2 blocks were surveyed during *kharif*, 2009. A total number of weed species were identified during the survey in Rice fields of Raigarh district. The main crop in the area during *kharif* was rice, vegetables and Black gram. *Commelina benghalensis* registered with highest density, dominance, frequency, relative density, relative frequency, relative dominance and IVI among the 41 weed species. *Commelina benghalensis* registered with highest density (5.35), dominance (6.37), frequency (31.72), relative density (11.09), relative frequency (6.64), relative dominance (0.24) and IVI (17.97) among the 41 weed species. The order of IVI of other weed species was followed by *Cyperus iria* (12.94), *Amaranthus viridis* (9.75), *Cyanodon dactylon* (8.54) and *Chloris barbata* (8.51) in descending order but with differed order of other ecological parameters.

A total number of 44 weed species were identified during the survey in non-cropped area of Raigarh district. *Cynodon dactylon* registered highest density/m^2 (7.7) frequency (54.48), relative density (11.36), relative frequency (9.56) and IVI (21.31) among the 44 weed species. Other weed species with higher IVI were *Commelina benghalensis* (13.25), *Achyranhes aspera* (12.48), *Digitaria sanguinalis* (11.76) and *Chloris barbata* (9.20), in descending order, but with differed order of other ecological parameters.

A total number of 36 weed species were identified during the survey in garbage area of Raigarh district. *Cassia tora* registered with maximum density (4.97), frequency (37.93), relative density (8.82), relative frequency (6.28) and IVI (15.30). This trend of IVI was closely followed by *Xanthium strumarium* (12.05), *Cynodon dactylon* (11.78), *Chloris barbata* (10.27) and *Sesbania bispinosa* (8.98), in descending order, but with differed order for other ecological parameters.

P - 3

Prevalent weed flora in Korba district of Chhattisgarh

P. K. Joshi and A. P. Singh
Programme Coordinator, Krishi Vigyan Kendra, Korba (C.G.)
e-mail : kvkkorba@yahoo.com

Import of food grains had always been the entry of alien weed species as evidenced in case of *Parthenium hysterophorus; Eichhornia crassipes*,etc. In recent past also, Government of India has imported 6288890 metric tones of wheat during 2006-07 from 11 countries and this wheat has been distributed in Chhattisgarh also along with other 9 states (namely Tamil Nadu, Andhra Pradesh, Kerela, Karnataka, West Bengal, Maharashtra, Gujraat, Orissa and Madhya Pradesh) through public distribution system. Along with this wheat, seeds of many weed species have also entered in our country, of which 5 weeds are of alien nature, namely, Ambrosia *trifida, Cenchrus tribuloides, Cyanoglossum officinale, Solanum carolinence and Viola arvensis*. Initial control of these alien weeds is of utmost importance to avoid their epidemic spread as has happened in case of *Parthenium hysterophorus.* With this view a surveillance programme was conducted during *kharif* 2009, so that, identification of 5 new suspected entries of alien weeds be done timely and strategies be evolved to control these weeds at the initial period of spread in the state. In addition, the other objective of the study was to identify prevalent weed flora of rice, maize and fellow area including garbage area of the district. A grid map of Korba district was prepared to conduct an effective surveillance of prevalent weed flora of *kharif* season in the district. During August 2009, the survey work was done in 22 villages of all the five blocks of the district. Fields of three farmers from each village were chosen for study. With each farmer, three locations *viz*. cropped area; non-cropped area and garbage area were considered the best places for survey, so that all types of weed species could be covered. At each point of survey, quadrate method was applied for taking weed observations; and for the purpose quadrate of 0.5 m (*i.e*. 0.25 M^2) was used. This quadrate was dropped randomly at five different places in cropped area, non cropped area and garbage area. Accordingly, density of weed per M^2 dominance, Frequency per cent, relative density, relative dominance, relative frequency and IVI were calculated. In Korba district, total 22 villages of 5 blocks were surveyed during the m/o August 2009. A total number of 27 weed species were identified during the survey in cropped area of Raipur district.

Total 28 weed species have been identified in the rice and maize field during the survey. It has observed that *Echinocloa crusgalli* registered with highest density (11.90), frequency (92.36%), relative density (9.43) and IVI (19.2), while the weed species *Xanthium strumarium* showed highest dominance (18.09) and relative dominance (0.36%) among all the 28 weed species identified. The order of IVI of also higher for weed species *Cynodon dactylon (*16.52) followed by *Cyperus rotundus (*16.10*)* and *Chloris barbata (*10.81*).*However, the lowest IVI (1.13) was recorded for *Croton spp.*

A total number of 24 weed species were identified during the survey in non-cropped area in the district. Highest density/m^2 was recorded for the weed species *Cassia tora* (10.21) followed by *Cyprus rotundus* (9.98) and *Achyranthes aspera* (9.89), while, *Xanthium strumarium* showed highest dominance (22.51) followed by *Euphorbia geniculata* (12.39) and *Achyranthes aspera* (12.36). The weed species with higher IVI were *Cassia tora* (17.07) followed by *Cyperus rotundus* (16.49), *Achyranthes asper* (15.98) and *Cynodon dactylon* (14.93) with differed order of other ecological parameters. On the contrary, *Portulaca quadrifolia* had the lowest IVI (0.28) amongst the 24 weed species.

A total number of 20 weed species were identified during the survey in garbage area of Korba district. *Cyperus rotundus* registered highest density/ m2 (9.75) frequency (81.09%) relative density (9.93), relative frequency (10.48) and IVI (20.72) among the weed species identified, whereas highest dominance and relative dominance was recorded for *Cynodon dactylon* (10.50 and 0.38 respectively). Other weed species with higher IVI were *Cynodon dactylon* (23.38) followed by *Commelina benghalensis* (18.02) and *Cassia tora* (17.16) but with differed order of other ecological parameters. On the contrary, *Solanum nigrum* had the lowest IVI (1.48) amongst the 20 weed species identified in garbage area of the district. The identified weed species existing in rice, maize, non-cropped area and garbage area of the district required attention of the agronomist involved in weed management research. Although, no alien weeds dangerous in nature, have been found in the district but to avoid their epidemic spread in future.

P - 4

Phytoecological survey of weeds in eastern dry zone of southern Karnataka with an emphasis on alien weeds

N. Ananda, Ramulu, K. P. Praveen, K. S., Somashekar, S. N. Anilkumar, T. C. Yogesh, H. A. Shanmukhappa and T. V. Ramachandra Prasad

University of Agricultural Sciences, MRS, Hebbal, Bengaluru (Karanataka)

e-mail: nananda@rediffmail.com

Karnataka state has been endowed with varied climatic and cropping pattern. The state is divided into ten agro-climatic zones. Among these, Eastern dry zone comprises of six districts. The zone receives an annual rainfall ranging from 679 to 915 mm with major soil of red sandy loam. A survey conducted during 2008-2009 under the National Invasive Weeds Surveillance Programme on weed flora revealed diversified weed flora in habitat wise *viz.,* cropped, non-cropped and garbage areas. The major crops of the zone are sorghum, tomato, mulberry, finger millet, maize and knol kohl. Survey in major cropped areas indicated predominance of weed species namely *Parthenium hysterophorus, Cyperus rotundus, Cynodon dactylon, Synederella nodiflora, Amaranthus viridis, Euphorbia hirta and Eclipta prostrata.* Recently *Synederella nodiflora,* is seen spreading to new areas in cropped as well as grassy areas. The weed covers ground with first onset of monsoon and slowly suppress grasses particularly *Cynodon* occurring under shade. This is becoming a major weed in lawn, garden and golf turf areas. *Cynodon dactylon,* wild castor, *Lantana camara* and invasive weeds *viz., Parthenium hysterophorus* and *Solanum carolinense* were observed in non-cropped areas. The predominant weeds observed in garbage area were *Cynodon dactylon, Sida acuta,* wild castor and invasive weeds *viz., Solanum carolinense* and *Parthenium hysterophorus.* Among the invasive weeds, *Solanum carolinense,* native to Gulf States distributed through import of the wheat from Australia, is noticed in garbage and non-cropped areas. The weed grows to a height of 45 to 85 cm with 6 to 7 branches and 5 to 15 fruits per plant. The flowers are pink in colour. The weed is perennial with root system extending up to 30cm deep; flowers are seen during monsoon as well as summer months. The spines of less than 1 cm with pinkish base are seen on stem, leaves (both the surfaces), calyx of flower and fruits. Seeds are brownish and nearly 250 to 500 seeds per fruit are produced. Seeds take 60 days to germinate under pot culture condition and starts flowering by 60-75 days after emergence. Unless quick remedial measures are taken, this species may become troublesome in the introduced area as it is very difficult to eradicate. Being perennial in nature and deep rooted, the alien weed might cause yield reduction in crops and deteriorate the quality of produce. Weed uses such as deworming, curing stomach ailment, tooth ache etc. could be explored, as revealed by local pandits while using other traditional *Solanum* spp.

P - 5

Weed occurrence in Tuticorin and Kanyakumari districts of Tamilnadu

P. Anandkumar and R. Balasubramanian

Dept. of Agronomy, Agricultural College and Research Institute, Madurai, TNAU (Tamil Nadu)

e-mail : anandan_microbio@yahoo.co.in

A survey work was conducted in southern parts of Tamil nadu with the objective of early detection of regulated weeds along with the weeds distribution in different categories. The work was carried out in Tuticorin and Kanyakumari districts. The survey was performed in each and every village of all blocks in every district. Grid map of the districts were prepared and the survey villages were delineated based on the main road, secondary and access roads. The villages were covered with cropped, non cropped and garbage areas. Each category was placed with 10 quadrates ($0.25m^2$) and the observation was recorded in the categories of grasses, sedges and broad leaved weeds. The Relative density was furnished. *Cyanodon dactylon*, *Parthenium hysterophorus* and *Cyperus rotundus* were found to be more dominant weeds in cropped area of Tuticorin district. In non cropped area, *Cynodon dactylon* was found to be higher followed by *Abutilon indicum*. Like that in garbage area also higher value of RD was registered with *Cynodon dactylon* followed by *Abutilon indicum*. In all categories, *Echinocloa* sps registered with lower RD value. In cropped area *Cynodon dactylon* registered higher value of RD followed by *Parthenium hysterophorus* where as in non-cropped area and garbage area, *Parthenium hysterophorus* registered higher value of RD followed by *Cynodon dactylon*. The lower RD value was registered with *Echinocloa* sps.

P - 6

Parthenium distribution and spread in Kerala

C. T. Abraham, S. T. Rathish, and T. P. Ramya
Kerala Agricultural University, Thrissur (Kerala)
e-mail : ctabraham@yahoo.com

Parthenium hysterophorus L., commonly known as carrot weed, white top or congress grass in India, is a herbaceous, erect, annual plant belonging to the family "Asteraceae". According to Varshney and Sushilkumar (2007) it has invaded 35 million hectares of cultivated areas, uncultivated, waste lands, road sides, bus stands and railway stations etc. It is regarded as one of the worst weeds in India.

Under the National Invasive Weeds Surveillance Programme, a detailed survey was conducted to understand the distribution of *Parthenium* in Kerala. Suitable route maps were prepared for each district by the Surveillance Inspectors (SIs) working under National Invasive Weeds Surveillance Programme for conducting the survey. The observations were taken using quadrat of 1m × 1m size. The places where *Parthenium* was noticed were marked in a map and compared with a similar map prepared based on a survey conducted during 2005 to assess the spread of the weed during the last four years.

Out of the 14 districts of the state, *Parthenium* has become a problem in Trivandrum, Idukki, Palakkad and Wayanad districts having road connections with the adjoining states of Tamilnadu and Karanataka where *Parthenium* is a serious problem. In the four districts mentioned above *Parthenium* has infested large areas, especially in the low rainfall regions. Local people have informed that the spread of *Parthenium* in these districts is mainly through cow dung brought from the adjacent states for agricultural purposes. In 2009, *Parthenium* has spread to more areas compared to the area reported based on the survey conducted in 2005 under the AICRP on weed control. Now *Parthenium* infestation is severe in Trivandrum (Parasala and Neyyantinkara), Idukki (Kumuly, Udumpanchola, Marayur, Kanthaloor and Vandiperiyar), Palghat (Kozhinjianpara, Attapadi and Menonpara) and Wayanad (Tholpettai, and Muthanga) districts. Other districts such as Kasargod, Malappuram, Kannur, Kozhikode, Trichur and Erankulam have localized minor infestations of *Parthenium* in 2009, whereas in 2005 the infestation of *Parthenium* was not all seen in these districts (Abraham and Girija, 2005). But in Kottayam, Alleppey and Pathanamthitta no infestation of *Parthenium* was noticed in 2009. Localized infestation was noticed near the pilgrim centre of Erumeli (Kottayam district) in 2005, but now the same spot was free of the weed, due to manual removal of weeds in the area. The present survey showed sporadic infestation of *Parthenium* in many parts of the state especially in the railway stations, bus stands, market places and pilgrim centers indicating that the spread is through the vehicles coming from infested region. The poor invasion of the weed in Kerala is supposed to be due to the high rainfall of the state which prevents the seed set of the weed and also due to the presence of other fast growing weeds like *Hyptis suaveolens*, *Cassia tora*, *Sida acuta*, *Lantana camara* and *Mikania micrantha* which smother the *Parthenium* plants. The area invaded by *Parthenium* is increasing fast and spreading to the new areas in Kerala. Even small infestation of this weed can cause crop loss and a threat to biodiversity. Considering the above facts, weed management operations should consider eradication of the weed in localized infestations, and containment in already infested large areas to prevent spread to newer areas.

P - 7 Incidence of earlier invaded weed species in Madurai, Theni and Virudunagar districts of southern Tamil Nadu

S. Nanthakumar and R. Balasubramanian
Dept. of Agronomy, Agricultural College and Research Institute, Madurai, TNAU (Tamil Nadu)
e-mail : nandusecret@gmail.com

A survey work was conducted in Theni, Madurai and Virudhunagar districts of southern Tamilnadu under NIWS scheme with the objective of early detection of regulated weeds along with the weeds distribution in different categories. The survey was performed in each and every village of all blocks in each district. During the survey work the already invaded weeds such as *Parthenium hysterophorus*, *Ipomea carnea, Eichhornea crassipes, Prosophis juliflora* and *Mimosa pudica* were studied and this result is given. All the weeds except *Eichhornea crassipes* were recorded in the surveyed districts. Irrespective of these three districts and locations, *Parthenium hysterophorus* incidence was more when compared to other invaded weed species and this incidence was very high in garbage area followed by non-cropped and cropped area. The next in order was *Prosophis juliflora* and very low incidence was noticed with Mimosa. In cropped area, Ipomea carnea and *Prosophis juliflora* were present only in Virudunagar district. In non cropped area, *Ipomea carnea* was absent in Virudunagar district. In garbage area, Madurai district alone registered with *Mimosa pudica*. Among the three districts, *Parthenium hysterophorus* was recorded more in virudunagar district especially in non-cropped area (21.91%) and garbage area (45.55%). In Madurai district the incidence of *Parthenium hysterophorus* was low in cropped area and higher in non-cropped area (13.19%) and garbage area (16.43%). In Theni district also, the incidence of *Parthenium hysterophorus* was low in cropped area and higher in non-cropped area (14.14%) and garbage area (21.49%). *Eichhornea crassipes* incidence was almost nil in all locations of the surveyed districts. However, *Eichhornea crassipes* and *Ipomea carnea* incidence were found in river and irrigation ponds.

P - 8 Assessment of weed flora in agro-ecosystems of Haveri district in Karnataka

Ramesh Nayak, M. B. Puradal, Ramesh Babu, B. N. Arvind Kumar, R. N. Bhat and G. Sajjanar
National Invasive Weed Surveillance Programme DWSR Centre, MARS, UAS, Dharwad (Karnataka)
e-mail : rameshbabu.niws@gmail.com

A survey was undertaken to study the weed flora of Haveri district in Karnataka during the period February–May 2009 under National Invasive Weed Surveillance Programme, DWSR Centre, UAS, Dharwad. A quadrat of 1 sq m was used to study the density, frequency and dominance of weed flora occurring in cropped, non – cropped and garbage area. The relative weed density, relative frequency and relative dominance were computed and Importance Value Index (IVI) was derived. These values form the basis for the present discussion.

Based on the IVI values *Cynodon dactylon* (55.1), *Parthenium hysterophorus* (50.43), *Euphorbia hirta* (20.03), *Cyperus rotundus* (15.65) and *Celosia argentea* (13.78) were the dominant weeds in cropped area. In non-cropped area, *Cynodon dactylon* (55.0), *Parthenium hysterophorus* (36.0), *Croton sparsiflorus* (20.66), *Euphorbia hirta* (16.74) and *Amaranthus viridis* (16.61) dominated and *Parthenium hysterophorus* (73.95), *Cynodon dactylon* (66.33), *Datura stramonium* (31.68), *Croton sparsiflorus* (17.59) and *Amaranthus viridis* (10.75) were the dominant weed species in garbage area.

The survey indicates that there is problem of troublesome weeds *viz*., *Cynodon dactylon* and *Parthenium hysterophorus*, in Haveri district such studies facilitates for the appropriate weed management strategies for increasing the crop productivity.

P-9 Assessment of in Weed Durg district of Chhattisgarh during '09

Nirmodh Prabha, Shweta Gupta, Shilpa Kaushik, Supriya Gautam and A.P.Singh
Department of Agronomy, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.)
e-mail : apalsingh@yahoo.com

In recent past, government of India has imported 6288890 metric tones of wheat during 2006-07 from 11 countries and this wheat has been distributed in Chhattisgarh along with other 9 states through public distribution system. Along with this wheat, seeds of more than 30 weed species have also entered in our country, of which 5 weeds are of alien nature, namely, *Ambrosia trifida, Cenchrus tribuloides, Cyanoglossum officinale, Solanum carolinence* and *Viola arvensis*. Initial control of these alien weeds is of utmost importance to avoid their epidemic spread as has happened in case of *Parthenium hysterophorus*. With this view a surveillance programme had been initiated in 2008, so that, identification of 5 new suspected entries of alien weeds be done timely and strategies be evolved to control these weeds at the initial period of spread in the state.

Initially, a grid map of Durg district was prepared to conduct an effective surveillance of 5 alien weeds and survey of prevalent weed flora of *kharif*, *rabi* and summer seasons in the district. Two blocks and 35 villages were covered in *kharif*, 2009. Fields of three farmers from each village were chosen for study. With each farmer, three locations *viz*. cropped area, non-cropped area and garbage area were considered the best places for conducting the survey, so that all types of weed species may be covered. At each point of survey, for taking weed observation through quadrate method, quadrate of 0.5 m (i.e. 0.25 sq.m. area) was used. This quadrate was dropped randomly at five different places in cropped area, non-cropped area and garbage area. Total number of all types of weed species occurring in each quadrate was recorded. The weed species uprooted during the observation were dried at room temperature initially and finally were dried in the oven and dry weight was recorded accordingly for each species of weeds surveyed at different locations. Accordingly, density of weed, dominance, frequency %, relative density, relative dominance, relative frequency and IVI (Importance Value Index) were calculated.

In Durg District, a total 30 villages of 07 blocks (10 villages of 2 blocks in *kharif* and 20 villages of 5 blocks in *rabi*) were surveyed during the year (2008-09). A total number of 39 weed species were identified during the survey in cropped area of this district. The main crop in the area during *kharif* was rice along with seldom of vegetables. During *rabi*, the main crops in the district were Rice, Lathyrus and Wheat. *Cynodon dactylon* registered with highest density, frequency, relative density, relative frequency and IVI among the 39 weed species, whereas, dominance and relative dominance was found to be highest with *Echinichloa colona*. Other weeds with higher IVI were *Echinochloa colona*, Unknown-2, *Cyperus iria* and *Ageratum conyzoides*, in descending order. *Spilanthes calva* were found to be lowest amongst the 39 weed species observed in Durg district during survey. A total number of 25 weed species were identified during the survey in non-cropped area of Durg district. *Alternanthera sessilis* registered highest density, dominance, relative density, relative dominance and IVI among the 25 weed species, whereas, frequency and relative frequency were found highest with *Cynodon dactylon*. Other weed species higher with IVI were *Cynodon dactylon*, *Parthenium hysterophorus*, *Cassia tora and Abeloschus maschatus*, in descending order, but with with differed order of other ecological parameters. *Ludvigia parviflora* had lowest ecological parameters of weed among the 25 weed species in the district during survey.

A total number of 26 weed species were identified during the survey in garbage area of Durg district. *Alternanthera sessilis* registered with highest density, frequency, relative density, relative frequency and IVI among the 26 weed species, whereas, dominance and relative dominance were found to be highest with *Ageratum conyzoides*. Other weed species with higher IVI were *Ageratum conyzoides*, *Cynodon dactylon*, *Cassia tora*, and *Commelina benghalensis,* in descending order, but with differed order of other ecological parameters. However, ecological parameters of *Xanthium strumarium* were found to be lowest amongst the 27 weed species in the district during survey.

P - 10

Occurrence of new alien invasive weeds *Cenchrus* sp. and *Solanum* spp. in southern Karnataka

T. V. Ramachandra Prasad, N. Ananda, Ramulu, H. A. Shanmukhappa, K. P. Praveen, T. C. Yogesh, K. S. Somashekar and S. N. Anilkumar,
UAS, Main Research Station, Hebbal, Bengaluru (Karnataka)
e-mail : tvramachandraprasad@rediffmail.com

An invasive alien weed specie whose introduction to the indicative ecosystem causes huge economic loss or alter biodiversity or environmental harm or harm to human health. Directorate of Plant Protection Quarantine and Storage has intercepted five alien invasive weeds namely *Cenchrus tribuloides, Solanum carolinense, Ambrosia trifida, Viola arvensis and Cyanoglossum officinale* through the imported Wheat to the tune of 6.3 million tons obtained from eleven countries during 2006-07. This wheat has been distributed to non-traditional wheat growing areas including southern Karnataka.

To locate these invasive weeds in Southern Karnataka, an intensive survey was undertaken in 17 districts during 2008-09. Survey revealed that new alien invasive weeds namely *Solanum carolinense L. and Cenchrus sp. (tribuloides or biflorus)* have been noticed in some pockets of Southern Karnataka. In addition to this, new weeds namely *Solanum sisymbriifolium* Lam, *Solanum violaceum* L., *Solanum elaeagnifolium* Cav., *Solanum torvum L, Solanum surrattense* Burm.f.,(near garbage areas), *Trachys muricata* (L.) Pers. (in cropped fields of pigeonpea, sunflower and vegetables) have also been noticed during 2008- 09.

Among these, *Cenchrus* sp. is noticed in pigeonpea fields around Guilala village, Hiriyur taluk, Chitradurga District during *kharif* 2009. It is an annual grass, under Poaceae, and it spreads by seed. The plant consists of loosely tufted clumps of tillers. The tillers join at the base and are supported by extensively branched fibrous root system. The weed noticed in 3 to 4 acres nearing to bund areas only. Weed grows to a height of 25 to 75 cm, 8 to 34 tillers/plant, 1 to 2 panicles/shoot, 4 to 9 cm panicle length and 17 to 45 seeds per panicle. At densely populated weed infested places, number of plants ranged from 1 to 11 plants/m. The weed appears to be seasonal and matures during November– December months after cessation of rains. The possibility of this weed entering into agricultural fields is high, as it is human tendency to transport and bring new crop seeds.

Solanum carolinense L. weed is a perennial, shrubby erect plant and its regeneration is through seed, roots and root cuttings. The weed has been noticed in Chintamani (Chikkaballapura District), Mysore, H.D. Kote (Mysore District), Holenarasipura (Hassan District) and Mudigere (Chikkamagalur District) near garbage areas and around road side of village settlements and labourers colony and around school premises. The weed grows to a height of 30 to 75 cm with 8 to 10 branches and total fruits of 3 to 20/plant. The weed is also noticed in Mudigere area. Here, the weed is occurring with purple flowers and green stripes on the white fruit which upon maturity becomes yellow. It may become troublesome in the introduced area as it is very difficult to eradicate, cause yield reduction in crops and deterioraste the quality of the produce. These weeds have already caused direct economic losses in agricultural fields in other countries. It is also found to act as alternate host for several pests and diseases and hence also cause indirect losses. The potential economic impact of these weeds is also rated high.

P - 11

Database management, of indigenous and invasive weeds of different crops and places in western Maharashtra.

P. S. Bodake, C. B. Gaikwad, R. Kambale and Bhalsingh
Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahmednagar(Maharashtra)
e-mail : cbgaikwad@indiatimes.com

Ever since the first cultivation systems were developed for food production farmers of all generations and areas have been faced with the problems of non crop plants growing amongst the crops. These non-crop plants, which compete with the crops for moisture, light, nutrients and space, have long been known as weeds. Alien invasive weeds present a major current and future problem to India. Several weeds have been introduced into India either by accidentally or through importing of food grains. Globalization may bring new weed problems while importing or exporting agricultural commodities as per the WTO agreement.

This database will help in retrieving the information on weeds of different districts of the country distributed in varied agro - ecological regions in various crops and cropping systems. The database will help in monitoring of weed flora shift or changes due to crop management systems. Database of weeds of different agro-ecoregions of the country can supply required information for prediction prevention and pooling of resources for developing the effective control measures for major weeds. The information on weeds with respect to their distribution in different crops and cropping system, non-cropped situations, water used for agricultural commodities as per the WTO agreement. Hence the present work on weed survey and surveillance is of vital importance for the Maharashtra state. The National Invasive Weed surveillance, DWSR, Jabalpur started this project in 10 states of which Maharashtra is one of theme. In western Mahatrashtra MPKV, Rahuri has created the database for 10 districts for cropped, noncropped, garbage and aquatic weeds.

Documentation of weed distribution could be of great use for planners and extension personnel in suggesting the plan of activities related to the problems of management of weeds. The data on major crops in the district wise will be of great importance for planning of weed management problem of specific type.

Weeds are plants that are undesirable to human activity at a particular time and place, and therefore, weeds will always be associated with human endeavours. In agriculture weeds cause huge reductions in crop yields, increase cost of cultivation, reduce input efficiency, interfere with agricultural operations, impair quality, act as alternate hosts for several insect pests, diseases and nematodes. Weeds compete with crop plants for various inputs /resources like water, nutrients, sunlight etc Invasive alien weeds (IAWs) are plants that are moved from their native habitat to a new location and in the absence of their co-evolved predators and parasites they eventually become established and spread rapidly causing tremendous harm, often irreversible to the environment, economy and in some cases to human health. Majority of the important weeds in India have ben introduced into the country in the past either accidentally or deliberately. Some of the majfor alien invasive weeds that have entered the countyr include *Lanatana camara, Eichhornia crassipes Salvinia molesta, Parthenium hysterophorus*, *Chromolaena odorata, Mikania micrantha, Mimosa* spp. etc. Even in the wheat imported recently during 2006-07, seeds of five regulated weed species, *viz*., *Cenchrus tribuloides, Solanum carolinese, Viola arvensis, Cynoglossum officinale* and *Ambrosia trifida* have been intercepted by the Plant Quarantine Officials.

P-12

Distribution of weed flora in southern Telangana zone of Andhra Pradesh

M. Madhavi, P. Swathi, Lalithnarayan and J. Swamy
Directorate of Weed Science Research Centre, Rajendranagar, ANGRAU, Hyderabad
e-mail : molluru_m@yahoo.com

Weed flora has always been in state of dynamism brought about by the disturbances by mankind for his benefits, thus paving the way for superior competitive species to gain the foothold in the changed agroclimatic conditions. Changes in the weed flora exposed to cultural, mechanical and herbicidal control made it necessary to study weed communities and to determine their composition under different environmental and agricultural conditions to improve the methods of their control. The present study was undertaken in southern Telangana zone of Andhra Pradesh during 2008-2009. covering Hyderabad, Rangareddy, Medak and Mahabubnagar districts. Survey was conducted in cropped, non cropped and garbage areas. Paddy, Maize, Cotton, Castor, Sugarcane and Vegetables are the main crops cultivated in the zone.

Altogether, 404 villages were surveyed which covered 4040 spots in cropped and non cropped areas 3420 spots in garbage areas. *Cyperus iria, Cyperus difformis, Echinochloa colonum, Eclipta alba, Ammania baccifera, Marselia quadrifoliata, Echinochloa crusgulli, Ageratum conyzoides* and *Alternanthera sessilis* were recorded in paddy. *Cynodon dactylon, Cyperus rotundus, Euphorbia hirta, Amaranthus viridis*, *Physalis minima, Phyllanthus spp, Celosia argentia, Euphorbia prostrata and Phaseolus trilobus* were predominant in Maize. *Commelina benghalensis, Dinebra aRabica, Phaseolus trilobus, Euphorbia hirta, Phyllanthus spp, Achyranthes aspera, Cyperus difformis, Saccarum spontaneum, Sogrhum halopense* and *Tridax procumbens* were recorded in Cotton. In sugarcane, *Ageratum conyzoides*, *Hoplicimonus buemanci, Corchorus oletorius, Achyranthus aspera, Sida spp, Amaranthus viridis* and *Physalis minima* were the dominant weed flora. *Cynodon dactylon, Parthenium hysterophorus, Cyperus rotundus, Dinerba aRabica* and *Gomphrina celosiodes were recorded* in Castor and vegetable crops.

In the non-cropped area the major weed species observed were *Parthenium hysterophorus, Sida spp, Calotropis zigantia, Digitaria spp, Borrerea hispida, Crotalaria spp, Trichodesma indica, Phaseolus trilobus, Cyperus difformis, Leucos aspera, Alternanthera sessilis, Amaranthus viridis, Cynodon dactylon, Dactyloctenium aegyptium, Trianthema portulacastrum* and *Phyllanthus spp.*

Critical inspection and survey in the garbage areas revealed that the weed species like *Parthenium hysterophorus, Triumpheta showbodies, Setaria glauca, Eragrostis spp, Amaranthus spp, Celosia argentia, Tribulus terrestris, Euphorbia hirta, Cyperus rotundus, Cynodon dactylon, Lantana camara, Sida spp, Dactyloctenium aegyptium, Trianthema portulacastrum and Phyllantus spp* were predominant.

P -13 Incidence of earlier invaded weed species in Pudukkottai and Tirunelveli districts of southern Tamil Nadu

P. Balamurugan and R. Balasubramanian

Dept. of Agronomy, Agricultural College and Research Institute, Madurai, TNAU (Tamil Nadu)

e-mail : kpbalamurugan@yahoo.co.in

A survey work was conducted in Pudukkottai and Tirunelveli districts of southern Tamilnadu under NIWS scheme with the objective of early detection of regulated weeds along with the weeds distribution in different categories. The survey was performed in each and every village of all blocks in each district. During the survey work the already invaded weeds such as *Parthenium hysterophorus*, *Ipomea carnea, Eichhornea crassipes, Prosophis juliflora* and *Mimosa pudica* were studied. Generally, all these invaded weeds were recorded in Pudukkottai and Tirunelveli districts. In Tirunelveli district, *Parthenium hysterophorus* was found at higher level than other species in all area like cropped (15.25%), non-cropped (15.19%) and garbage area (16.46%) and it was followed by *Prosophis juliflora* and *Mimosa pudica*. In Pudukkottai district under cropped area more incidence of *Mimosa pudica* was recorded compared to other invaded weeds. But *Parthenium hysterophorus* was found at higher level in non-crop area (13.31%) and garbage area (17.96%) of Pudukottai district and it was followed by *Ipomea carnea* and *Mimosa pudica* in non-crop area and by *Mimosa pudica* and *Prosophis juliflora* in garbage area. *Eichhornea crassipes* was absent in both cropped area and garbage area of Pudukkottai. Among the invaded weeds, *Eichhornea crassipes* was observed minimum in both the districts.

P -14 Weed surveillance impact for identification of weed crop association in pulses and oil seeds in Maharashtra

C. B. Gaikwad, P. S. Bodake, R. Kambale and Bhalsingh

Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist- Ahmednagar(Maharashtra)

e-mail : cbgaikwad@indiatimes.com,

Magnitude of weed problem varies with the agro-ecological conditions and the level of management. Pulse and oilseed crops are important in all the seasons. The emphasis on cereals and commercial crops, have driven away the attention of these crops. Productivity of these crops is severely affected if weeds are not controlled within critical period of crop - weed competition will lead to greater reduction in yield of these crops.

Globalization has brought new weed problems while importing or exporting of agricultural commodities as per WTO agreement which may endanger the biodiversity. Many regions of the country have flora that contain the high proportion of introduced species. Some of them become aggressive in their surroundings and succeed rapidly in invading particular habitat and replacing indigenous. The weeds like *Partenium hysterophorus* in non cropped areas, Exchornia crassipes in water bodies and Phalaris minor in cropped areas which were introduced through imported wheat made an impact on agriculture and environment.

It is therefore necessary to conduct effective survey and monitoring for early detection of regulated weeds. The present investigation of rigorous survey and surveillance launched under National Invasive Weed Surveillance Project by Directorate Weed Research, Jablpur in 10 states, of which Maharashtra is one of them to asses the risk due to introduction of quarantine weeds and effective monitoring. Prominent weed species of pulses and oil seeds observed in different districts of Maharashtra at various places. Since weed competition is one of the most important constraints in crop production, weed management determines the production efficiency of a farm. Therefore, the invasion from the imported wheat has learnt a lesson to detection and eradication of such invasive weeds is essential. Otherwise they may spread and cause catastrophic damage in large scale as happened in the past. The present work of weed surveillance of invasive weeds is fruitful in providing database on invasion of various weed species in major pulse and oilseed crops.

P - 15 Infestation of *Parthenium* in different districts of Madhya Pradesh

Sudeep Tomar, S. S. Tomar, Avinash Tomar, Jagendra Singh and Preeti Sharma
DWSR- Centre, College of Agriculture, RVSKVV Campus, Gwalior (M.P.)
e-mail : sudeeptomar@gmail.com

Parthenium hysterophorus is one of the seven most dreaded weeds of the world which has infested 35 millions hectares of land, usually infesting the agricultural fields in India. It is grow vigorously with onset of monsoon however, it can grow through out the year. It is an aggressive weed which is a health hazard to sensitive human, live stock and yields of different crops are also reducing markedly. It spreads rapidly under different situations; hence the comprehensive survey and monitoring aspects are necessary in *Parthenium* infested area of the state. The survey on this aspects was conducted in Ratlam, Mandsaur, (2005-06), Panna, Katni, Bhind, Morena, Gwalior, Guna, Ragarh, Vidisha, Shivpuri, Sheopur, Datia and Ashok Nagar in the year 2008-09. This survey was conducted in cropped area of 18 districts, 10 districts of non cropped area and 10 districts of garbage area.Standard methodology adopted for survey as per guidelines of NIWS programme DWSR, Jabalpur. The data were collected and complied on the basis of Relative Density (R.D). Data indicated that district Bhind, Morena, Gwalior, Sheopur, Shivpuri, Datia, Guna, Ashok Nagar, Rajgarh, Mandsaur, Ratlam, Jhabua, Dhar, Khargone, Khandwa, Panna and Katni having mild infestation in cropped area (0.67 - 25 % Relative Density). In non cropped area of districts Bhind, Gwalior, Shivpuri, Sheopur, Datia, Guna and Vidisha having mild infestation (08.46 - 17.70 % RD), whereas Morena and Ashok Nagar having more relative density (25.25 - 35.52 % R.D.). In garbage area Bhind, Morena, Gwalior, Sheopur, Shivpuri, Datia, Guna, Ashok Nagar and Vidisha districts having mild range of infestation(5.80 - 22.36 % R.D).

P - 16 *Echinochloa* in the Brahmaputra valley, Assam

I. C. Barua, J. Deka. N. C. Deka and Nilay Borah
DWSR Centre, Assam Agricultural University, Jorhat (Assam)
e-mail : icbarua@aau.ac.in

Species belonging to *Echinochloa* Beauv. are one of the important groups of weeds in rice growing areas of the world. Most of the species are mimic to rice and create severe problem to the crop. The threshold level of *E. crusgalli* (L.) Beauv. was found to be 80 plants/ m^2 in case of improved rice varieties and 20 plants in local varieties. Almost all the taxa under this genus are good fodder, and palatability is more in their early stages. Caryopsis are good food for certain small birds as well as for human at the time of famine. This genus is known to be represented by 50 taxa of species and intra-specific ranks in the world. A taxonomic study, conducted since 2005 to enumerate the available taxa in the Brahmaputra Valley, recorded as many as 12 taxa under 10 species. Out of all these taxa, *E. stagnina* (Retz.) Beauv. was the only perennial species found in this region. *E. colona* (L.) Link was the common facultative weed and appeared in deep water paddy field at before-flood condition, upland paddy fields as well as other upland cropland and non-cropland situations of both plains and hills. The Eurasian species *E. crusgalli* subsp. *cruasgalli* var. *crusgalli* was recorded as the most common rice associated obligate weed in the entire Brahmaputra valley, whereas its variety *practicola* Ohwi along with *E. crusgalli* subsp. *hispidula* (Retz.) Honda variety *hispidula* and *austro-japonica* Ohwi were of Asiatic origin but comparatively less frequent. Amongst the other common species of this genus, *E. oryzoides* (Ard.) Fritsch, *E. muricata* (Beauv.) Fern. and *E. inundata* Mitchel & Vickery of Asiatic, North American and Australian origin, respectively, were worth mentioning. Asiatic species *E. frumentacea* Link and South American species *E. crus-pavonis* (H.B.K.) Schult were found occasionally during the study, though they were once of the common occurrence in this region as per the literature of twenty to forty decades old. Two African species *viz*. *E. subverticellata* Pilger and *E. ugandensis* Snowd. & Hubb. have been recorded as newly introduced species to the country

P-17 Incidence of earlier invaded weed species in Tuticorin and Kanyakumari districts of southern Tamil Nadu

P. Anandkumar and R. Balasubramanian
Dept. of Agronomy, Agricultural College and Research Institute, Madurai, TNAU (Tamil Nadu)
e-mail : anandan_microbio@yahoo.co.in

A survey work was conducted in Tuticorin and Kanyakumari districts of southern Tamilnadu under NIWS scheme with the objectives of early detection of regulated weeds along with the weeds distribution in different categories. The survey was performed in each and every village of all blocks in each district. During the survey work the invaded weeds such as *Parthenium hysterophorus*, *Ipomea carnea, Eichhornea crassipes, Prosophis juliflora* and *Mimosa pudica* were studied and this result is given. Generally, all these invaded weeds were recorded in Tuticorin and Kanyakumari districts. Invariably, both districts were noticed with high incidence of *Parthenium hysterophorus* among the invaded weed species in cropped, non-cropped and garbage areas. *Ipomea carnea* was absent in garbage area of both the districts. The presence of *Eichhornea crassipes* was noticed almost in all locations of both districts except the cropped area of Tuticorin district. In Tuticorin district, *Parthenium hysterophorus* was found in higher level with a relative density ranging from 13.93 to 20.09%. It was followed by *Mimosa pudica* in cropped area, *Prosophis juliflora* and *Mimosa pudica* in non-cropped area and garbage areas in Tuticorin district. In Kanyakumari district, *Parthenium hysterophorus* was found in higher level with a relative density ranging from 13.30 to 22.95%. It was followed by *Mimosa pudica* in cropped area and *Eichhornea crassipes* and *Ipomea carnea* in non-cropped area and *Eichhornea crassipes* and *Mimosa pudica* in garbage area in Kanyakumari district.

P -18 Impact of IAS (Invasive alien species) on native flora of Chhattisgarh

Pratibha Katiyar
Department of Crop Physiology & Agricultural Biochemistry, IGKV, Raipur (C.G.)
e-mail : pratibhakatiyar@rediffmail.com

Invasive defined as species that in non native (exotic/alien) to the ecosystem cause economic and environmental harm or harm to human health. Alien species refer to non-native or exotic organism that occur outside their natural adaptation ranges and dispersal potential. IAS are wide spread in the world and poising most serous threat to biodiversity next to habitat loss. Therefore, the study was carried at in AICRP-WC survey programme at IGKVV Raipur, to identify the invasive species present in the Chhattisgarh plain and its impact on native flora of the region. It was observed that some dominant alien weed species are continuously increasing in the area *i.e. Alternanthera sessalis, Amaranthus spinosus, Borreria spp., Celosia argentea, Convolvulus arvensis, Corchorus olitoritus, Croton banplandianum, Cynodon dactylon, Eichhornia crassipes, Fimbristylis miliacea, Lantana Camara, Mimosa pudica, Sida acuta, Ageratum conyzides, Bidnse pilosa, Chromolena odorata, Eclipta prostrata, Emilia sachifolia, Galinsoga parviflora, Parthenium hysterophous, Sanchus oleraceus, Tridex procumbens, Xanthum strumarium*. Some of them are invasive or adventive and causing negative impact on native flora and biodiversity. *Parthenium hysterophorus* complete four generation in a year and producing 10,000 viable achenes also having pollen allelopathy and thereby inhibiting the pollen germination in native flora. *Galiusoga pasiflora* in an aggressive and spreading fast particularly on disturbed habitats and are posing a serious threat to certain elements of the native flora. *Eichhornia crassipes* has been the same to aquatic and wetland biodiversity.

P-19 Resource use efficiency with special reference to herbicides use in wheat.

A. M. Jaulkar, S. S. Tomar and K. S. Yadav
Directorate of Weed Science Research Centre, RVSKVV Campus Gwalior (M.P)
e-mail : wc_sst@yahoo.co.in

In wheat, an attempt has been made to obtaine the resource use efficiency under irrigated and rainfed farming situations to examine the regression coefficient slope and allocated to wheat in Chambal and Gwalior division of M.P. The productivity of recourse use has been calculated by fitted the cobb - Douglas production function for this study. A sample of 60 farmers were selected randomly in proportion of 30:30 sample farms represented under tubewell irrigated farming situation and rainfed farming situation and data collected to cost of cultivation for wheat during 2008-09.

The productivity of each input had been tested under irrigated and rainfed farming conditions. It was observed that farms under tubewell irrigated farming situation, all the coefficients were depicted positive and consequently resulted, land, human labour and labour use for weeding showed a significant relationship with gross income from wheat. The labour use for weeding displayed at 0.21 percent variation in gross income over an increase of 1 percent investment on labour use for weeding. Whereas farms under rainfed farming situation, all the coefficient were explain positive except bullock labour (-0.1671) and it indicate that excess use of bullock labour which was un-necessarily increased the cost of production of wheat crop per ha. of land. Contrast to that, in case of seed the coefficient value was positive and indicated proper seed selection suited to rainfed situation. It is concluded that the association of variable had maximum in gross income from wheat i.e. 82 percent and it was only 65 percent variations under rainfed farming situation.

P -20 *Cynodon dactylon* - a menace in Bagalkot district of Karnataka

Ramesh Nayak, Ramesh Babu, B. N. Aravind Kumar, M. B. Puradal, R. N. Bhat and G. Sajjanar
National Invasive Weed Surveillance Programme DWSR Centre, MARS, UAS, Dharwad (Karnataka)
e-mail : rameshniws.si@gmail.com

A Survey on weed flora was carried out in Bagalkot district during *Kharif* 2009 under National Invasive Weed Surveillance Programme, DWSR Centre, UAS, Dharwad. A quadrat of one sq m was used to study the density, frequency and dominance of weed flora in cropped, non cropped and garbage areas. Relative density, relative frequency and relative dominance were worked out and finally Importance Value Index (IVI) was obtained.

Based on IVI values, the dominant weed species in cropped area were *Cynodon dactylon* (46.63), *Parthenium hysterophorus* (31.51), *Digera muricata* (30.87), *Euphorbia hirta* (18.23) and *Commelina benghalensis* (14.50); in non cropped areas, *Cynodon dactylon* (39.41), *Parthenium hysterophorus* (28.45), *Amaranthus viridis* (18.59), *Cassia ceresea* (16.21) and *Commelina benghalensis* (14.96), similarly in garbage areas *Cynodon dactylon* (55.21), *Parthenium hysterophorus* (53.29), *Datura metal* (51.55), *Amaranthus viridis* (45.75) and *Croton sparsiflorus* (12.58) were the dominant weeds. The survey revealed that there is a problem of troublesome weeds *viz*., *Cynodon dactylon* and *Parthenium hysterophorus* in the cropped, non cropped and garbage areas of the district. The study therefore calls for appropriate weed management strategies to be taken up for the effective control of these weeds.

P- 21 Aliens and naturalized species in flora of greater Hyderabad

M. Venkat Ramana[1], J. Swamy[2], P Swathi[2] and M. Madhavi[2]
[1]Directorate of Weed Science Research Centre, ANGRAU, Hyderabad
[2]Dept. of Botany, Osmania University, Hyderabad.
e-mail: molluru_m@yahoo.com

Those naturalized exotics that become so successful as to spread in the flora and displace native biota or threatens valued environmental, agricultural or personal resources by the damage it causes are considered invasive. Invasive exotic species are the second largest cause of biodiversity loss in the world and impose high costs to agriculture, forestry, and aquatic ecosystems. Introduced species are a greater threat to native biodiversity than pollution, harvest, and disease combined. Established exotic species have the ability to displace or replace native plant and animal species, disrupt nutrient and fire cycles, and cause changes in the pattern of plant succession. Keeping this in mind survey was conducted for flora in general and weed flora in Greater Hyderabad region which is covering parts of Rangareddy, Madak and Mahaboobnagar districts to identify the aliens and naturalized species during 2005-2009. During the survey more than 100 aliens and naturalized elements were reported. Out of which 94 represented dicotyledons and 6 represented monocotyledons. Out of 100, twelve represented trees, nine represented shrubs, six represented climbers, 73 represented herbs. The following flora were found to dominate the native vegetation and causing threat to them ie. *Alternanthera tenella* subsp. *tenella* Colla; *Calyptocarpus vialis* Less.; *Chamaesyce hyssopifolia* (L) Small; *Chamaesyce prostrata* (Aiton) Small; *Conyza bonariensis* (L.) Cronq.; *Croton bonplandianum* Baill.; *Gomphrena serrata* L.; *Hyptis suaveolens* (L.) Poit.; *Jatropha gossypifolia* L.; *Lantana camara* L.; *Lysiloma latisiliquum* (L.) Benth.; *Parthenium hysterophrous* L.; *Prosopis juliflora* (Sw.) DC.; *Senna uniflora* (Mill.) H.S. Irwine & Barneby; *Solanum erianthum* D. Don. *Synedrella nodiflora* (L.) Gaertn.;*Tridax procumbens* L.; *Tribulus terrestris* L.; *Rhynchelytrum repens* (Willd.) C.E. Hubb.

P -22 Major alien weeds of Onattukara region in Kerala

S. T. Rathish, C. T. Abraham Zoy Thomas and P. O. Bijoy
Kerala Agricultural University, Thrissur (Kerala)
e-mail : ctabraham@yahoo.com

Onattukara region of Kerala, comprising the Karunagapally, Karthikapally and Mavelikara taluks of Kollam and Alappuzha districts. A survey was conducted under National Invasive Weeds Surveillance Programme 2008 – 09 revealed that the weeds present in Onattukara region are different from the other regions of this state. In this region, the invasion of several alien weeds were found in non cropped areas, rice crop and coconut gardens. The major weeds found are *Croton hirtus, Sesamum radiatum, Indigofera astragalina (I. hirsuta), Cenchrus echinatus, Melochia corchorifolia, Ipomoea pescaprae, Pedalium murex* and *Ipomoea pestigridis.* Among this *Croton hirtus* and *Sesamum radiatum* are the new alien weeds spreading fast in non cropped areas of this region. *Melochia corchorifolia*, is usually seen as a major weed in rice fields of Kollam, during the first crop season. It is also a serious menace in the sesamum crop during the summer season. *Indigofera astragalina* is found to be a major weed of non cropped areas of Alleppey and Kollam, where it is mostly seen along the sides of the NH 17 in Kerala. The sandbur, *Cenchrus echinatus*, an annual grass native to Central America, is a similar weed of *Cenchrus tribuloides* (which was the quarantine weed suspected to have got introduced through the wheat imported to India during 2006–07), is spreading fast in non cropped areas of this region. It invades the sandy soils in the beaches and river beds and reduces their recreation value. However, it is known to protect the soil from the erosion action of the waves. *Pedalium murex* (not a alien weed), belonging to the family pedalicaeae is a serious problem because of its thorns and causing difficulties for the cultural operations. Above mentioned weeds are the major threats to the native flora of this region.

P -23

Rating of earlier invaded weed species in southern districts of Tamil Nadu

R. Balasubramanian

Dept. of Agronomy, Agricultural College and Research Institute, Madurai TNAU (Tamil Nadu)
e-mail : balurb@yahoo.com

A survey work was conducted in nine districts of southern Tamil Nadu under NIWS scheme with the objective of early detection of regulated weeds along with the weeds distribution in different categories. The survey was performed in each and every village of all blocks in each district under cropped, non-cropped and garbage areas. During the survey work the already invaded weeds such as *Parthenium hysterophorus, Ipomea carnea, Eichhornea crassipes, Prosophis juliflora* and *Mimosa pudica* were studied and the over all rating scale of these invaded weeds for the individual district was arrived. Among the various invaded weeds studied, *Parthenium hysterophorus* was alone found at high rating in majority of the districts under study *viz*., Madurai, Theni, Virudhunagar, Tirunelveli, Kanyakumari and Ramanathapuram and medium rating was noticed in three districts *viz*., Sivagangai, Pudukottai and Tuticorin. In case of *Ipomea carnea*, the rating was found to be only very low to low in all the nine southern districts and no district was seen with a rating of medium or high. With reference to *Eichhornea crassipes* no district was observed with high rating but Kanyakumari district was recorded with medium rating due to high rainfall whereas it was very low in districts like Madurai, Tuticorin, Tirunelveli and Pudukottai. *Eichhornea crassipes* was not recorded in Theni, Virudhunagar, Sivagangai and Ramanathapuram. In case of *Prosphis juliflora*, high rating was recorded in Ramanathapuram district and medium rating was observed in Sivagangai, Pudukottai, Virudhunagar and Tuticorin and it was low in other three districts. With reference to *Mimosa pudica*, no district was observed with high rating but Kanyakumari district was recorded with medium rating and it was very low in Ramanathapuram. However, *Mimosa pudica* was found to be low in remaining seven districts. It is concluded that among the various invaded weeds studied *Parthenium hysterophorus* was the only weed found at high level in most of the districts of southern Tamil Nadu. Next important weed *Prosobis juliflora* was found at high level in Ramanathapuram district and medium level in four districts where it is being used for various purposes like fuel wood in villages, fuel in brick chamber and non-conventional energy source for gasification in electricity production. Generally, both *Ipomea carnea* and *Eichhornea crassipes* were noticed in water storage area such as ponds, lakes, canal and in some rivers. Otherwise in the surveyed area both *Ipomea carnea* and *Eichhornea crassipes* were low to very low. *Mimosa pudica* is found at medium level only in Kanyakumari district and in other districts it is only a minor weed.

P-24 Study on carry over effect of glyphosate K salt applied in preceding transgenic stacked maize hybrids in succeeding green gram

D. Ravisankar, C. Chinnusamy, K. Kalaichelvi and P. Muthukrishnan
DWSRC, Department of Agronomy, TNAU, Coimbatore (Tamil Nadu)
e-mail: ravi.agri@gmail.com

Herbicides are used quite extensively in agricultural production system throughout the world. Herbicides, when applied to the field do not only control targeted weeds, but may also leave unwanted residues in the soil, which are ecologically harmful. Although the efficacy of herbicide in controlling weeds is important, its residual impact should also be considered for environmental safety. Preferred herbicides should not only have good efficacy, but also poses minimum adverse effects to crop, ecology and environment. Transgenic stack hybrid corn (MON 89034 X NK603) was developed for preventing yield losses of corn crop to improve productivity. The major yield reducing factors for corn cultivation in India are weeds and insects. The stacked product having both insect protection and herbicide tolerant traits will provide protection to the crop from target pests and also provide effective weed management system to farmer. In this view, the field experiment was conducted to study the carry over effect of glyphosate K salt applied in preceding transgenic stacked maize hybrids (Mon 89034X NK 603) in succeeding green gram in the experimental site of Tamil Nadu Agricultural University; Coimbatore. Glyphosate was applied to preceding transgenic stacked maize hybrids (Mon 89034X NK 603) as early POE application at 900, 1800 and 3600 g /ha. The results shows that germination percentage of residual green gram was not significantly influenced by weed control treatments imposed on the previous maize crop. The germination percentage of green gram was in the range of 85 to 98% and also there was no crop phytotoxicity in residual green gram observed with different dose of glyphosate and other weed control treatments applied in transgenic maize hybrid.

P-25 Bioefficacy evaluation of herbicide resistant transgenic corn hybrids for crop safety and productivity

D. Ravisankar, C. Chinnusamy, K. Kalaichelvi and P. Muthukrishnan
DWSRC, Department of Agronomy, TNAU, Coimbatore (Tamil Nadu)
e-mail: ravi.agri@gmail.com

The development of crop cultivars with resistance to selected herbicides has the positive impact on agricultural production systems and food safety. Transgenic maize (corn) has been deliberately genetically modified to have agronomically desirable traits. Herbicide resistant corn plants that confer tolerance to glyphosate by production of the glyphosate-tolerant CP4 5-enolpyruvylshikimate-3phosphate synthase (*CP4 EPSPS*) proteins. Globally, 25 countries have planted biotech crops in an area of 800 million ha in 2008. India ranks fourth with a single biotech crop of *Bt* cotton. As an initiative on transgenic corn, transgenic stacked maize hybrids evolved by Monsanto India Ltd. MON 89034 is 2nd generation Bt corn technology effective against lepidopteron insect pests with a unique and innovative "dual mode of action". This new technology said to be offer superior and consistent control broad spectrum control of the target lepidopteron insects pests. NK603 is the glyphosate tolerant technology for the effective weed management system. The plant becomes tolerant to the herbicide while all other weed flora suppressed after application of herbicides. The transgenic corn hybrids were evaluated during w*inter* 2008-09 at experimental site of Tamil Nadu Agricultural University; Coimbatore. Glyphosate was applied as early POE application at 900, 1800 and 3600 g ae/ha in Hishell and 900 M Gold transgenic corn hybrids compared with non transgenic counterparts with PE atrazine at 0.5 kg/ha + HW on 40 DAS and with and without insect management. Early POE application of glyphosate at 900, 1800 and 3600 g/ha registered lower weed density, dry weight and WCE in transgenic Hishell and 900 M Gold. Higher grain and stover yield was recorded with POE application of Round up at 900, 1800 and 3600 g ae/ha in Hishell and 900 M Gold transgenic hybrids. Average yield obtained in transgenic hybrid was 10 t/ha and conventional transgenic maize hybrid was 8 t/ha.

P- 26 Phytotoxicity evaluation of glyphosate resistant cotton hybrids and weed control in winter irrigated ecosystems

C. Nithya, C. Chinnusamy and P. Muthukrishnan
DWSRC, Department of Agronomy, TNAU, Coimbatore (Tamil Nadu)
e-mail : nithiyachinnu@yahoo.co.in

Herbicide and insect resistance are the two categories of transgene-conferred traits for crops that have significant effects on agriculture. Cotton is one of the important crop that has been genetically altered to address challenges with weed and insect control. Cotton hybrids are cultivated under wider plant spacing and heavily fertilized, which inturn invites multiple weed species infestation. Due to increased scarcity for labourers, manual weeding is not economic and the available pre - emergence herbicide has lesser weed control efficiency in controlling major problematic weeds like *Cyperus rotundus* and *Cynodon dactylon*. In this view, the research was conducted with glyphosate resistant cotton hybrids evolved by Monsanto Mahyco Pvt Ltd., India, were evaluated during winter 2009-10 at experimental site of Tamil Nadu Agricultural University, Coimbatore. The experiment was laid out in a randomized block design replicated thrice with the objective of, to find out the weed control efficacy of glyphosate formulation (potassium salt of glyphosate) in transgenic cotton hybrid and to evaluate the phytotoxic effect of glyphosate on cotton

Glyphosate was applied as early POE application on 25 and 60 DAS at 900, 1350, 1800, 2700, 3600 and 5400g/ha in MRC 7347 BG-II RRF test hybrid. These treatments were compared with hand weeding on 15 and 30 DAS and unweeded control. Broad leaved weeds constituted 92%, grasses 4% and sedges 4% before first POE herbicide spraying. 76% broad leaved weeds, 13% grasses and 11% sedges was observed before second herbicide spray. In both the sprays, Early POE application of glyphosate 2700, 3600 and 5400 g /ha registered lower weed density in transgenic cotton hybrids compared with other treatments. Glyphosate at 2700, 3600 and 5400g/ha recorded significantly lesser weed dry weight and higher weed control efficiency. This was followed by HW on 15 and 30 DAS recorded lesser weed dry weight and high weed control efficiency. Glyphosate 5400g ae/ha was observed with crop phytotoxicity symptoms like yellowing, downward cupping, drooping of leaves and chlorotic symptoms. This was recovered within 25 days after herbicide spraying. Complete drying of all weeds was observed at 15 DAHS except *Commelina benghalensis, Portulaca oleraceae, Cleome gynandra* and *Cyperus rotundus.* They developed chlorotic and drying symptoms at 20 DAHS with 2700, 3600 and 5400g/ha. Increased use of transgenic cotton with herbicide and pest resistance has resulted in more efficient insect and weed management practices.

P-27

Impact of weed dynamics on production efficiency under diversified and intensified rice based cropping systems in Kymore plateau and Satpura hills zone of Madhya Pradesh

Monika Soni, Dr. V. B. Upadhyay, S. K. Vishwakarma, Poonam Singh and Deepika Tiwari
Department of agronomy, JNKVV, Jabalpur, Madhya Pradesh
e-mail : monika.soni8@gmail.com

Field experiment was conducted on diversification and intensification of cropping system under irrigated and rainfed production system over existing rice-wheat and rice-chickpea cropping systems during the year 2007-08 in clay loam soils of Jabalpur (M.P.). The treatments consisted with 12 crop sequences *viz*., T_1-rice (Kranti)-wheat (GW-273), T_2-rice (Kranti)- chickpea (JG-322), T_3-Hy. rice (Pro Agro 6444)-onion (Pusa Red)-green gram (Pusa Vishal) G+R, T_4-rice (Pusa Basmati-1)-berseem fodder+Seed (JB-5), T_5-Hy. rice (JRH-5)-potato (Kufri Sinduri)-maize (JM-12) cob+fodder, T_6-Hy. rice (JRH-5)-*gobhi sarson* (Terri Uttam)-maize (JM-12) cob+fodder, T_7-Hy. rice (JRH-5)-vegetable pea (Arkel)-sunflower (PSH-12), T_8-Hy. rice (JRH-5)-potato (Kufri Sinduri)-groundnut (Jyoti), T_9-Hy. rice (JRH-5)-*gobhi sarson* (Terri Uttam)-groundnut+maize 4:2, T_{10}-Hy. Rice (JRH-5)-*gobhi sarson* (Terri Uttam)-okra (Parbhani Kranti), T_{11}-Hy. rice (JRH-5)-garlic (G-41)-maize+cowpea 4:2 rows and T_{12}-Hy. rice (Pro Agro 6444)-marigold (African Giant)-maize (JM-12) cob+fodder. These treatments were tested in randomized block design with 4 replications. The soil of the experimental site was slightly alkaline in reaction (soil pH 7.7) with low OC content (6.8 g/kg) and having normal EC (0.48dS/m) and analyzing medium in available N (266 kg/ha) and low in available P (9.2 kg/ha) and medium in available K (300 kg/ha) with 1068.2 mm rainfall. Sowing of all crops in different crop-sequences was done by using recommended varieties and sowing practices and sowing of succeeding crops in each crop-sequence was done immediately after harvesting of preceding crops. Other crop management practices *viz*., fertilizer application, irrigation and drainage, weed control and intercultural and plant protection measures were adopted in all crops as per package of practices and as and when required. Various observations were recorded on pattern of weed infestation in various crops under different crop sequences at 25 DAS and at harvest. Under *kharif*, in rice *Echinochloa crusgalli* was the most dominating weed contributing 32.8% of total weed intensity at most critical period (25 DAT) while *Monochoria vaginalis* at harvest stage (18.8%). During *rabi*, relative density of weeds varied between different crops. In early (30.2 to 43.3%) and at harvest stage (10.1 to 46.8%) *Medicago denticulata* was found to be more serious weed almost in all *rabi* crops grown under different crop-sequences but in onion & garlic *Portulaca oleracea* having higher intensity at harvest stage (45.2%). The *Portulaca spp.* predominantly infested to all summer crops at early (41.5 to 54.6%) and harvest stage (37.2 to 44.1%). In rice varieties the weed intensity m^{-2} and biomass ranged from 229.0 to 254.2 and 9.98 to 11.42 q/ha under different crop sequences respectively. During *rabi*, weed intensity and biomass was higher in vegetable pea (207.3) and potato (7.10). During summer season, the weed intensity was maximum (156.4 m^{-2}) in okra which resulted into the highest weed biomass production (6.47q/ha). Similar results were reported by Singh *et al.,* 2005. Both rice and wheat crops grown under rice–wheat system require large quantity of irrigation water which is favourable to build up a typical weed infestation problem. All diversified and intensified crop-sequences significantly led to record higher production efficiency (83.13kg/ha/day to 57.05kg/ha/day) beneficial to minimize the serious challenges posed by the weeds as compared to both existing cropping sequences *viz*., rice-wheat (45.63kg/ha/day) and rice-chickpea (39.49kg/ha/day).

P-28 Use of models to understand climate-weed interaction in field situations

Somnath Choudhury, A. K. Tripathi, Amit Dixit and Neelam Chouksey
RMD College of Agriculture and Research Station, Ambikapur (CG)
e-mail : somnath_dhar@yahoo.com

Temperature and rainfall determine where each species can live and reproduce. Climate change will directly affect, the geographic range of species, the timing of species' life cycles, the population dynamics of species, the location of natural habitats (some species will have to move with their host habitats), the structure and composition of ecosystems (i.e. the decline and extinction of some species and the invasion of other species). Weeds with efficient dispersal mechanisms such as water, wind or birds are better equipped to shift their range, while species with short generation times are better equipped to evolve, and increase their tolerance of warmer temperatures. Each species will cope and adapt in different ways, so their ranges are likely to expand and contract at different rates, which will affect competition between species. Weeds are usually very competitive and often find an opportunity to establish new populations when natural or desirable plant species decline. The projected increase in fire and drought will favour the establishment of some weeds. Climate change may also favour some native plants to the extent that they may become weeds.

However, to understand the competition process in agricultural systems, models like INTERCOM has to be evaluated with respect to its capacity to explain and predict phenomena observed in the real system through field experimentation. In contrast to predictive models, where it is not a problem if the assumptions are not sound as long as the model predicts accurately, it is important for application of this model that it is as mechanistic as possible. If, for example, the model is being used for designing plant types with high competitive ability, wrong assumptions in the model will lead to wrong conclusions and research directions. Therefore, it is important not only to test the final output of the model, but evaluate components of the model as well.

P-29 Evaluation of oxadiargyl and 2,4-D (Na salt) in direct seeded long duration varieties of paddy

Javed Akhter and Pratibha Katiyar
Department of Crop Physiology and Biochemistry, IGKVV, Raipur (CG)
e-mail : pratibhakatiyar@rediffmail.com

The field experiment was conducted during wet season (*kharif*) 2005 at Instructional farm of IGKVV, Raipur (CG) for post graduate degree program in the department of Crop Physiology and Biochemistry. The experiment was carried out to explicit the impact of foliar application of oxadiargyl and 2,4-D (Na salt) on weed management in direct seeded long duration paddy. Five long duration varieties of paddy *i.e.,* Dubraj, Vasumati, Gopalbhog, Pusabasmati and Badshabhog were taken for experimentation at six herbicides levels. The experiment was conducted in directed seeded rain fed lowland conditions in split plot design. It was observed that as compared to individual effect of oxadiargyl @ 0.08kg/ha and 2,4-D (Na salt) @ 0.6kg/ha the combined effect of oxadiargyl + 2,4-D (Na salt) @ 0.08 + 0.6 kg/ha was found to be most effective in controlling weed biomass and density and it was at par with hand weeding twice (at 30, 45 DAS). It was observed that the combined effect of oxadiargyl + 2,4-D (Na salt) improved the morpho -physiological attributes *i.e.,* plant height number of tillers, biological yield, panicle weight, CGR and grain yield in all the experimental varieties. This treatment was at par with hand weeding twice (at 30,45 DAS).

P-30

Weed Management studies in direct-seeded Rice

R. B. Tiwari, T. D. Pandey and K. L. Nandeha
IGKV, TCB College of Agriculture & Research station, Bilaspur (C.G.)
e-mail : klnandeha@yahoo.co.in

A field experiment was conducted during the rainy seasons of 2008 and 2009 to evaluate the efficiency of herbicides either applied as pre- emergence or in combination with post- emergence; post-emergence alone and manual weeding twice at 20 & 40 DAS in direct seeded rice .Result reveals that the application of herbicide pyrozosulfuron as pre-emergence at 0.20 kg /ha +fenoxoprop as post- emergence @ 0.06kg /ha ; fenoxoprop at 0.06 kg/ha mixed with ethoxysulfuron at 0.015 kg/ha as post-emergence showed the highest weed control efficiency, grain yield and net profit and lowest weed dry matter,followed by application of butachlor as pre-emergence at 1.0 kg/ha + fenoxoprop as post- emergence at 0.06 kg/ha, oxadarzil as pre- emergence at 0.75kg/ha +fenoxoprop as post- emergence at 0.06 kg/ha and unweeded control .However, the difference with hand weeding twice was not significant. Yield losses due to uncontrolled weed growth in direct seeded rice ranges from 40-80 per cent. About 70% of rice is grown under direct seeded condition and farmers generally control the weeds by removing manually but timely and effective control of weeds through manual weeding becomes difficult due to unfavorable weather conditions and scarcity of labourers. Often, manual weeding proves uneconomical due to ever increasing labourer wages. Most of the weeds can be controlled with selective herbicides. Therefore, it seems that, weeds growth at early stages can be reduced to minimum by pre-emergence application of herbicides & control of later emerged weeds by application of post-emergence herbicides.

A field experiment was conducted during *Kharif* seasons of 2008 and 2009 at TCB College of Agriculture & Research Station, Bilaspur. The soil of experimental area was clay loam in texture having pH 7.4., organic carbon 0.78%, available $P_2 0_5$ 20.5 kg/ha and $K_2 0$ 425 kg/ha. The treatment comprised seven weed control measures *viz*. W_0- control (unweeded); W_1- hand weeding twice 20 & 40 DAS; W_2—Butachlor as pre-emergence at 1.0 kg a.i./ha+ fenoxaprop as post-emergence at 0.060 kg/ha; W_3- pyrozosulfuron as pre-emergence at 0.20 kg/ha + fenoxaprop as post-emergence at 0.060kg/ha; W_4-oxadarzil as pre-emergence at 0.075 kg/ha + fenoxaprop as post-emergence at 0.060 kg/ha; W_5- fenoxaprop as post-emergence at 0.060kg/ha mixed with metsulfuron methyl+ chlorimuron at 0.020kg/ha as post-emergence; W_6-Fenoxaprop @ 0.060kg/ha mixed with ethoxysulfuron at 0.015kg/ha as post-emergence. The experiment was laid-out in Randomised Block Design with three replications. The crop was fertilized with 100: 60: 40 kg NPK/ha. The full doses of phosphorus and potash were applied at the time of sowing .While the Nitrogen was given in three equal splits *i.e* at the time of sowing, active tillering and panicle initiation stages. Seedling of 20 days age of rice variety MTU-1010 was transplanted at 20 x 10 cm spacing. Observations on weed composition and weed dry weight was recorded at harvest and weed control efficiency was calculated by standard procedure along with crop yield & yield attributing characters. *Weed Flora:* The major weed flora observed in the experimental field included *Echinochloa crus-galli, Echinochloa colonum, Cyperus rotundus, Commelina benghalensis, Monochoria vaginalis, Ludvigia perenis.* Different weed control measures significantly reduced the weed biomass and eventually increased weed control efficiency during both the years of experimentation. Treatment W_3 –application of pyrazosulfuron as pre-emergence + fenoxoprop as post- emergence ; W_5-Fenoxoprop mixed with Metsulfuron +Chlorimuron as post-emergence and W_6 fenoxoprop mixed with Ethoxy sulfuron as post-emergence significantly reduced dry weight of weeds over other treatments but in turn non significant with two hand weeding. All the weed control measures significantly influenced the yield of rice compared with unweeded check. Treatment W_3 –application of pyrazosulfuron as pre-emergence + fenoxoprop as post-emergence ; W_5-Fenoxoprop mixed with metsulfuron +chlorimuron as post-emergence and W_6 Fenoxoprop mixed with Ethoxysulfuron as post-emergence produced significantly higher grain yield over other weed management practices, however was at par with hand weeding .The highest net profit was fetched with the Treatment W_3 –application of Pyrazosulfuron as pre-emergence + Fenoxoprop as post-emergence, followed by W_6-fenoxoprop mixed with metsulfuron +chlorimuron as post emergence ; W_6 fenoxoprop mixed with ethoxy sulfuron as post emergence W_1 –hand weeding twice , W_2- butachlor as pre-emergence +fenoxoprop as post-emergence. , W_4-Oxadarzil as pre-emergence +fenoxoprop as post emergence and unweeded control. The increased in grain yield due to weed control measures was owing to reduced weed density , weed dry weight and better weed control efficiency.

P-31 Smothering effect of intercrops on weed biomass in aerobic rice

M. M. Venkatesha, N. Krishnamuthy, Mukund Joshi and N. Ananda
Department of Agronomy, UAS, GKVK, Bangalore (Karnataka)
e-mail : mandi_venkatesha@rediffmail.com

Experiment was laid out in randomized complete block design with seven intercrop treatments i.e., rice + french bean, rice + bhendi, rice + radish, rice + amaranthus, rice + soybean, rice + coriander compared with sole rice with three replications. The rice hybrid used for study was KRH^{-2}, french bean was Arka Komal, bhendi was Arka Anamika, radish was Arka Nishant, amaranthus was is Arka Suguna, soybean was JS-335 and coriander was DWD-3. The aerobic cultivation was carried out as per the recommendation given by UAS, Bangalore. For sole crop, before sowing furrows were opened at 30 cm interval with the help of hand hoe. Two to three seeds were dibbled per hill at intra row 30 cm spacing. For intercrops, paired row system of 30 -60-30 cm was followed in rice and intercrops were introduced in 60 cm wider space between rice rows.

Amaranthus, coriander and radish were harvested after one month of sowing. They were harvested for vegetable purpose. Bhendi was harvested after 6th week after sowing. Soybean was harvested for grain purpose. Sole rice crop yield was recorded separately and based on this data rice equivalent yield and economics were worked out.

Sole rice crop recorded significantly higher grain yield (5470 kg/ha) compared to rice yields in different intercropping systems. But it was on par with rice yields in rice + amaranthus (5085 kg/ha) indicating high smothering effect on weeds by amranthus. Bhendi suppressed the rice yields to a maximum extent (31.8 %), while, amaranthus recorded least suppression (7.11 %). Further, intercropping of amaranthus with rice was significantly helpful in reducing the monocot (0.95 g/m and 1.57 g/m at 15 and 30 DAS, respectively), dicot (1.04 g/m and 1.58 g/m at 15 and 30 DAS, respectively) and total weed dry weight (1.22 g/m and 2.05 g/m at 15 and 30 DAS, respectively) and causing high smothering efficiency (136.9 % and 148.8 % at 15 and 30 DAS, respectively). Intercropping of coriander was also useful in similar way (0.99 to 1.57, 1.07 to 1.67 and 1.28 to 2.19 g/m and 130.5 to 139.3 %, monocot, dicots, total weed dry weight and weed smothering efficiency at 15 and 30 DAS, respectively). The maximum monocot, dicot and total weed dry weight were recorded in rice + french bean at 15 DAS (1.43, 1.31 and 1.80 g/m, respectively) and at 30 DAS (2.39, 2.02 and 3.05 g/m, respectively). Rice + amaranthus recorded significantly higher rice equivalent yield (18,007 kg/ha) compared to sole crop of rice (5,470 kg/ha) and other intercropping treatments. However, it was statistically on par with rice + coriander (17,926 kg/ha). This indicated that amaranthus and coriander were more compatible with rice as intercrop and useful to suppress the weed growth at earlier stage. The rice + radish recorded maximum cost of cultivation (Rs. 20,475/ha) but rice + amaranthus recorded significantly higher gross returns (Rs.10,3382/ha), net returns (Rs. 84,107/ha) and B: C ratio (1:5.36) as compared to the other intercropping treatments. It was statistically on par with rice + coriander which recorded gross returns (Rs. 10,2678/ha), net returns (Rs 82,943/ha) and B:C ratio (1:5.20). The lowest gross returns, net returns and B: C ratio were recorded with rice + french bean (Rs 29,949 and Rs.10,024/ha and 1:1.50, respectively). It can be concluded by this study that the weed problem in aerobic rice can be overcome by adopting rice + amaranthus or rice + coriander intercropping system without affecting the rice yield and net returns as compared to radish, french bean or soybean. However, Rice + soybean intercropping system was not only economical and efficient in resource use, but left favorable residual nutrients status particularly available nitrogen (311.1 kg/ha), available phosphorous (44.6 kg/ha) and potassium (221.5 kg/ha).

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Productivity and economics of rice as influenced by weed management practices under different crop establishment techniques

M. T. Sanjay, T. V. Ramachandra Prasad, G. R. Denesh, H. S. Ravi Kumar, D. S. Lokesh, N. Ananda and M. K. Basavaraj

DWSRC, University of Agricultural Sciences, Bengaluru (Karnataka)

e-mail : mt.sanjay@gmail.com

A field experiment was conducted for three consecutive seasons (*kharif* 2008, summer and *kharif* 2009) to investigate the performance of weed management practices under different rice establishment techniques at the Agricultural Research Station (UAS, Bengalmser), Kathalagere, Davanagere district. The soil type was sandy clay loam with average fertility level. The trial was carried out in a split plot layout with four crop establishment techniques in main plots *viz*., S1 - system of rice intensification, S2 - normal transplanted rice, S3 - direct seeded rice - broadcasting of sprouted rice and S4- drum seeded rice - sprouted low land rice and subplot treatments consisted of four weed control treatments *viz*., W1 - pyrazosulfuron ethyl 25 g /ha - 3 DAS/P fb mechanical weeding (45 DAP/S), passing of cono weeder at 15, 25 & 35 DAS/P, W3 - 2 hand weeding at 20 and 45 DAS/P and W4 - unweeded control. Mean yield of three seasons indicated that paddy grain yields obtained in normal transplanted rice (4367 kg/ha), system of rice intensification (4120 kg/ha) and drum seeded rice (3933 kg/ha) were at par with each other but inturn were significantly superior over direct seeded rice (2992 kg/ha) as a result of reduced weed competition measured in terms of lowered weed density and dry weight. Drum seeding and broadcasting lowered the cost of cultivation by Rs. 3075 and Rs. 3200/ha over transplanting, while SRI method saved Rs.500/ha, on account of avoiding transplanting and use of drum seeder. Among weed management practices pre-emergence application of pyrazosulfuron ethyl 25 g/ha - 3 DAS/P fb mechanical weeding (45 DAP/S) recorded significantly higher grain yield (4664 kg/ha) compared to other practices, but comparable with two hand weedings (20 & 45 DAS/P, 4367 kg/ha). Further use of pyrazosulfuron ethyl 25 g/ha (3 DAS/P) fb one mechanical weeding (45 DAS/P) could save weeding cost by Rs.3250/ha over hand weeding (Rs.5425 /ha) and resulted in better returns of Rs. 24,983/ha as against Rs.20,995/ ha in hand weeding, as compared to unweeded control, owing to good control of weeds. Passing of conoweeder (15, 25, and 35 DAS/P) could not control weeds within the rows and gave paddy yields lower than hand weeding (4009 kg/ha), although saving in cost of cultivation to an extent of Rs. 3800/ha was achieved. Among combination of treatments cultivation of rice under normal transplanting technique with pre emergence application of pyrazosulfuron ethyl 25 g/ha - 3 DAP fb mechanical weeding (45 DAP) recorded numerically higher grain yield (5158 kg/ha) compared to all other treatment combinations.

Among rice establishment techniques, drum seeding and broad casting lowered the cost of cultivation by Rs. 3075 and Rs. 3200/ha over transplanting, while SRI method saved Rs. 500/ha, on account of avoiding transplanting and use of drum seeder. With regards to paddy yields, transplanting gave slightly higher yield, followed by SRI and drum seeding. While it was pretty low in broadcasting of rice, which could not minimize weed menace. Although SRI was cheaper by Rs. 500/ha over transplanting by saving seed cost and cost of management (by planting on 14th day after seeding), but gave lower yield than transplanting and consequently could not reap the benefit of lowered cost of cultivation.

For weed management in these systems of rice establishment, use of pyrazosulfuron ethyl 25 g ai/ha (3 DAS/P) fb one mechanical weeding (45 DAS/P) was very effective in lowering weeds of all types and gave slightly higher yield as that of hand weeding. The use of herbicide could save weeding cost by Rs. 3250/ha over hand weeding and resulted in better returns of Rs. 24,983/ha as against Rs. 20,995/ha in hand weeding, as compared to unweeded control, owing to good control of weeds. Passing of Conoweeder (15, 25, and 35 DAS/ P) could not control weeds with in the rows and gave paddy yields lower than hand weeding, although saving in cost of cultivation to an extent of Rs. 3800/ha was observed.

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Effect of tillage and weed management practices on weed dynamics and weeds seed bank in wheat after transplanted rice

Radhey Shaym, Rohitashav Singh, V. K. Singh and S. K. Guru

Dept. of Agronomy, College of Agriculture, G.B. PUAT, Pantnagar U.S Nagar, (Uttarakhand)

e-mail : rohitash_1961@rediffmail.com

Rice-wheat is the most important cropping system in North India. Sowing of wheat in this region is generally delayed due to the cultivation of long and medium duration rice varieties and time required in field preparation of wheat. The advancing of wheat sowing is possible by zero till ferti drill or reducing the tillage operations. Tillage is also an important component of weed management with influencing the vertical distribution of weed seeds in soil layer and weed diversity. So, investigations were initiated to find out the role of tillage techniques and weed control practices on weed dynamics, yield of wheat and weed seed bank under rice-wheat sequence.

A field experiment was conducted at Crop Research Centre, GBPUA&T, Pantnagar, during the year 2005-06 and 2006-07. The soil was sandy loam in texture with pH 7.8. The experiment was laid out in split-plot design with treatments , comprising 3 tillage practices, zero tillage (ZT), reduced tillage (RT) and conventional tillage (CT) in main plots; and 4 weed management practices, *viz*. two hand weeding at 35 and 55 Days after sowing (W1), isoproturon 1.5 kg/ha (W2), clodinafop-propargyl 60 g fb metsulfuron methyl (MSM) 4 g/ha (W3) and weedy check (W4), in sub-plots and was replicated thrice. Post-emergence application of isoproturon and clodinafop was done 30 DAS while MSM was applied 7days after first spray.

The major weed flora in experimental field were : *P. minor, Melilotus* spp. *C. album, Medicago denticulata* and *Rumex acetocella*. Zero tillage at par with reduced tillage recorded significantly lower weed dry weight than conventional tillage during both the years. This was due to the fact that intensive tillage operation in conventional tillage brought out the weed seeds from sub-surface to favorable moist upper soil layer for good germination. Similar finding were reported by Sinha and Singh (2005). Two hand weeding recorded significantly lower weed dry weight as compared to clodinafop fb MSM which had also statistically difference than isoproturon. Zero tillage at par with reduced tillage recorded significantly higher grain yield than conventional tillage during both the years. The higher yield under zero tillage might be owing to earlier sowing and higher number of effective tillers. Hand weeding twice at par with clodinafop fb MSM recorded higher grain yield than isoproturon during both the years. Higher yield under these treatment were due to better efficacy to control the weeds. Bulk density of soil was non-significantly influenced by tillage practices except 2004-05. Conventional tillage recorded significantly lower bulk density of soil than other tillage methods. The lower bulk density of soil under conventional tillage practices might be attributed to increase soil volume under pulverized condition due to loosening of soil mass.

P. minor, Melilotus spp. and *C. album* seeds were higher under conventional and reduced tillage and *M. denticulata* and *R. acetocella* under zero tillage Irrespective to depth seeds of *P. minor C. album* and *M. denticulata* were almost equally distributed upto 0-5 cm and 5-10 cm. However, seeds of Melilotus spp. and R. acetocella were higher in upper 0-5 cm soil layer.

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P-34 Effect of weed management practices with relation to sowing dates in direct seeded unpuddled rice

Jitendra Kumar, Dheer Singh, Rohitashav Singh and Radhey Shyam
Dept. of Agronomy, College of Agriculture, G.B. PUAT, Pantnagar U.S Nagar (Uttarakhand)
e-mail : jitendraagron@gmail.com

A field experiment was conducted during *Kharif* season of 2006 and 2007 at Crop Research Centre of G. B. Pant University of Agriculture and Technology, Pantnagar district U.S. Nagar (Uttarakhand) in loamy soil which having medium in organic matter (0.67 %), high in available phosphorus (38 kg/ha) and medium in available potassium (181.25 kg/ha) to evaluate the efficacy of different herbicides *viz*. butachlor 1.5 kg/ha (PE), pendimethalin 1.5 kg/ha (PE), pendimethalin 1.0 kg/ha + anilophos 0.4 kg/ha (PE), thiobencarb 1.5 kg/ha (PE), pretilachlor 0.75 kg/ha (PE), fenoxaprop-p-ethyl 0.06 kg/ha (15 DAS) followed by 2,4-D @ 0.5 kg/ha (30 DAS), anilophos 0.4 kg/ha (10 DAS) and two hand weedings (20 and 40 DAS) under different sowing dates *viz*. 05 June, 20 June and 05 July and their effects on weeds, crop growth, yield and economics of rice. Weed free and weedy check were also included in the experiment. The field experiment was laid out in split-plot design with 3 replications. Rice variety "Govind" was sown in lines at 20 cm distance with recommended dose of fertilizer 120 kg N, 80 kg P_2O_5 and 60 kg K_2O per hectare. *Echinochloa colonum L. among grasses, Commelina benghalensis L. and Caesulia axillaris L.* among non-grasses and *Cyperus rotundus L.* among sedges were the predominant weeds in experimental field. Uncontrolled weeds in weedy check plots caused on an average reduction in grain yield by 74.4 per cent during 2006 and 67.4 per cent during 2007 over weed free plots. The lowest weed population and dry weight were recorded in 05 July sown crop over rest of two sowing dates (05 June & 20 June). Highest yield attributes, grain yield (2488 kg/ha during 2006 and 2703 kg/ha during 2007) and nutrients uptake by crop plants was recorded in 20 June sown crop. Pre-emergence application of pendimethalin 1.0 kg/ha + anilophos 0.4 kg/ha and two hand weedings (20 and 40 DAS) produced highest grain yield during both the years. Pendimethalin 1.5 kg/ha and fenoxaprop-p-ethyl 0.06 kg/ha followed by 2,4-D, 0.5 kg/ha also gave effective control of weeds and higher grain yield. Pendimethalin 1.0 kg/ha + anilophos 0.4 kg/ha applied one day after sowing found superior over all other herbicidal treatments in reducing population and dry matter of weeds and it lead to highest grain yield which ultimately fetched highest net return during both the years.

P-35 Impact of water status on rice weed competition and floristic composition of weeds

Pratibha Katiyar and S S Kolhe
Department of Crop Physiology and Biochemistry, IGKVV, Raipur (CG)
pratibhakatiyar@rediffmail.com

Weeds interfere with rice growth by competing for one or more growth limiting resources *i.e.,* light, nutrient and water. The field experiments during 2003-2006 in AICRP-WC at IGKV at Raipur (CG) center explicit the variation in floristic composition of weeds according to the water status and cultivation practices. It was observed that cultural practices greatly alter the competitive relationship between rice and weeds. Thus, upland, rainfed low land and irrigated are the different kinds and degree of weed competitions. The floristic composition of weeds were affected according to the water status of the field. The survey of weeds in rice fields of different cultures indicated that the C_4 weed species *i.e.,Brachiaria spp, Cynodon dactylon, Cyperus rotundus, Digitaria spp, Echinochloa spp, Elucine indica , Fimbristylis miliacea, Ischaemum rugosum, Leptochloa chinensis* and *Imperata cylindrica* were dominated in dryland soil and rainfed cultivation particularly in upland conditions. Whereas, C_3 weed species *i.e., Eclipta spp., Commelina benghalensis, Monochoria viginalis, Eichornia crassipes, Ipomea spp and Ageratum conyzoides* etc. were dominant in submerged soil and particularly in irrigated conditions. Hence, upland rice and rain fed lowland rice with limited precipitation face severe competition with C_4 weeds because of their high WUE, NUE and LUE as compared to C_3 weeds.

P-36 Influence of time of sowing and weed control methods on yield and economics of direct seeded rice

T. V. Ramachandra Prasad, M. T. Sanjay, G. R. Denesh, H. S. Ravi Kumar, N. Ananda, D.S. Lokesh and Santhosh Upanal

Directorate of Weed Science Research Centre, Hebbal, Bengaluru (Karnataka)

e-mail : tvramachandraprasad@rediffmail.com

A field experiment was conducted during *kharif* 2008 & 2009 to study the influence of sowing time and performance of weed management practices in direct seeded rice under upland condition on a sandy clay loam soil at the Agricultural Research Station, Kathalagere, Davanagere District, under the jurisdiction of the University of Agricultural Sciences, Bengaluru. The trial was laid out in a split plot design with the time of sowing in main plots *viz*., M_1 - before onset of monsoon and M_2 - after onset of monsoon. The difference in two dates of sowing is 21 days. The sub plot treatments consisted of weed management practices such as W_1 - pretilachlor – S at 0.5 kg/ha (5 DAS), W_2 - butachlor 1.5 kg /ha (5 DAS) + 1 hand weeding at 45 DAS, W_3 = chlorimuron ethyl 10 WP + metsulfuron methyl 10 WP(Almix) at 4 g/ha (15 DAS), W_4 - sesbania (broadcast) + 2,4 – D EE at 0.5 kg/ha at 30 DAS, W_5 – hand weeding (20 & 45 DAS) compared with W_6 - unweeded control. Major weed flora observed in the experimental plots was *Cyperus iria, Fimbristylis miliacea, Scirpus* sp (among sedges)*, Panicum tripheron, Echinochloa colona* and *Panicum dilatatum* (among grasses). Where as among broad leaf weeds, major weeds were *Ludwigia parviflora, Glinus oppositifolius, Rotala verticillaris, Dopatrium junceum, Spilanthes acmella, Eclipta alba, Lindernia veronicaefolia*, *Marselia quadrifoliata,* and *Alternanthera sessilis.* Data (2008 and 2009) indicated that sowing time in direct seeded rice had no influence on weed emergence and consequently had similar paddy yields (3760 to 3775 kg/ha). Among weed management practices, hand weeding was the best in controlling weeds resulting in significantly higher grain yield (4784 kg/ha) followed by application of butachlor (4260 kg/ha) and pretilachlor – S (4185 kg/ha). Combination of chlorimuron ethyl 10 WP + metsulfuron methyl 10 WP (Almix) at 4 g/ ha (15 DAS) gave slightly lower yield (4048 kg/ha) as a result of good control of sedge and broadleaved weeds without affecting grasses. Unweeded control lowered the yield significantly by 57% (1820 kg/ha). Use of herbicides was cheaper than hand weeding and saved weeding cost by Rs.5070 in pretilachlor to Rs.5550/ha in Almix application, as the cost of two hand weeding amounted to Rs.6300/ha. The marginal returns/ marginal cost was pretty higher with the use of herbicides (Rs.22.8 to 36.6/ rupee investment) as compared to mere 4.5 in case of hand weeding, indicating saving in cost of cultivation and lowering the drudgery of weed management through labourers.

P-37 Effect of weed management practices on soil health in direct seeded rice under rice-chickpea cropping system

Raj Kumar, H. P. Tripathi, Jaidev, S. S. Singh and A. K. Singh

Department of Agronomy, N.D.U.A.T., Kumarganj, Faizabad (U.P.)

e-mail: rkpnduat@gmail.com

The field experiment was conducted during *kharif* season of 2008-09 at Faizabad to study the effect of herbicides on soil health in direct seeded rice under rice-chickpea cropping system. Soil at the test site was silt loam with pH 8.13, EC 0.22 dSm-1, OC 0.33%, bulk density 1.44 g/cc available NPK 172.7, 18.2 and 257 kg/ha, respectively. The experiment was laid out in a randomized block design with four weed management practices (weedy check, mechanical weeding (2), butachlor at 1.5 kg/ha and anilophos at 0.5 kg/ha fb. one hand weeding at 30 DAS in each herbicide treatment). The treatments were replicated three times. The herbicides were applied as pre-em. at 3 days after sowing. Recommended dose of NPK (120:60:60) was applied. There were non significant variations observed due to various treatments in affecting the pH, EC, OC and bulk density of soil at various crop stages. Maximum population of total bacteria and fungi (45.0 and 25.8 cfu/g) were observed at 50 DAS in direct seeded rice soil under mechanical weeding treatment followed by butachlor, anilophos and weedy check, respectively. Herbicides butachlor and anilophos applied in rice crop did not cause any harmful effect on soil health.

P-38 Characterization of ecological parameters of weed flora in paddy ecosystems of Bellary district in Karnataka

Ramesh Babu, Ramesh Nayak , M. B. Purdal, B. N.Aravind Kumar, G. Sajjanar and R. N. Bhat
National Invasive Weed Surveillance Programme DWSR Centre, MARS, UAS, Dharwad (Karnataka)
e-mail : rameshbabu.niws@gmail.com

Under the National Invasive Weed Surveillance Programme, DWSR Centre, UAS, Dharwad, a survey was carried out during June - September 2009 in Bellary district of Karnataka, to identify the invasive weed flora and to study the dominant and problematic weeds in the district. The data on weed density, frequency and dominance data were collected. Based on this data, the relative density (%), relative frequency (%), relative dominance (%) and Importance Value Index (IVI) were computed. Based on IVI values obtained during the survey, the dominant five weeds in the paddy fields were *Croton sparsiflorus* (66.51), *Parthenium hysterophorus* (63.2), *Amaranthus viridis* (16.72), *Acalypha indica* (13.65) and *Tridax procumbens* (10.47). Similarly in non cropped area, the dominant weeds were *Cassia ceresea* (998.06), *Parthenium hysterophorus* (157.72), *Amaranthus viridis* (82.59), *Cynodon dactylon* (40.49) *and Croton sparsiflorus* (31.27); in garbage area *Cynodon dactylon* (285.38), *Cassia ceresea* (281.13), *Amaranthus viridis* (191.94), *Croton sparsiflorus* (97.15) and *Acalypha indica* (36.47) were dominant.

Croton sparsiflorus is native to Tropical America. In Northern Karnataka, it is found growing profusely all along roadsides, garbage area and fallow lands. It is a matter of great concern from these studies that now it is also growing in paddy fallows during summer months (Feb- June). However, its occurance is not noticed in standing paddy crop during *Kharif*. In future, a close watch is needed to study its spread to cropped areas.

P-39 Resistence of *Echinochloa colona* against post emergence application of azimsulfuron

C. Sangeetha, C. Chinnusamy, K. Kalaichelvi and P. Muthukrishnan
Department of Agronomy, T.N.A.U., Coimbatore (Tamil Nadu)
e-mail: chandrusan2007@gmail.com

Rice is one of the major crops in Tamil Nadu and also cultivated in large area. One of the major constraints in rice cultivation is weed infestation.The two important species *Echninochloa colonum* and *E. crusgalli* are predominant weeds in our state. Due to labour scarscity at the peak period of rice cultivation, application of herbicide is an alternative way to reduce the crop-weed competetion. But repeated application of the same herbicide would develop resistance to the specific weed. In this view, an experiment was conducted in completly randomised block design with three replication under controlled condition to study the resistance development of *Echinochloa* sp. and mortality percentage against azimsulfuron at various concentrations 30,35,40 GAH in predominant rice based cropping system. *Echinochloa* seeds were collected form 10 different locations of paddy field where azimsulfuron was applied for five seasons,It was applied on 3 to 4 leaf stage of *Echinochloa* plants as early post emergence (EPOE). Reddening of stems and leaves, chlorosis and drying intensity was higher with increased dose (35 and 40 g/ha) of azimsulfuron than lower dose of 30 g/ ha under pot culture condition. 100 % control of *Echinochloa* was observed at 21 DAT at 35 and 40 g/ha and there was no regeneration of dried seedling with azimsulfuron at all the tested doses. Based on weed density 35 and 40 g/ ha had better control than lower dose of 30 g/ha. At 40 and 60 DAT, control was maximum to 93.6 and 100 per cent with post emergence application of azimsulfuron at 40 g/ha, which was followed by 35 g/ha. Based on the experiments conducted, it has revealed that there was no resistantance developed by *Echinochloa* plants against post-emergence application of azimsulfuron at 30, 35 and 40 g/ha. There was no regeneration of *Echinochloa* seeds observed at all the doses upto 60 DAT. The control and drying was higher with 35 and 40 g/ha than 30 g/ha and the drying percentage was higher at 14 and 21 DAT. This showed that *Echinochloa* has not developed any resistance to the post-emergence herbicide (azimsulfuron) under controlled condition.

P-40 Effect of age of *Sesbania* ands nitrogen levels on dry matter and nutrient accumulation, weed dynamics and grain yield of transplanted rice

M.L. Kewat
Department of Agronomy, College of Agriculture, JNKVV, Jabalpur (M.P.)
E.mail mlkewat 2006 @ yahoo.co.in

Rice is one of the important food crops of India. It is cultivated in nearly 44 million ha with the annual production of 96 million tones but the productivity is quite low (28 q/ha) compared to China (62.66 q/ha) and Japan (65.82 q/ha). Of the different reasons of low productivity, the effective weed control and nitrogen management assumes the top most priority in transplanted rice. Therefore, a comprehensive study was undertaken during *kharif* seasons of 2005 and 2006 at research farm of DWSR, Maharajpur, Jabalpur to adjudge the effect of age of *Sesbania* and nitrogen levels on dry matter and nutrient accumulation of *Sesbania*, weed dynamics and yield of transplanted rice. It is obvious from the data averaged ovr two years that dry matter (2.30 q/ha) and nutrient accumulation was less (6.54 kg N, 3.38 kg P & 6.42 kg K) when *Sesbania* was green manured at the age of 30 days but both the indices were increased correspondingly with the increase in age of *Sesbania* being the maximum (43.0 q/ha dry matter, and 61.49 kg N, 34.4 kg P and 43.86 k/ha) when 75 days old *Sesbania* was green manured. The study further revealed that monocot weeds are predominant (57.6%) in transplanted rice ecosystem compared to dicot weeds (42.4%). However, *Cyperus iria* (30.77%) among the monocot and *Eclipta alba* (23.08) among the dicots were more rampant. The density of *Cyperus iria, Echinochloa colona, Eclipta alba* and *Alternanthera philoxeroides* was more (14.82, 6.95, 13.08 and 7.08/m^2 when 30 days old sesbania was green manured but it was reduced identically with the increase in age of *Sesbania* at the time of burial being the minimum (10.23, 4.35, 8.68 and 5.99/m^2) under 75 days old *Sesbania*. The density of aforesaid weeds was also minimum when no any nitrogen was applied to transplanted rice but density of weeds was maximum in the plots receiving 120 kg N/ha applied through urea. Green manuring of 60 days old *Sesbania* alongwith 90 to 120 kg N/ha round more remunerative as it recorded the superior values of yield attributes (effective tillers per hill, panicle length and test weight) and grain yield compared to burial of 75 days old *Sesbania* alongwith all levels of nitrogen (0, 30, 60, 90 and 120 kg N/ha).

P-41 Weed management study in basmati rice under aerobic regimes.

Vivek, Raghuvir Singh , N. S. Rana , R. B. Yadav, and S. S. Tomar
Sardar vallabh bhai patel university of Agriculture & Technology (Meerut)
e-mail : wc-sst@yahoo.com.in

A field experiment was conducted during *kharif* 2005- 2006 to study the effect of weed management practices of basmati rice. The soil of experiment site was sandy loam in texture low in organic carbon, medium in available phosphorus and potassium with pH 7.7. The experiment was laid out in randomized block design with three replications. Eleven weed control treatment consisting pendemethalin at 1.0 kg/ha, pendemethalin 1.0 kg/ha + one hand weeding, pretilachalor at 500 g/ha, Almix at 4.0 g/ ha, almix at 4 g/ha + one hand weeding, pretilachalor at 500 g/ha, pendemethalin at 1.0 kg/ha (pre em) + 2, 4- D at 500 g/ha (post em.), 2, 4- D at 500 g/ ha (post em.) + one hand weeding, pretilachalor at 500 g/ ha (pre em.), +2, 4- D E 500 g/ ha (post em.), two hand weeding at 20 and 40 DAS, Pendemethelin at 1.0 kg/ ha (pre em) + Almix at 4 g/ ha (post em.), control. *Echiniehloa crusgalli, Echiniehloa colona, Trianthema monogyna, parthanium hysterophorus, cysrus rotundus, Digra* arvensis, *And cynodon dectylon* were the major weed species in the experiment site. All the weed control measures lead to significant reduction in the weed population and weed dry matter accumulation as compare to weedy check. Application of pendemethalin at 1.0 kg/ha (Pre em) followed by one hand weeding produced the highest grain yield of basmati rice attributed lowest of weed density and weed dry matter accumulation however treatments namely two hands weeding, Pendemethalin at 1.0 kg/ha + Almix at 4 g and Almix at 4 g/ha (post em) + one hand weeding were at par with pendimethalin at 1.0 kg/ha (pre em) + one hand weeding during both the years.

P-42 Precision farming technology for site-specific weed management

V. P. Singh, Pavan K. Kaurav and C. Kannan
Directorate of Weed Science Research, Jabalpur (M.P.)
e-mail : pawankaurav@gmail.com

The timeliness of weed management is also vital as for most crops, the crop yields are mostly influenced by weed status during the first three to four weeks after emergence. Generally, farmers spray herbicides uniformly over the field, without regard to the amount or location of the weeds. It has long been experienced and recognized that weeds are not spread uniformly across fields, but are often quite patchy. Spraying herbicides uniformly across a field where target weeds are not uniformly distributed could be wastage of resources and add to the social, environmental, and economic concerns about herbicide use. Effective weed control with reduced herbicide use is an important component of precision agriculture. Precision management of agricultural inputs such as herbicides for weed control is crucial to ensure profitable cultivation of crops and long-term sustainability of the land. The main aim of the precision weed management or site- specific weed management is to apply the right dose of the right herbicide at the right place. The previous research work of scientist at abroad shows that the site specific weed management helped in reducing the herbicide application by 10 to 80%. It reduces the cost of weed management and the weed free areas of crop not sprayed may yield 5 to 10 % more, when phyto-toxic effect of herbicide is over looked. To the targeted spraying of the herbicide, the detection and quantification of weeds are required. For detection and quantification of weeds in cultivated crops, generally two methods have been used. The first is to detect certain morphological differences between crop and weed and second is based on the differences between plant reflectance spectra (spectral signature of crop, weed and their mixture). Therefore an intensive research work at DWSR has been initiated to focus on the identification of the spectral signature of the crop, weed and their mixtures. Using such advanced technique for sensor based weed detection in standing crop would lead to development of on the-go herbicide applicator, which would result in judicious use of harmful chemical and help in avoiding needless pollution of soil and environment.

P-43 Morphophysiological and biochemical analysis of rice genotypes for weed suppression and allelopathy

Jadhav, A. and Pratibha Katiyar
Department of Crop Physiology and Biochemistry, IGKVV, Raipur (CG)
e-mail: pratibhakatiyar@rediffmail.com

Rice cultivars with strong weed suppression ability as a result of optimizing both competitive and chemical interference could become an important tool in integrated weed management. Therefore, the experiments were conducted in three consecutive years in *kharif* 2005 - 2007 at Instructional farm of IGKV, Raipur (C.G.) in the department of Crop Physiology and Bichemistry for doctorate research program to explicit the morpho physiological and biochemical traits in three groups of rice genotypes against weed suppression and allelopathy. It was observed that the morpho physiological traits *i.e.,* plant height, shoot biomass, photosynthetic rate and transpiration rate and growth parameters *i.e.,* leaf area (LA) leaf area index (LAI), crop growth rate (CGR) and relative growth rate (RGR) were highly significant and negatively correlated with weed biomass and responsible for weed suppression. However, the genotypes those having less difference in economic yield in weedy check (un weeded) and hand weeding twice (control) remarkably found to be efficient against weed suppression. Long duration genotypes seems to have some potential against weed suppression. The phenol content of plant parts *ie.,* leaf, stem and root and total carbohydrates contents were highly significant and negatively correlated with weed biomass and seems to be useful for weed suppression. Amongst the experimental genotypes leaves of Safri-17 contains maximum phenol content and followed by Dubraj and Vasumati as compared to shoot and root. The phenol content of leaves, shoot and root was highly significant and negatively correlated with weed growth.

P-44 Total productivity and weed dynamics as influenced by different rice based cropping systems under the condition of Chhattisgarh plains

S. K. Sarawgi, Shrikant Chitale, Alok Tiwari and J. S. Urkurkar
Department of Agronomy, Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh)
e-mail : sarawgi1959@yahoo.in

The diversification of the existing cropping system and the introduction of some new high yielding and work profitable crop(s) in the plains of Chhattisgarh are essentially required for better agricultural output. But these changes with existing affect the weed dynamics. Keeping in view of the above fact, the present investigation was carried out.

Seven cropping sequences were followed with 'Indira sugandhit Dhan-1, a cultivar of rice in rainy season as a base crop. The cropping systems were rice-wheat (cv. GW 273) – fallow as check; rice-mustard (cv. Pusa Bold) – green manure (GM); rice-coriander (cv. Pant Dhaniya) – green gram (cv. HUM-1); rice-table pea (cv. Arkil) – maize (fodder), rice – brinjal (cv. Hybrid Nisha) – GM; rice- onion (cv. Nasik Red) – GM and rice – potato (Kufri Chipsona for first two years and K. Badshah for later two years)–cowpea (cv. Gomti) with recommended package of practices under irrigated condition. Rice was grown with transplanted method and sunhemp (*Crotolaria juncea*) a green manure crop in respective treatment with 40 days age. N, P and K were supplied as per recommended dose of the crops. The yield obtained from winter and summer crops was converted into rice equivalent yield. Prevailing farm gate prices of produce were used to workout the economics of different systems. Weed population and dry weight was recorded at 30 and 60 DAS in *Rabi* season for three years i.e. 2006-07, 2007-08 and 2008-09.

Data (2003-04 to 2008-09) revealed that the maximum total productivity was obtained under rice–potato–cowpea system (222.86 q/ha) than other systems, but amongst all the systems, rice-brinjal-GM was identified to be distinctly superior and more economically viable in terms of net returns (Rs. 98,525/ha) and benefit: cost ratio (2.40) than rice - potato - cowpea because potato requires huge investment on seed material and intercultural operations which reduced the B:C ratio (1.38). The weeds became a major problem during *Rabi* under irrigated conditions. The predominant weed species observed in the experimental field during *Rabi* season were *Melilotus indica, Chenopodium album, Echinochloa colona, Cynodon dictylon, Eleusine indica, and Anagallis arvensis*. Among all these weeds, *Melilotus indica* had highest population and recorded 60% of total weed population. Mustard and coriander was highly infested by weeds at 60 DAS, respectively. This might be due to slow growth of both the crops during initial stage and wider spacing particularly in mustard. Lower weed density and dry matter of weeds in rice-wheat and rice-vegetables (rice-brinjal-GM, rice-onion-GM and rice-potato-cowpea) cropping sequences was due to smothering effect of wheat and due to repeated intercultural operations in vegetables. However, no definite trend of crop diversification was observed on weed population Smothering effect of intercrops on weed biomass in aerobic rice

P-45 Effect of weed management practices and cultivars on Boro rice (*Oryza sativa* L.) and associated weeds

D. K. Roy
Department of Agronomy, Rajendra Agricultural University, Pusa, Samastipur (Bihar)
e-mail : dr_dhirendra_krroy@yahoo.com

A field experiment was carried out consecutively three years from 2005-06 to 2007-08 at Rice Research sub-station, Biraul, Darbhanga in deep water ecosystem of North Bihar to evaluate the effect of weed management practices and cultivars on growth and yield of boro rice. The results revealed that the variety Gautam recorded the highest grain yield (7.6 q/ha) and the variety Prabhat was proved to be better in suppressing the weeds. Application of butachlor at 1.5 kg/ha as pre-emergence + 2, 4-D at 1.0 kg/ha as Post-emergence recorded the similar grain yield to that of hand weeding twice (25 and 45 DAT).

P-46 Weed management practices in transplanted rice by using glyphosate

C. Ramachandra, G. R. Denesh and M. Syd anwarulla
Zonal Agricultural Research Station, V.C. Farm, Mandya, Bangalore (Karanataka)
e-mail : grdenesh@rediffmail.com

The field experiment was conducted in transplanted rice during 2008-09 to study the pre-plant post emergence use of glyphosate to control weeds in transplanted rice. The treatment details consists of pre-plant post emergence application of glyphosate (41% SL) 0.75 kg/ha at 15 days before crop establishment (DBCE) followed by pre-emergence use of butachlor (50 % EC) 1.5 kg /ha at 5 days after transplanting (DAT) or early post emergence use of butachlor (50 % EC) at 1.5 kg/ha + almix (20 WP) 4 g/ha at 10 DAT and these were compared with alone use herbicides, hand weeding twice, use of conoweeder alone and unweeded control. The experiment was laid out in a Randomized Complete Block Design with three replications. The soil type was red sandy loam with neutral pH (6.12), normal EC (0.108 d S/m), low to medium in organic carbon (0.50%) and available N of 298 kg /ha, P_2O_5 of 28 kg/ ha and K_2O of 212 kg / ha. The major weed flora observed in the experimental fields were *Cyperus difformis, Fimbristylis miliacea* and *Scirpus* sp (from initial stage), *C. procerus* (from 60 DAP onwards, among sedges); *Echinochloa colona* and *Panicum tripheron* (from initial stages, among grasses); *Ludwigia parviflora, Spilanthus acmella, Rotala verticillaris, Lindernia veronicaefolia, Glinus oppositifolia* (from initial stages, among broad leaves weeds). Other weeds noticed in lower density were *Paspalum dilatatum,* P*anicum repens* (grasses), *Lobelia alsinoides, Eclipta alba, Alternanthera sessilis, Cyanotis axillaries* and *Aeschynomene indica.* The Results revealed that, pre-plant post emergence use of glyphosate at 0.75 kg ai/ha at 15 DBCE followed by early post emergence use of butachlor at1.5 kg /ha + almix at 4 g /ha at 10 DAT recorded higher paddy grain yield (5516 kg/ha), which was on par with use of pre-plant post emergence use of glyphosate 0.75 kg/ha at 15 DBCE followed by pre-emergence use of butachlor 1.5 kg/ha at 5 DAT (5230 kg/ha) and significantly superior over rest of the treatments (4056 to 5029 kg /ha).

P-47 Effect of weed management under different methods of rice establishment in the lateritic soil of West Bengal

A. Hossain, B. Duary and D. C. Mondal
DWSR, Visva-Bharati Centre, Sriniketan (West Bengal)
e-mail : bduary@yahoo.co.in

Field experiment was conducted in a sandy loam soil of Agriculture Farm, Visva-Bharati, Sriniketan in the lateritic belt of West Bengal during *kharif* 2008 and 2009 to study the effect of rice establishment techniques and different weed management methods on weed growth and productivity of rice. Four rice establishment techniques *viz.* system of rice intensification (SRI), normal transplanting, broadcasted sprouted seed and drum seeding of sprouted seed were assigned in main plot and four weed management practices *viz.* pyrazosulfuron ethyl at 25 g/ha + mechanical weeding (cono-weeder), cono-weeder, two hand weeding and weedy check in sub-plot replicated thrice in a split-plot design. The seeding was done on the same day for each establishment technique. The experimental results revealed that the pre-dominant weed species in the experimental field were *Fimbristylis miliacea, Ludwigia parviflora, Hydrolea zeylanica* and *Lindernia crustacea.* Among the different weed management practices, pyrazosulfuron ethyl 25 g/ha + cono-weeder was found to be the most effective in controlling all categories of weeds. With respect to yield and yield attributes, SRI system was found to be the most effective technique in achieving the highest number of effective tillers, number of grains and grain yield of rice. Rice establishment in SRI technique with pre-emergence application of pyrazosulfuron ethyl at 25 g/ha integrated with mechanical weeding (cono-weeder) recorded the highest grain yield of rice (4210 kg/ha).

P- 48 Effect of establishment techniques and weed management practices on weed dynamics, yield attributing characters and yield of rice.

R. A. Yadav, Naushad Khan and R. N. Dixit

Dept. of Agronomy, C. S. Azad University of Agriculture and Technology, Kanpur (U.P.)

e-mail : ramashish94@yahoo.in

A field experiment was carried out during *kharif* season of 2008 and 2009 at the Students' Instructional Farm to find out effect of methods of rice establishment technique and weed management practices as on yield attributing characters and yield of rice. The experimental field having neutral pH, normal salt concentration, low organic carbon, medium available phosphorus and potassium. Experiment was conducted in Split Pot Design with three replication. Line sowing and drum seeded rice (sprouted) were sown on 1.8.2009 and 12.7.2009. Transplanting was done on 20-8-2009 and 30.7.2009 and transplanting under SRI System was also done on 10.8.2008 and 22.7.2009 during both the year. Weed dynamics was affected by method of rice establishment. On an average, minimum number of weed flora were observed in system of rice intensification followed by transplanting except *Cyperus rotundus* at 30, 60 day after sowing and at harvest. Among the weed management practices, pyrazosulfuran + mechanical weeding significantly minimized weed populations at 30 and 60 day stage of crop but manual weeding (twice) was effective at harvest. Weed dry weight was also influenced by method of rice establishment. The minimum weed dry weight was observed in system of rice intensification except sedges at all the stages. The weed management practice, *viz* pyrazosulfuran + mechanical weeding gave better response with regard to growth, yield characters and grain yield of rice except hand weeding (twice). Plant growth, yield attributing characters and yield were also influenced by rice establishment techniques. The highest plant height and number of effective shoot/meter length was observed in system of rice intensification and minimum was recorded in drum seeded sprouted rice. The maximum grain yield (26.89q/ha) was also obtained in system of rice intensification followed by transplanted rice (25.57 q/ha). The minimum yield (12.8 q/ha) was observed in drum seeded sprouted rice. The weed management practice, pyrazosulfuran + mechanical weeding gave higher yield (25.47 q/ha) followed by hand weeding (twice) (23.47 q/ha). In seed rain/m^2 concern, the weed population of *Dactyaocteniun aegyptium* and *Phyllanthus niruri* was influenced by method of rice establishment and weed management practices. The minimum number of seed rain/m^2 was recorded in system of rice intensification followed by transplanting. The maximum number of seed rain/m^2 was counted in drum sprouted seeded rice. The seed rain/m^2 was also influenced by the weed management practices. The minimum number of seed rain/m^2 was observed with application of pyrazosulfuran + mechanical weeding incomparison to all other weed management practices except hand weeding twice.

P- 49 Studies on weed seed bank in long term experiment on rice-yellow sarson cropping system in the lateritic soil of West Bengal

D. C. Mondal, B. Duary and A. Hossain

DWSR, Visva-Bharati Centre, Sriniketan, (West Bengal)

e-mail : bduary@yahoo.co.in

An investigation was carried out during 2007-08 and 2008-09 in the Institute of Agriculture Farm, Visva-Bharati, Sriniketan to find out the effect of butachlor (repeated) or butachlor / pretilachlor (rotational) applied in rice as well as pendimethalin (repeated) or pendimethalin / isoproturon (rotational) applied in yellow sarson combined with fertilizer or OM / FYM on the weed seed bank in succeeding crops through the studies of seedling emergence in long term experiment on rice-yellow sarson cropping system. The soil of the experimental field was sandy loam with low organic carbon and N having soil pH of 6.4. Results revealed that repeated use of butachlor with fertilizer in rice resulted in the lowest number of total weed emergence in *kharif* season indicating its more effectiveness in depleting soil weed seed bank. Butachlor applied either repeatedly or in rotation with pretilachlor was found to be more effective in reducing number of weed seeds when combined with fertilizer than that of FYM. Repeated use of pendimethalin along with fertilizer resulted in the lowest number of total weeds in *rabi* season. Thus, repeated use of butachlor along with fertilizer in transplanted rice followed by pendimethalin (repeated) with fertilizer in yellow sarson was found to be the most effective in reducing the number of weed seed in soil under rice - yellow sarson cropping system in the lateritic soil of West Bengal.

P- 50 Studies on comparative efficiency of organic, inorganic and integrated nutrient management on crop productivity and weed dynamics of various rice-based cropping systems in Madhya Pradesh

Rajiv Dubey, R. S. Sharma, S. K. Vishwakarma
Department of Agronomy, GBPUAT, Pantnagar, U.S. Nagar (Uttarakhand)
e-mail:rajivdubey.1503@rediffmail.com

In view of the escalating cost of fertilizers, environmental pollution and ecological disturbance due to indiscriminate use of fertilizers, there is a need to develop organic nutrient management in rice-based cropping systems. In Madhya Pradesh, rice-based cropping systems particularly rice-wheat system is predominant. Keeping in view the above, a study was conducted to compare the total productivity of different rice-based cropping systems under organic, inorganic and integrated nutrient management and to find out the effect of various nutrient management and cropping systems on existing weeds-flora.

The experiment was conducted from *kharif* 2004-05 to summer 2007-08 at Krishi Nagar Research farm, J.N.K.V.V., Jabalpur (M.P.). The experiment was laid out in unreplicated strip plot design. The statistical analysis of the data for the year 2007-08 was not possible because of unreplicated treatments, hence variations were judged on the basis of mean values. Total 12 treatments consisted with 3 nutrient management practices (100% organics-M1, 100% inorganics - M2 and INM as 50% organics + 50% inorganics-M3) and 4 crop-sequences (Green-manuring by sunnhemp-rice-wheat,-CS1, rice-potato-okra,-CS2, rice-berseem (fodder and seed)-CS3 and rice-vegetable pea-sorghum (fodder),-CS4.In case of inorganic nutrient management recommended doses of fertilizers andin organic nutrient management organic manures were applied for sowing of each crop. Rice-potato-okra system (CS2) produced significantly maximum REYS (187.16 q/ ha) mainly due to inclusion of high value crops like potato and okra during *rabi* and Summer seasons. These results are in close conformity with the findings of other researchers from different Agro-climatic conditions. The productivity of all cropping systems was maximum (127.44 q/ ha) with 100% inorganic nutrient management closely followed by integrated nutrient management (122.44q/ ha). The 100% organic nutrient management although produced minimum system productivity (110.62q/ ha) under all cropping systems in terms of rice equivalent yield and it showed improving trend in the productivity with each advancement in the crop-cycle every year. The weed dynamics (weed intensity and weed-biomass) varied remarkably between the various cropping systems as well as nutrient management practices. Inclusion of green-manuring before transplanting of rice markedly reduced the weed-intensity and weed-biomass under all cropping system, while 100% organic nutrition as well as integrated nutrient management tended to enhance the weed-intensity and weed-biomass.

P-51 Methods of rice establishment techniques under various weed management practices on the performance of drilled rice

V. B. Nevase, S. P. Gosavi, and A. V. Dahiphale
Department of Agronomy, Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli (Maharastra)
e-mail : niwsp.dapoli@gmail.com

A field experiment was conducted during *kharif* 2008 and 2009 at Agronomy farm, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli to find out the effective and economic weed control practices for rice crop. The experiment was conducted in split plot design with three replication. The main plot treatments comprising of four different rice establishment techniques *viz*. normal transplanting, systems of rice intensification (SRI), broadcasting sprouted rice and direct seeded sprouted dibbled rice and the sub plot treatments consisting of four weed management practices like pyzazosulfuron @ 20 g ha^{-1}, conoweeder one way hoeing between lines 20 cm apart, two hand weeding at 20 and 40 DAS and weedy check. Result revealed that the growth of grasses and sedges was significantly more than BLWs. The method of normal transplanting exhibited least weed growth over all other methods, but it was statistically identical to SRI method during both the years of experimentation. Under the various weed management practices, the treatment hand weeding twice (20 and 40 DAS) exhibited 95% and 89% weed control efficiency during the year 2008 and 2009 followed by use of pyrazosulfuron (85%) 2008 and conoweeder (70%) 2009 respectively. As a result normally transplanted rice crop in combination with two hand weeding significantly recorded highest grain yield (40.20 and 55.73 q/ha) followed by conoweeder (40.30 and 54 q/ha), respectively.

P-52

Weed management in direct-seeded rice for enhancing water productivity under rainfed environment

A. L. Rathore, A. P. Singh, M. L. Sharma and S. S. Shaw
Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.)
e-mail : apalsingh@yahoo.com

Weeds are the major problem in direct seeded rice. Farmers do weed management by biasi operation in direct seeded rice. Uneven and unpredicted onset and termination of monsoon causes delayed biasi operation at one end and terminal drought on the other hand. This indirectly increases the problems of labour and water. With introduction of post-emergence herbicide, weeding control may be easier and cost effective. Therefore, field investigations were conducted for three years (2004-05 to 2006-07) on farmers field at Kotanpali village, block Bagbahra district Mahasamund under IRRI-IGKV collaborative CURE project. Treatments included combinations of three methods of rice establishment as main plots (dry seeding, wet seeding and broadcast biasi), three weed management as sub plots (pre-emergence herbicide, post-emergence herbicide and inter culture / biasi operation) and two fertilizer doses as sub-sub plots (recommended and farmers fertilizer dose i.e. respectively 80:50:30 and 50:30:00 kg N: P_2O_5: K_2O/ha). The treatments were replicated four times following split-split-plot design. Pre emergence herbicide includes application of pendimethalin 1.0 liter/ha on moist soil 2-4 days after sowing or receipt of rainfall followed by one hand weeding (1HW) at 40-45 days after emergence (DAE). In post emergence herbicide treatment, tank mixed combination of fenoxaprop-p-ethyl 60 g/ha and chlorimuron + metsulfuron 4 g/ha was applied at 18-21 DAE followed by 1HWat 40-45 DAE. Ploughing between the rows of rice crop at 20-25 DAE for weeding purposes is termed a inter culture operation. After inter culture operation, weeds were removed manually. Ploughing of 30-40 days old crop in 5-10 cm water standing with a non-turning, animal drawn plough followed by gap filling is termed as biasi operation or biasi. Both after inter culture and biasi; one HW weeding was done at 40-45 DAE.

Combined application of tank mixed fenoxaprop-p-ethyl 60 g/ha and chlorimuron + metsulfuron 4 g/ha + 1 HW, controlled weeds effectively in direct seeded rice. In addition to effective control of weeds, it enhanced 26% seed yield of rice compared to inter-culture/ biasi operation. Labour requirement in BCR was significantly more than DSR and WSR. Of the total labour requirement in rice, 43% labour was required in BCR for controlling weeds. Labour requirement was substantially reduced (21%) with application of post-emergence herbicide for weed control compared to interculture/ biasi operation. Post emergence herbicide, substantially (2.5 times) reduced the labour requirement in the BCR for weed control. Weed management by post emergence herbicide significantly reduced cost of cultivation in rice.

Seed yield of rice was significantly highest in dry seeded rice followed by wet seeded and broadcast biasi rice in three years. By adopting DSR, improvement in rice productivity was 48% with range from 34-60% over BCR in the three years. The DSR harvested 15-20 days earlier to BCR and WSR therefore retained better soil moisture regime after rice harvest during normal rainfall years. Chickpea was established after dry seeded rice in residual soil moisture during 2004 and 2005 as sufficient soil moisture was available after rice due to rains in last fortnight of September. Chickpea yield was quite attractive during both the years. Significantly highest net profit was obtained in dry seeded rice and DSR based rice-chickpea cropping system. The dry seeded rice also improved cropping intensity of rainfed rice area by 200% and employment opportunities for about 8 months in place of employment fro 4 months in rice alone. Up-scaling of the technology are being done on large scale giving the promising results for adoption by the farmers of the region.

P- 53 Performance of different weed control measures in rain fed direct seeded upland rice

T. D. Pandey, K. L. Nandeha and R. B. Tiwari
I.G.K.V., TCB College of Agriculture & Research Station, Bilaspur (C.G.)
e-mail : tdp1963@rediffmail.com

Weed competition is one of the major constraints that limit the productivity of rain fed upland rice. Though, hand weeding is the general practice adopted by the farmers, but it is becoming more & more cost prohibitive and causing drudgery. Since weed problem in upland situation is very complex because of aerobic soil condition, high temperature, dry tillage practice and phasic emergence of weeds, in such condition an any single method of weed control may not be fully effective. An efficient weed management, restricting weed growth particularly within the critical crop growth period of 25 days old, could induce essential growth dynamics with subsequent yield advantage . Amongst several weed management techniques which are being practiced in rice cultivation, use of herbicide is believed to be the most economic proposition as compared to manual weeding. However, manual weeding appears to be the most effective to keep the crop nearly weed free situation for a considerable period of time. Hence, there was a need to test the different weed management techniques, for efficient control of weeds as well as to reduce the total cost involved in weeding operations under rain fed upland rice production system.

The experiment was conducted in randomized block design with three replications. The treatment consisted of T_1-anilophos 30 EC at 0.60 kg/ha, T_2- anilophos 30 EC at 0.40 kg/ha, T_3- butachlor 50 EC at 1.5 kg/ha, T_4- butachlor 50 EC at 1.0 kg/ha, followed by 2,4-D Na salt 80 WP at 0.60 kg/ha, T_5- pendimethalin 30 EC at 1.50 kg/ha, T_5- pendimethalin 30 EC at 1.0 kg/ha, followed by 2,4-D Na salt 80 WP at 0.60 kg/ha, T_7 - hand weeding once at 35 DAS, T_8- hand weeding twice at 35 and 55 DAS, T_9- non weeded check.

The results revealed that, the maximum grain yield (3.3 t/ha) was obtained from treatment butachlor 50 EC at 1.5 kg/ha which was closely followed by two hand weedings at 35 & 55 DAS (3.11 t/ha), butachlor 50 EC at 1.0 kg/ha), followed by 2,4-D Na 80 WP at 0.60 kg/ha. However, other treatments were at par with each other except weedy check. Higher grain yields in these treatments might be due to better control of weeds as observed from lower weed density and better yield contributing characters, like higher number of panicles m^{-2}, panicle weight(g), 1000-grain weight (g). As regards weed density, the treatment T_4, T_2 and T_8 were found superior as compared to other treatments. The number of weeds m^{-2} was maximum with weedy check which was responsible for reduction of yield. The yield improvement in weed control treatments was 65%, 67%, 61% and 66% in T_2, T_3, T_4 and T_8, respectively over weedy check. The highest weed control efficiency (WCE) of 67.92 % was observed in two hand weeding treatment, followed by T_4 (66.03%) and T_2 (63.20).

P-54 Effect of rice (*Oryza sativa*) planting method and weed management on rice

D. K. Gupta and Sandeep Sharma
IGAU, RMD Collage of Agriculture and Research Station, Ambikapur (C.G.)
e-mail : sameer_sandy2002@yahoo.com

Weeds are the major biotic constraints. The competition is intense in direct seeded rice which reduces the rice yield from $40^{-1}00$ per cent. However, uncontrolled weeds cause a reduction of 35-55 per cent of grain yield under transplanted conditions. In the present investigation, efforts have been made to test the efficacy of new herbicides along with anilofos against complex weed flora in different methods of rice cultivation.

The treatments comprised of three method of planting *viz*., line sowing (Direct seeding), transplanted and lehi method (broadcasting of sprouted seeds) in main plots and six weed management practices *viz*., weedy check, two hand weeding (30 & 50 DAS), pretilachlor 700 g/ha (per-em), oxadiargyl 80g /ha (per-em) fb

ethoxysulfuron 15 g/ha(post-em), pretilachlor + safener 700 g/ha (per-em) fb ethoxysulfuron 15 g/ha (post-em), anilofos 0.5 kg/ha (pre-em) in sub-plots. Transplanting of 25 days old seedling was done and at the day of nursery sowing direct seeding and lehi was done with variety MTU-1010. Crop was fertilized with 100:50:50 kg NPK/ha. Crop was raised with the adoption of recommended agronomic and plant protection measures.

Two years pooled data revealed that weed population and its dry weight were not influenced by method of rice cultivation; however, these were higher under direct seeding over transplanting and lehi method. All the weed control treatments were found to be significantly superior over weedy check in reducing the density and dry matter accumulation during both the year. The minimum weeds, its weight and higher WEC were recorded with oxadiargyl 80g/ha (pre-em) + ethoxysulfuron 15g/ha (post-em) followed by pretilachlor + safener 700g/ha (pre-em) + ethoxysulfuron 15g/ha (post-em). These herbicidal treatments were as good as two hand weeding done at 30 and 50 DAS. The results also indicated that treatment oxadiargyl 80g/ha (pre-em) + ethoxysulfuron 15g/ha (post-em) recorded significantly higher panicle/m^2, length of panicle and 100- seed weight over weedy check, which was statistically at par with pretilachlor + safener 700g/ha (pre-em) fb ethoxysulfuron 15g/ha (post-em) and two hand weeding (30 & 50 DAS). This may be attributed to significantly lower weed density and dry matter accumulation of weeds. Transplanting of rice gave significantly higher grain yield (60 q/ha) i.e. 8.5 % higher over direct seeded line sowing (55 q/ha). The differences between direct line sowing and lehi method of rice cultivation (53 q/ha) was non- significant. It may be conduced that transplanting method of rice cultivation was superior over direct line sowing and lehi method under irrigated conditions. Amongst the various weed management treatments, new herbicides at lower doses like oxadiargyl 80 g/ha (pre-em) fb ethoxysulfuron 15 g/ha (post-em) and pretilachlor + safener 700 g/ha (pre-em) fb ethoxysulfuron 15 g/ha (post-em) should be cost effective and sustainable for managing weeds in rice fields.

P-55 Effect of sowing times and weed control measures on weed density and growth in dibbled rice (*Oryza sativa*) under Konkan conditions

K. P. Anande, V. B. Nevase, A.V. Dahiphale and S. P. Gosavi
Department of Agronomy, Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli (Maharastra)
e-mail : niwsp.dapoli@gmail.com

A trial was conducted to study the effect of sowing times and weed control measures on the performance of dibbled rice during *kharif*, 2008-09 at Agronomy Farm. The main plot treatment comprising of three different sowing times *viz*. before onset of monsoon, one week after onset of monsoon and two weeks after onset of monsoon. The sub plot treatment consists of weed control measures i.e. pretilachlor 0.5 kg/ha, butachlor 1.5 kg/ha + one hand weeding fenoxaprop-p-ethyl 60 g/ha, *S. rostrata* intercropping with rice + 2 , 4-D 0.5 kg/ha, weedy check and weed free check. The soil of the experimental field was sandy clay loam in texture and slightly acidic in reaction, medium in available nitrogen and phosphorus and moderately high in available potassium.

Results revealed that the sowing of rice under dibbled conditions before onset of monsoon produced significantly lower weed density and growth compared to the remaining sowing times. As regards, different weed control measures application of butachlor 1.5 kg/ha + one hand weeding recorded lower weed density which shows the supremacy over rest of treatments except spraying of pretilachlor 0.5 kg/ha but weed free check was significantly superior over all other treatments followed by the intercropping of S. rostrata + 2,4-D 0.5 kg/ha. Similar trend was observed in the weed growth. As a result sowing before onset and monsoon produced significantly highest grain yield (46.56 q/ha) which was significantly superior over all other treatments. Weed free check recorded, maximum grain yield that is/ 42.40 q/ha and which was significantly superior over rest of the treatments. s

P- 56 Early post-emergence application of azimsulfuron on weed control and productivity of irrigated and rainfed direct seeded rice

P. Murali Arthanari, C. Chinnusamy and N. K. Prabhakaran
Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu)
e-mail : agronmurali@gmail.com,

Rice is the main staple food and also an exportable commodity. Traditionally, rice is grown by transplanting with rice seedlings into the puddled and continuous flooded soil condition. Direct seeding rice (DSR) avoids the puddling and maintains continuous moist soil conditions and thus reduces the overall water demand for rice culture. The productivity of the DSR is often reported to be lower, mainly due to problems associated with weed management. Weed infestation continues to be a serious problem in dry seeded rice. Aerobic soil conditions and dry-tillage practices, besides alternate wetting and drying conditions, are conducive for germination and growth of highly competitive weeds, which ultimately causes grain yield losses. In this context, on farm trials have been conducted in different locations of Tamil Nadu during *kharif 2009* in irrigated (3 locations) and rainfed (2 locations) ecosystem to study the effect of post emergence application of azimsulfuron in irrigated and rainfed direct seeded rice.

The trials consist of three treatments *viz.*, hand weeding twice on 25 & 45 DAS (T_1), pre – emergence pretilachlor (S) 0.45 kg/ha on 3 DAS fb azimsulfuron 50 DF 35 g/ha on 20 DAS + hand weeding on 45 DAS (T_2) and pre – emergence butachlor 1.0 kg/ha on 8 DAS + hand weeding on 45 DAS (T_3). Under irrigated conditions, the *Echinocloa colona, was the* grass weeds*, Cyperus iria* was the sedge and *Ammania bacifera,* and *Eclipta alba* were the broad leaved weeds found in the fields. *Ammania bacifera, and Eclipta alba* were noticed in two locations. *Echinocloa colonum* in three locations. Further, Weed dry weight was considerably lower in T_2 in all three locations and it was higher in T_1. In T_1 due to disturbance of soil by hoeing facilitated emergence of more weeds. Post-emergence application of azimsulfuron suppressed the late merged weed effectively. As a result, T_2 recorded higher grain yield (3584 - 5880 kg / ha) and also in lower weeding cost (Rs.2210 /ha). Gross return and net return were higher in T_2 (Rs.45367-Rs.79498/ha and Rs. 21367- 54722/ ha). Return due to weeding was also higher in T_2 (Rs.4003- 28648/ ha). Effective control of late emerged weeds was the reason for higher yield and economic returns in T_2. Whereas, in the rainfed situation, *Panicum repens, was the* grass weed*, Cyperus rotundus* was the sedge and *Acalypha indica,* was the broad leaved weed found in the fields. The above three species were predominant in two locations.

Weed dry weight was considerably lower in T_2 in all two locations and it was higher in T_1. In T_1 due to disturbance of soil by hoeing facilitated emergence of more weeds. Post-emergence application of azimsulfuron suppressed the late emerged weed effectively and recorded higher grain yield (1715 kg / ha) and low weeding cost (Rs.2210 /ha). Gross return and net return were also higher in T_2 (Rs.20748 - Rs.23328/ha and Rs. 10628-13108/ ha). Return due to weeding was also higher in T_2 (Rs.4606- 6473/ ha). Effective control of late emerged weeds was the reason for higher yield and economic returns in T_2. Based on the experiments, it is concluded that Pre emergence Pretilachlor (S) 0.45 kg/ha on 3 DAS fb azimsulfuron 50 DF 35 g/ha on 20 DAS + hand weeding on 45 DAS (T2) for broad spectrum weed control and higher grain yield and economic returns in both irrigated and rainfed direct seeded rice.

P-57 Effect of system of rice intensification (SRI) and manipulated SRI on weed infestation and yield of transplanted hybrid rice

A. K. Verma, N. Pandey and G. K. Shrivastava
Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.)
e-mail : anil_verma@sify.com

Weeds have been recognized as potential pests since inception of agriculture and were controlled through mechanical, physical and chemical method. In SRI, weeds are incorporated into soil by conoweeder. But, adoption of SRI weeding for large area becomes inconvient because of unavailability and lower efficiency of engaged human power and timely management of weeds. Further, herbicide might have option for effective control of weeds in relatively larger area. The present experiment was therefore, undertaken to study the effect of SRI and manipulated SRI on weed infestation and yield of transplanted hybrid rice. Field experiment was conducted during wet seasons of 2007 and 2008 at Research cum instructional farm of Indira Gandhi Krishi Vishwavidyalaya, Raipur on a silty clay loam soil having pH 7.3, EC 0.51 dS/m at 25°C and available N, P and K were 214, 18.8 and 293, respectively. Twelve treatment combinations i.e. 10 days seedlings + 100% manure + mechanical weed management + application of 2 cm water at hairline crack development stage (SRI) ($A_{10}M_{100}$WmIs); 10 days seedlings + 100% manure + chemical weed management + water management as per SRI ($A_{10}M_{100}$WcIs); 10 days seedlings + 100% manure + mechanical weed management + cyclic submergence of 5 cm water at 3 days after disappearance (DAD) of ponded water ($A_{10}M_{100}$WmI3D); 14 days seedlings + 100% manure + mechanical weed management + water management as per SRI ($A_{10}M_{100}$WmIs); 14 days seedlings + 100% manure + mechanical weed management + cyclic submergence of 5 cm water at 3 DAD of ponded water ($A_{14}M_{100}$WmI3D); 10 days seedlings + 100% fertilizer + mechanical weed management + water management as per SRI ($A_{10}M_{100}$WmIs); 10 days seedlings + 100% fertilizer + Chemical weed management + water management as per SRI ($A_{10}M_{100}$WcIs); 14 days seedlings + 100% fertilizer + mechanical weed management + water management as per SRI ($A_{10}M_{100}$WmIs); 10 days seedlings + 50% manure + 50% fertilizer + Mechanical weed management + water management as per SRI ($A_{10}M_{50}F_{50}$WmIs); 10 days seedlings + 50% manure + 50% fertilizer + chemical weed management + water management as per SRI ($A_{10}M_{50}F_{50}$WcIs); 14 days seedlings + 50% manure + 50% fertilizer + mechanical weed management + water management as per SRI ($A_{14}M_{50}F_{50}$WmIs); recommended practices of hybrid rice (RPH) were laid out in a randomized block design with three replications.

Eleven different weed species belonging to five families were found to infest the experimental crop. The most important weed species throughout the growing season were *Echinochloa colonum, Digitaria sanguinalis, cyperus iria and Ludwigia octovalvis* having higher degree of infestation. Chemical weeding through herbicide ($A_{10}M_{100}$WcIs or $A_{10}F_{100}$WcIs or $A_{10}M_{50}F_{50}$WcIs) was equally effective to that of mechanical weeding through conoweeder as per SRI ($A_{10}M_{100}$WmIs or $A_{10}F_{100}$WmIs or $A_{10}M_{50}F_{50}$WmIs) for weed density and biomassat 14 and 34 DAT. However, at 54 DAT and at harvest, weed density and biomass was significantly reduced under mechanical weeding as compared to chemical method of weed management. Therefore, grain yield was significantly higher under mechanical method of weed management ($A_{10}M_{100}$WmIs, $A_{10}F_{100}$WmIs or $A_{10}M_{50}F_{50}$WmIs) than that of chemical method of weed management ($A_{10}M_{100}$WcIs, $A_{10}F_{100}$WcIs or $A_{10}M_{50}F_{50}$WcIs).

P- 58 Weed seed bank studies in direct-seeded rice based cropping systems

A. P. Singh, Tapas Choudhary, Vivek Tripathi, S. Dwivedi and R. Lakpale
Department of Agronomy, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.)
e-mail : apalsingh@yahoo.com

Weed dynamics changes with nature of crops grown in any cropping system. The floristic composition of weeds and its density under rice-chickpea system will differ entirely with that of rice-mustard system. Also, the vertical entry of seeds of weed species depends heavily on methods of weed management and tillage operations. Therefore, management of weeds in different rice-based cropping system will differ from one system to the other. Weed seed bank study enables to have estimates of probable competition of weeds in the area in next growing season. Such study is also helpful in monitoring the effectiveness of treatments applied for weed management which ultimately helps in developing weed management system for specific cropping system of the region.

Rice variety MTU-1010 was the test crop sown directly in lines at a spacing of 20 cms. apart during *kharif* followed by *rabi* season crops like wheat, mustard, potato, linseed, berseem, chickpea and field pea. Recommended dose of fertilizer was applied to all crops. Soil samples from three depths i.e. 0-5, 5-10 and 10-15 cms were collected treatment wise from three random spots in each treatment after the harvest of *rabi* season crops in 2008-09. The soil samples were put in small pots followed by regular watering to facilitate early emergence of weeds. Species wise weed emergence was recorded at 15, 30 and 45 days after sowing.

Medicago denticulta, Cyperus iria, Alternanthera triandra, Cynotis axillaris were the main weeds emerged from the soil layer of different depths. Other weeds include *Rumex dentatus, Melitotus indica, Chenopodium album, Euphorbia geniculta, Physalis minima* etc. in small numbers. At 0-5 cm layer, overall emergence of *Medicago denticulta* was highest, followed by *Cyperus iria*. The maximum number of weeds emerged under rice-fieldpea system followed by rice-linseed. The majority of weeds emerged within 30 days after sowing. Though, germination continued up to 45 days but was very small in number. At 5-10 and 10-15 cm layers, again the overall emergence of *Medicago denticulta* was highest, followed by *Cyperus iria*. At 5-10 cm depth, the maximum number of weeds emerged under rice-berseem system followed by rice-field pea. While, at 10-15 cms depth, the maximum number of weeds was recorded under rice-berseem followed by rice-potato system. The majority of weeds emerged within 30 days after sowing. Though, germination continued up to 45 days at this depth also but was very small in number.

P-59 Establishment techniques and weed management practices in puddled low land rice

M. Revathi, N. K. Prabhakaran and C. Chinnusamy
Department of Agronomy, T.N.A.U., Coimbatore (Tamil Nadu)
e-mail : revathi.agronomy@hotmail.com

Rice is a predominant crop of India contributing 43 per cent to the total food grain production. Productivity of rice is low because of several constraints such as method of establishment, late transplanting, poor nutrient management and poor weed control. Weed management is one of the major factors at farmers' fields which is affecting yield.

Several herbicides including butachlor proved most successful against weeds of transplanted rice. Farmers are not using suitable herbicides in right amount that is causing high weed density and also they use same herbicides and method of weed control which allow weed shift and results in low yield. Most of the rice herbicides are used to control grassy weeds effectively. Sedges and broad leaved weeds are also the major weed groups and reduce the yield of rice. The traditional methods of weeding operation are time consuming

and labour intensive. It is not taken up at appropriate time due to non-availability of labour at critical stages of crop growth. Hence, now-a-days, integrated weed management practices and also mechanical weeding are increasing. Therefore, the present investigation was carried out to study the effect of establishment techniques, weed management practices and their interactions on weed control efficiency, growth, productivity and profit of puddled lowland rice. Experiments were conducted at Tamil Nadu Agricultural University, Coimbatore during *kharif* 2008 and *rabi* 2008-09. The experiment was laid out in strip plot design with three replications. The four crop establishment techniques (system of rice intensification, transplanting, direct planting system and drum seeding) and four weed management practices (pre-emergence pyrazosulfuron ethyl 30 g/ha^{-1} at 3 DAT/8 DAS + weeding with finger type double row rotary weeder at 40 DAT/S, weeding with conoweeder twice at 20 and 40 DAT/S, two hand weeding at 20 and 40 DAT/S and un-weeded control) were allotted to main and sub plots respectively. Among three groups of weeds, grass weed density was dominant in both the seasons. However, it was higher in *kharif* than that in *rabi* season. *Echinochloa crus-galli* was the dominant grass weeds in crop establishment techniques and weed management practices in both the seasons. Among the crop establishment techniques, distinct reduction of total weed density and total weed dry weight were observed in direct planting system whereas weed control efficiency, yield and economic returns were higher in system of rice intensification in both the seasons. Among weed management practices, pre-emergence application of pyrazosulfuron ethyl 30 g/ha at 3 DAT/8 DAS + weeding with finger type double row rotary weeder at 40 DAT/S registered lower total weed density and total weed dry weight and higher weed control efficiency. However, yield and economic returns were higher in weeding with conoweeder twice at 20 and 40 DAT/S.

P- 60 Studies on threshold values of *Cyperus iria* in direct seeded rice under calciorthent soils of north Bihar

[1]N. K. Sinha, D. Singh and D. K. Roy

Rajendra Agricultural University, Pusa, Samastipur (Bihar)

Correspongind author : Central Arid Zone Research Institute, RRS, Jaisalmer (Rajasthan)

e - mail: nksinha.cazri@gmail.com

Cyperus iria is a major weed in rice, which pose a serious threat to successful rice cultivation in north Bihar. Weed density is the major factor in determining the out come of the competition between weeds and crops.Types of crop play an important role in crop-weed completion because of the similarity in morphological feature , canopy structure and relative growth rate which are more resembles with *Cyperus iria* in rice at early stages of growth . Till to date no any systematic study has been made so far to find out competitiveness of this weed in calciorthent soils of north Bihar and the extent of reduction caused by it in growth and yield of rice. Keeping these points in view, the present investigation was undertaken with a view to find out the relationship between variable densities of *Cyperus iria* and grain yield of rice is obtained vis-à-vis control measures are must to be adopted. A field experiment was conducted during *kharif* 2004 and 2005. To study the effect of different levels of infestation of *Cyperus iria* on performance of rice, seeds of *Cyperus iria* collected during previous year were evenly spread over the plots just before rice sowing with the soil in both the years. Rice var .Rajshri was sown in micro plots of 2 m x 2 m with four replications in Randomized Block Design. Different weed densities of *Cyperus iria* was maintained in rice plots by thinning out of the extra seedlings and retaining 0, 15, 30,45,60,75,90 and 105 plants/m^2 in both the years. Other weeds and *Cyperus iria* which emerged later were removed. The dry weight of *Cyperus iria* from each treatment was determined The data on weed biomass, crop biomass was taken at 60 days after sowing (DAS) and grain yield of rice were recorded year wise.

Plant height of rice showed decreasing trend with the successive increase in the intensity of *Cyperus iria*. The dry weight of *Cyperus iria* increased with the increase in its density. consequently the rice grain yield decreased due to competitive effect of *Cyperus iria* with the crop. Yield reduction based on the pooled data was worked out to be 6.12 to 69.06 percent over Control with increase in the weed density from 15 to 105 /m2. This might be due to the same morphological appearance and canopy structure of *Cyperus iria* in rice

which restrict in trapping of solar radiation causing low formation of photosynthates finally reduces the rice yield. Further, data pertaining to rice yield under lesser intensity of *Cyperus iria* giving lesser weed interference duration resulting significant effect on grain yield and it also appears to be quite logical that the crop made more utilization of the environmental resources attributed to efficient source sink relationship resulting from higher assimilation and augmented photosynthetic system. The hindrance in yield due to same morphological appearance and canopy structure is supporting the findings obtained in wheat crop by Mahajan et al., (2004) and Gogoi et al., (1991), respectively. Such types of results were also obtained by Walia et al., (2001) and Singh et al.,(2006) in wild oat and rye grass, respectively. It may be concluded from the study that *Cyperus iria* of 15 plants can be considered the threshold levels of competition for rice, as it causes the minimum loss of 6.12 percent in grain yield. Above this density levels control measure must to be under taken to protect the crop from losses due to crop weed competition.

P- 61 Influence of date of sowing, crop geometry and weed control methods on weed control and productivity in direct seeded rice

N. N. Angiras, Suresh Kumar and S. S. Rana

Deptt. of Agronomy, Forages and Grassland Management, CSK HPKV, Palampur (H.P.)

e-mail : angirasn@yahoo.co.in

In rainfed areas of Himachal Pradesh, the time of sowing is primarily controlled by the onset of monsoons. When delayed and with a few exceptions, most of the varieties suffer to a large extent. Similarly, row orientation has a considerable influence on tillering capacity and yield of the crop which directly correlated with net assimilation rate. The rice herbicides presently used are mainly pre-emergence and weeds coming at later stages of crop growth are not controlled as effectively as at emerging stage. Hence, the present investigation was carried out to study the effect of date of sowing, row orientation and weed control methods (pre and post emergence herbicides) alone and in integration, in controlling weeds in direct seeded upland rice.

A field experiment was conducted during the *kharif* season of 2004, 2005 and 2006. Eighteen treatment combinations of 2 dates of sowing (Early and late) and 3 row orientation (East west direction, bidirectional and broadcast sowing) in main plot and 3 weed control methods (farmer's practice, Butachlor 1.50 kg/ha (pre) fb. halod and cyhalofop butyl 90 g/ha fb. 2, 4 –D kg/ha) in subplots were tested in split plot design with three replications. Rice variety HPR 957 was sown on June 10, 22 and 7 (D_1) and June 25, July 8 and June 24 (D_2) during 2004, 2005 and 2006 using 100 kg seed/ha. Application of herbicide was made with power sprayer using 700 L water per hectare. Except weed control treatments, the crop was raised in accordance with the recommended package of practices the crop was fertilized with90 kg N, 40 kg P_2O_5 and 40 kg K_2O/ha as based dose. Weed count and dry weight were recorded at 60 and 90 DAS from two randomly selected spots (0.25 m^2) in each plot and expressed as number/m^2 and g/m, respectively. The data on count and dry weight of weeds were subjected to (square root transformation) for statistical analysis. Yields were harvested from net plot. Economics of the treatments was computed based on the prevalent market price or those fixed by University. plot and expressed as number/m^2 and g/m^2, respectively.

The predominant weed flora which infested the experimental plots during the experimentation consisted of *Echinochloa colona, Cyperus sp., Digitaria sanguinalis, Panicum dichotomiflorum, Ageratum conyzoides, Cynotis sp.* and *broadleaved weeds*. Rice grain yield owing to timely and late seeding was comparable during 2004 and 2006 indicating that farmers can go for late seeding without any loss. On an average rice grain yield under normal sowing time was 38.0% higher than under late seeding time. The total weed count and dry weight were also not significantly affected due to row orientation treatments. Cyhalofop-butyl fb. 2,4-D resulted in significantly lower count and dry weight of weeds over farmer's practice during 2005 and 2006. Owing to superior weed control, cyhalofop butyl fb. 2,4-D resulted in significantly higher rice grain yield over farmer's practice during all the three years. However, it did not significantly increase rice grain yield over butachlor fb. *halod* during 2005 and 2006. Butachlor fb. *halod* also brought about significant increase in rice grain yield over farmer's practice during 2005 and 2006. Cyhalofop butyl fb. 2,4-D and butachlor fb. 2,4-D on an average incressed rice grain yield to the tune of 15.9 and 8.6 per cent, respectively over the farmer's practice of *halod* fb. one hand weeding.

P- 62 Evaluation of appropriate water, weed and nutrient management practices for getting higher yield attributes and yield of scented rice under the concept of SRI

Rajendra Prasad Sahu and S. K. Sarawgi
Dept. of Agronomy, IGKV, Raipur (C.G.)
e-mail : rpsagrotech@gmail.com

Rice (*Oryza sativa* L.) is the major staple food grain crop of India. Productivity of rice in India is 2.20 t/ha which is quite low as compared to other rice growing countries like Japan (6.8 t/ha), Korea (6.1 t/ha), China (5.9 t/ha) and Indonesia (4.3 t/ha). Among various factors, methods of cultivation play a dominant role in reducing the productivity. SRI is another emerging water saving technology, with many fold increase in crop yield. System of rice intensification (SRI) was first developed in Madagascar in 1980's. At present, above 1 lakh farmers worldwide adopted and use this method. This methodology is gaining momentum all over the world, although it is in a budding stage in India. By adopting this system of cultivation we could save water, protect soil productivity, save environment by checking methane gas and bring down the input cost, besides increasing the production for providing food to the growing population.

The present investigation was carried out at the Instructional farm, IGKV during *kharif* - *rabi*-2007-08 and 2008-09. In *kharif* season the experiment was laid out in RBD with three replication and 14 treatments consist of *viz*. 1- Standard SRI; 2- SRI + 12-15 DOS; 3- SRI + 15-18 DOS; 4- SRI + 2 SPH + 20X20; 5- SRI + 20X20; 6- SRI + 1 CW + 1HW; 7- SRI + whipsuper + almix; 8- SRI + saturation for Life Cycle; 9- SRI + saturation upto tillering + 5±2 upto PI then saturate up to PM; 10- SRI + 10 t FYM + 75% NPK + PSB + BGA; 11- SRI + 5 t FYM + 100% NPK + PSB + BGA; 12- Standard transplanting; 13- Transplanting + 12-15 DOS, 2-3 SPH, 20 X 20 cm and whipsuper + almix and 14- Transplanting + 15-18 DOS, 2-3 SPH, 20 X 20 cm, 2,4-D, FYM 5 t/ha.

Highest number of effective tillers/plant (11.9) was recorded under SRI + saturation for Life Cycle during first year. However, during second year highest number of effective tillers/plant (15.5) was recorded under SRI + 10 t FYM + 75% NPK + PSB + BGA, whereas standard transplanting recorded lowest number of effective tillers. Under SRI management strategies, standard SRI recorded significantly highest panicle length, panicle weight and number of filled grains/panicle and it also recorded significantly lowest sterility percentage and number of unfilled grains/panicle during both the years. Under SRI management strategies, significantly higher test weight was recorded under SRI + whipsuper + almix. Highest grain yield of paddy (34.57 q/ha) was observed under standard SRI during first year where as, under SRI + 5 t FYM + 100% NPK + PSB + BGA during second year. Highest straw yield of paddy (80.13 q/ha) was observed under SRI + whipsuper + almix. Under SRI based input management strategies highest harvest index of paddy (42.4%) was observed under SRI + 5 t FYM + 100% NPK + PSB + BGA.

These results also supported by the findings of Krishna and Biradarpatil (2009) who found that 12 days seedlings produced more number of tillers and productive tillers per plant at harvest. The younger seedlings (8 days-old) flowered early and 12 days seedlings recorded higher seed yield per ha (3.25 t). The treatment combination of 12 days old seedling with wider spacing recorded maximum seed yield per ha. Ameta *et al.* (2009) reported that 10 days old seedlings in SRI significantly increased the number of tillers per hill (45.47) and rise to 22.89% higher number of grains per panicle which ultimately significantly increased the rice yield by 15.20% over traditional planting and rise to significantly yield of 4761 kg/ha against 4076 kg/ha under traditional planting.

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Efficacy of bispyribac-sodium, azimsulfuron and penoxsulam for post-emergence weed control in transplanted rice

Dharam Bir Yadav[1], S. S. Punia[2] and Ashok Yadav[2]
[1]CCS HAU Regional Research Station, Karnal (Haryana)
[2]CCS Haryana Agricultural University, Hisar (Haryana)
e-mail : jagir@hau.ernet.in

Pre-emergence herbicides are being used for management of weeds in transplanted rice but they have very narrow application window and continuous stagnation of water is needed for their efficacy. Hence, the need for effective post-emergence herbicides is often realized to combat weeds in transplanted rice and help in saving of precious water resources. Bispyribac-sodium, penoxsulam and azimsulfuron were evaluated against mixed weed flora in transplanted rice (cultivar HKR 47) in different experiments conducted at Karnal during *kharif* 2005 to 2009. Post-emergence herbicides were applied by spray with flat-fan nozzle using 300 l/ha water, and pre-emergence herbicides as sand-mix or splash application. Experiments were laid out in randomized block design with three replicates.

Major associated weeds were *Echinochloa crus-galli* (L.) *P. Beauv.* and *E. colona* (L.) Link among grasses, *Ammannia baccifera* L. and *Euphorbia sp* among broadleaf weeds and *Fimbristylis miliacea* (L.) Vahl, *Cyperus iria* L., *Cyperus rotundus* L. and *Cyperus difformis* L. among sedges. Bispyribac-sodium applied at 15 or 25 days after transplanting (DAT) was found equally effective against grassy weeds, but control of broadleaf weeds and sedges was more when applied at 15 DAT. Bispyribac 25 g/ha at 15 or 25 DAT was adjudged the most suitable herbicidal treatment resulting in 174-199% and 37-41% increase in the rice yields over weedy check during 2006 and 2007, respectively. Bispyribac provided excellent control of grassy weeds, but was slightly weak against some of broadleaf weeds and sedges. Penoxsulam 25 g/ha as pre-emergence (3 DAT) and 22.5 g/ha as post-emergence (10-12 DAT) application provided satisfactory control of all type of weeds consequently resulting in grain yield of transplanted rice similar to weed free checks during 2005 and 2006. Penoxsulam was particularly better against broadleaf weeds and sedges than butachlor and pretilachlor.

Control of grassy and broadleaved weeds increased with increase in dose of azimsulfuron up to 30 g/ha during 2006 and 2007. Azimsulfuron provided excellent control of sedges even at 10 g/ha, and all the treatments (10-30 g/ha at 15 or 25 DAT) were better than pretilachlor and were as good as weed free check. Yields under azimsulfuron 30 g/ha at 15 DAT were at par with pretilachlor but inferior to weed free check during 2006 and 2007; however the results were not consistent in other experiments.

In another experiment during 2008 and 2009, the control of grassy weeds further increased with increase in its dose up to 50 g/ha, and azimsulfuron 40 g/ha at 15 DAT provided yields at par with weed free check during 2009. Control of weeds with azimsulfuron was better when applied at 15 DAT than 25 DAT. Azimsulfuron was slightly weak against Echinochloa sp., but could be good against it at quite high doses. However, azimsulfuron may be good candidate for situations of sedges dominance, and its tank-mix application even at 10 g/ha with bispyribac 25 g/ha was a good combination as evaluated in direct seeded rice during 2008 and 2009. There was no phyto-toxicity of bispyribac, penoxsulam and azimsulfuron up to 60, 50 and 80 g/ha, respectively, on rice and no residual toxicity on succeeding wheat crop; hence could be safely used in rice-wheat system.

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Floristic composition of weeds and weed seed bank affected by different crop establishment methods of rice of Kymore Plateau and Satpura hill zone of Madhya Pradesh

Amit Jha, M. L. Kewat, K. K. Agrwal and R. S. Sharma
Department of Agronomy,JNKVV, Jabalpur (M.P.)
e-mail : amitagcrewa@rediffmail.com

Weeds have a greater genetic diversity than rice crop. Consequently, if a resource (light, water, nutrients or carbon dioxide) changes within the environment, it is more likely that weeds will show a greater growth and reproductive response. In central part (Madhya Pradesh and Chattishgarh) of India rice grown in variable climatic condition. In Jabalpur rice is grown in various ecosystems. Therefore, Field experiments were conducted during *kharif* 2004 to 2009 in rice at Research Farm, JNKVV, and Jabalpur (M.P.) for the study of weed dynamics including floristic composition of weeds and weed intensity. seven tillage and sowing methods for each crop components (direct seeding in dry fields, direct seeding of rice by zero till seed drill, direct seeding of sprouted seeds in puddled field by drum seeder, direct seeding of sprouted seeds in wet field by drum seeder, manual transplanting, SRI and mechanical transplanting) in rice cv.Kranti; The normal rainfall of Jabalpur during *kharif* months 167.2, 375.5, 441.3, 217.0 and 30 mm, respectively. Based on the data species wise weed composition varied due to different crop establishment methods in rice. 30 weed species had shown their presence in rice with some minor weeds during June to Novmber months. The weeds infesting to rice in during the month of June and July were *Echinochloa colona + E. crusgalli, Cyperus iria , Scripus latiflorus , C. rotundus , Eleusine indica,, Panicum repnes, Pasplaum saguinale, Eclipta alba, Amania baccifera , Commelina communis, Trianthema monogyna , Digiteria ciliris , Alternanthera philoxeroides + A. sessilis* and *Ludwigia palustris*.

It was remarkable that Elusine indica present in minimum rainfall area whereas Scripus *latriflorus, Alternathera philoxeroides, Monochria vaginalis* and *Marsilia qudrifoliata* found in high rainfall area and water stagnation is more. Some new weeds *viz*. *Cyperus defformis, Fimbristylis miliace ,Sahima nervosum, Caesulia axillaris Monochoria vaginalis, Cyanotis axillaris,* and *Marsilea qudrifolia* had sown their severe infestation in the last month of September to October when the rainfall slowdown. Total weed intensity was (116 weeds/m^2) at 30 day stage of rice ,which was double (201 weeds / m^2) at maturity stage. Direct seeded rice had significantly higher weed intensity (143, and 226 weeds/m^2 at 30DAS and maturity stages, respectively) with the highest weed biomass 5.55 q/ha at maturity stage than all other 6 tillage and sowing methods. The weeds seed counts before sowing of rice significantly varied due to different treatments in both years of investigations number of weeds seed count significantly different due to direct effect of different tillage and sowing method of rice at all the three layers (0-5 cm, 5-10 cm and 10-5 cm) of soil in both years. But seed counts did not varied before sowing of rice due to the effect of different tillage and sowing method of preceding wheat at each layer of soil during both years. It is remarkable that seed counts were maximum in top layer (0-5 cm) of soil which orderly declined in deeper layer upto 10-15 cm depth of soil. It is also observed that number weed seeds 1 kg of soil are greater during second year than the previous year under all treatments on top layer of soil (0-5 cm) ,mean seed counts was maximum (55.2) in DSR-P_1 among all tillage and sowing methods of rice .

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Effect of age of seedlings, weed management practices and humic acid application under system of rice intensification

R. Balasubramanian, M. P. Kavitha and V. Ganesaraja

Dept. of Agronomy, Agricultural College and Research Institute, Madurai TNAU (Tamil Nadu)
e-mail : balurb@yahoo.com

Field experiments were conducted at Agricultural College and Research Institute, Madurai during *kharif* 2006 and 2007, to study the effect of age of seedlings, weed management practices and humic acid application under system of rice intensification in Periyar-Vaigai Command area. The experiments were laid out in split plot design with three replications. The mainplot consisted of age of seedlings and weed management practices. Three age of seedlings *viz*., 14, 18 and 22 days old seedlings were evaluated with four levels of weed management practices *viz*., mechanical weeding three times at 15, 30 and 45 DAT, pre-emergence application of pretilachlor 0.75 kg/ha+one mechanical weeding at 30 DAT, pre emergence application of pretilachlor 0.75 kg/ha + post-emergence application of 2,4-D Na salt 1.0 kg/ha. Three levels of humic acid application *viz*., seedling dip (0.3 per cent humic acid), foliar spray (0.1 per cent humic acid) twice at 30 and 45 DAT and seedling dip (0.3 per cent humic acid) + foliar spray (0.1 per cent humic acid) twice at 30 and 45 DAT were assigned to sub plot.

The weed growth in terms of total weed density and weed dry matter production (DMP) were significantly lower with 14 days old seedlings. Pre emergence application of pretilachlor 0.75 kg/ha + one mechanical weeding at 30 DAT significantly reduced the weed density, weed DMP and nutrient removal by weeds thereby higher weed control efficiency and weed control index. The observed weed growth was lower with humic acid application as seedling dip (0.3 per cent humic acid) + foliar spray (0.1 per cent humic acid) twice at 30 and 45 DAT. Higher growth characteristics (plant height, number of tillers m-2, crop DMP, LAI) and yield attributing characters (productive tillers m-2, filled grains/panicle, panicle length and test grain weight) were recorded with 14 days old seedlings over 22 days old seedling during 2006 and 2007.

All the yield attributes were improved by pre emergence application of pretilachlor 0.75 kg/ha + one mechanical weeding at 30 DAT and humic acid application as seedling dip (0.3 per cent humic acid) + foliar spray (0.1 per cent humic acid) twice at 30 and 45 DAT. Fourteen days old seedlings registered highest grain and straw yield in both the years to the extent of 27.99, 21.89 and 24.09, 19.21 per cent increase over 22 days old seedlings, respectively during 2006 and 2007. Pre emergence application of pretilachlor 0.75 kg/ha + one mechanical weeding at 30 DAT registered highest grain yield of 60.36 and 48.73 per cent increase over unweeded check. Seedling dip (0.3 per cent humic acid) + foliar spray (0.1 per cent humic acid) twice at 30 and 45 DAT registered higher grain yield to the tune of 27.50 and 22.77 per cent over seedling dip (0.3 per cent humic acid). Improved yield (9674 and 10974 kg/ha) and higher net return (Rs.42,333 and 45,269/ha) and benefit cost ratio (2.95 and 2.99) were obtained from combined effect of transplanting 14 days old seedlings with pre emergence application of pretilachlor 0.75 kg/ha + one mechanical weeding at 30 DAT and humic acid application as seedling dip (0.3 per cent humic acid) + foliar spray (0.1 per cent humic acid) twice at 30 and 45 DAT during both the years and this treatment combination can be recommended for getting higher yield and economic returns under System of Rice Intensification.

P-66 Effect of establishment method and weed management practices on rice (*Oryza sativa* L.)

H. P. Agrawal, Geet Sharma, J. R. Patel and O. P. Kashyap
IGKV, TCB College of Agriculture & Research Station Sarkanda, Bilaspur (C.G.)
e-mail- sharmageet@yahoo.co.in

In Chhattisgarh plain *kharif* rice occupy more than 80% of cultivable area. In this area on the basis of ensured irrigation or land situation farmers grow rice with different methods. Out of several methods beushening or biasi system is most prevalent followed by transplanting, direct seeded line sowing and *lehi* system. In transplanting and *lehi* system, after puddling of soil, established seedlings and sprouted seeds are sown respectively whereas in *biasi* system puddling is done in the standing seedlings. However, in direct seeded method there is no need of puddling. Thus puddling produces different micro climate in each system and also influence the ecology of weeds. In view of the above, the present study was mooted to study the effect of establishment method and weed management on yield of rice.

The experiment was laid out in split- plot design with three replications by keeping three methods of rice establishment *viz.* transplanting, broadcast *biasi* and direct seeded line sowing in main plot, where as five weedy management practices *viz*. butachlore, fenexoprop- p-ethyl, fenexoprop-p-ethyl with metsufuron methyl +chlorimron methyl along with one hand weeding (30 DAS) and weedy check were taken in sub plot. Seeds of rice cultivar IR-36 were sown at the same time for directed seeded line sowing (20 cm row apart) and broadcast *biasi* in the respective plots 100 kg/ha. For transplanting, seeds were sown in nursery 30 kg/ha on the same date. 21 Days old healthy seedling were transplanted in puddle plot at 20 x 10 cm spacing, however, *biasi* was done at 30 DAS by running desi plough in the respective plots in 5 cm. standing water. Butachlore herbicide was applied 3 day after direct seeding and transplanting, fenexoprop-p- ethyl either alone or mixed with metsulphuron methyl + chlorimuron ethyl were applied 15 day after direct seeding or transplanting as per treatment. These herbicides were applied with spray volume of 500 liter of water/ha by using flat fen nozzle. Rice crop was fertilized with 100:60:40 kg NPK/ha. Full dose of phosphorus and potash and half dose of nitrogen were given as basal and remaining half dose of nitrogen were split into two parts and given at tillering and panicle initiation stage.

Transplanting of rice seedling produced significantly higher grain and straw yield of rice in comparison to broadcast *biasi* and direct seeded line sowing method due to better favorable microclimate. However, broadcast *biasi* and direct seeded line sowing were found statistically at par in respect to grain and straw yield of rice. All the weed management practices resulted in significantly higher grain and straw yield of rice than the weedy check. Combination of fenexoprop–p -ethyl and metsulfuron methyl + chlorimuron ethyl resulted in significantly higher grain and straw yield of rice in comparison to other weed management practices. However, sole application of either fenexoprop–p-ethyl as post emergence or butachlore as pre-emergence and one hand weeding did not influence the grain and straw yield of rice

P-67 Weed management in system of rice intensification in sodic soil.

S. Somasundaram, S. Ramasamy and G. Kathiresan
Anbil Dharmalingam Agricultural College Adhiparasakthi Agrl. College, Kalavai (Tamil nadu)
e-mail 1: rainfed02@yahoo.co.in

Weed management is an important production factor in system of rice intensification. In this context a field experiment was conducted during samba season (Aug - Jan) of 2008 at Anbil Dharmalingam Agricultural College and Research Institute, Trichy farm with alkali soil of pH 8.4, EC 0.14 ds/m and ESP 16.1. The experiment was laid out in split plot design with three replications. Rice variety TRY 1 was tested with the following treatments *viz*., rice establishment techniques and weed management (M1- conventional planting + no rotary weeding , M2-conventional planting + rotary weeding, M3- SRI planting + no rotary weeding, M4-SRI planting + rotary weeding) and nutrient management (S1- Control, S2- 150:50:50 kg/ha NPK, S3-S2 + FYM (12.5 t/ha), S4- S3 + azophosmet + PPFM) In no rotary weeding treatment conventional method of weeding (butachlor 1.25 kg/ha + hand weeding 35 DAT) was practiced. Results revealed significant difference in yield attributes and grain yield by the treatment studied. Higher No of panicles hill-1, filled grain panicle and panicle length was recorded by M4S4 - SRI + rotary weeding + 150: 50: 50 kg/ha NPK + FYM + Azophosmet + PPFM and higher no of panicles meter^2 was recorded by M2S4 - Conventional planting + rotary weeding + 150: 50: 50 kg/ha NPK + FYM + Azophosmet + PPFM. Regarding grain yield, SRI planting + rotary weeding + 150: 50: 50 kg/ha NPK + FYM (12.5 t/ha) + azophosmet (seed treatment 200 g/ha and soil application 2 kg/ha) + PPFM (foliar spray @ 1 ppm at PI and heading) recorded significantly higher grain yield (6608 Kg/ ha) and was comparable with conventional planting + rotary weeding +150: 50: 50 kg/ha NPK + FYM (12.5 t/ha) + azophosmet (seed treatment 200 g/ha and soil application 2 kg/ha) + PPFM (foliar spray @ 1ppm at PI and heading) (6075 Kg /ha).

P-68 Variability in the morphologic characters of weedy rices of Kerala

T. Girija, V. E. Rajeev and C. T. Abraham
DWSR Centre, Kerala Agricultural University, Thrissur (Kerala)
e-mail : girijavijai@gmail.com,

Rice is the major food crop of Kerala. Currently the wide spread incidence of weedy rice in the rice growing tracts of Kerala has become a major threat to the rice cultivation in the state. A survey conducted by AICRP on weed control in the rice growing tracts of Kole lands, Thrissur and Kuttanad of Alleppy and Kottayam districts revealed the presence of different biotypes of weedy rice with variation in height from (70cm to 130cm) . tiller number (1 to 32), panicle number (1 to 12), awn length (1.8cm to 6.6 cm) and seed colour. Seed colour varied from golden yellow, brown, and black. Awn pigmentation was noticed in some variants. A distinguishing purple colouration in the basal internode was a character noticed in some of the wild rice specimens collected from the field. The ear head and grain characters also showed high variability. In some variants these characters were very much similar to the cultivated rice whereas intermediary characters with varying similarity to wild rice were also noticed. The possibility of cross pollination between these variants and cultivated rice is also likely. Molecular characterisation is essential to confirm the variability observed in the field. Germination studies revealed the presence of staggered dormancy. The initial germination (just after harvest) ranged from 8-12%. Above 50% of the seeds germinated after 5 months of storage, 5-10% seeds germinated during the interveing period. The chaff percentage was very high (up to 70%) in all the variants collected.

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Evaluation of suitable post-emergence herbicide for the control of rice weeds under puddled condition

Shilpa Koushik[1], Mukesh Pandey[1], B. L. Chandrakar[2], and A. P. Singh[3]
Dept. of Agriculture, Korba[1], Raipur[2] and IGKV, Raipur, (C.G.)[3]
e-mail : apalsingh@yahoo.com

Over the centuries rice workers have developed different weed management practices. A point has already been made them cultivation of rice under direct seeded condition conducive to profuse weed growth. However, if the weed population could effectively be controlled, direct seeded rice cultivation may offer a unique advantage of raising yields at par with transplanted rice. The types of weed flora obtainable under direct-seeded condition are so variable that it may not be possible to manage them by one method alone. Not only this, flushes of weeds come up at different stages. Considering the fact, there is a need to manage the weeds during critical crop-weed competition period either by physical methods or through herbicides. In Chhattisgarh state, farmers generally control weed manually. The physical methods are costly, labour consuming and the advantage of manual weeding could only be achieved when it is performed timely. Chemical weed control is regarded to be better than hand weeding due to drudgery of weeding and meager availability of labour at peak period of weed infestation. In this respect, application of new and wide spectrum herbicide is alone or in combination may give satisfactory weed control. The present investigation was conducted at Instructional Farm of Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) India during the *Kharif* season (June-October) 2006. The experiment was laid out in randomized block design comprised of eight treatments of various combinations of different herbicides *viz*. PIH 2023 10% SC 15 g/ha at 18 DAS; PIH 2023 10% SC 20 g/ha at 18 DAS; PIH 2023 10% SC 25 g/ha at 18 DAS; PIH 2023 10% SC 30 g/ha at18 DAS; PIH 202310% SC 60 g/ha at 18 DAS : almix 20% WP 4 g/ha 18 DAS; control (unweeded check) and hand weeding at 30 DAS with three replications. Rice cultivar "IR-64" was grown as a test crop. Rice was manually sown with a seed rate of 60 kg/ha July, 2006 and harvested in November, 2006. The crop was fertilized with 100:60: 40 kg NPK/ha, respectively. Results revealed that almost all growth parameters, yield attributes and grain yield were significantly higher under post-emergence application of PIH 2023 10% SC at 25 g/ha at 18 DAS after sowing over other treatments. *Echinochloa colona, Cyperus* spp*., F. miliaceae, L. hyssopifolia* were the pre-dominant weeds in experimental plot. Minimum weed density was noted under post emergence application of Almix 4 g/ha and PIH 2023 25 g/ha at 20, 40, 70 and 90 DAS. Whereas, at harvest lower dry matter of weeds and highest weed control efficiency was recorded under almix 4 g/ha , PIH 2023 25 g/ha and PIH 2023 60 g/ha, respectively. It was found effective to control broad spectrum of weeds *viz*., grasses, sedges and forbs. Application of PIH 2023 60 g/ha gave the highest gross return (Rs 33301.5/ha), net return (Rs. 21218.3/ha) and additional net return (Rs.12494.75/ha). The second best treatment was having gross return (Rs.30976.90/ha) net return (Rs.20043.7/ha), additional net return over control (Rs.11265/ha), respectively.

P-70 Influence of maize based cropping systems on weed dynamics and crop productivity

J. K. Jadhav, A. K. Gore and M. G. Patil
Directorate of Weed Science Research Centre, M.A.U., Parbhani (M.H.)
e-mail : anandk.gore@rediffmail.com

Weed infestation is more prounced in maize during *kharif* season due to frequent rains and heavy fertilization. The yield losses as high as 45% caused by weeds have been reported in Maize. In the era of labour shortage, high labour wages, less preference to chemicals i.e. herbicides alternative ways for effective and economical weed control may be given to the farmers in sound farming system. In this view a field experiment was conducted at Parbhani to study the influence of maize based cropping systems on weed dynamics and crop productivity in both crops i.e. in *kharif* and *rabi* season crops. The soil of the experimental site was medium deep black which was low in available N, medium in available P and high in available K. The experiment was laid out in split plot design having five cropping systems *viz*. maize-wheat, maize-chickpea, maize-*rabi* sorghum, maize-safflower and maize-pea as main plot treatments and two weed control treatments *viz*. recommended practice of weed control (2 HW and 1 H at 3 & 6 WAS) and weedy check as sub plot treatments. The *Kharif* maize crop was associated with *Digera arvensis, Alternanthera sessilis, Parthenium hysterophorus, Acalypha indica, Euphorbia genicullata, Cynodon dactylon and Brachiana eruciformis.* The dominant weed species observed in wheat were *Brachiaria eruciformis*, *Cynodon dactylon, Digera arvensis, Euphorbia genicullata* and *Parthenium hysterophorus.* The dominant weed flora observed in pea was *Brachiaria eruciformis, Cyperus rotundus, Commilena benghalensis, Euphorbia genicallata and Chrozophora rottleri.* In safflower dominant weed species observed were *Brachiaria eruciformis, commelina benghalensis, Cynodon dactylon,* Euphorbia *genicullata, Digera arvensis* and *Parthenium hysterophorus.* Gram was infested with *Euphorbia genicullata, Chenopodium album, Parthenium hysterophorus* and *Brachiaria eruciformis*. *Rabi* sorghum was found to be infested with *Cynodon dactylon, Brachiaria eruciformis, Digera arvensis* and *Chrozophora rottleri*.

The dry weed weight was found to be influenced due to different cropping systems and weed control treatments. The significantly lowest dry weed weight of grassy weeds was observed in maize-chickpea cropping system at 30 DAS and at 60 DAS it was found at par only with maize-wheat cropping system. As regards broad leaved weeds their lowest dry matter was observed in maize-chickpea cropping system and it was found at par with maize-wheat and maize-*rabi* sorghum cropping system and found significantly lowest than rest of the cropping systems. Whereas, the significantly lowest dry weed weight was observed in recommended practice and weed control i.e. 2 HW and 1 H for *kharif* crop and 2 HW for *rabi* crops for grassy as well as broad leaved weeds at 30 & 60 DAS. Whereas at 60 DAS significantly lowest dry weed weight of broad leaved weeds was observed in maize-chickpea cropping system which found at par only with Maize-wheat cropping system.

The maximum weed control efficiency of grassy (44% and 28%) as well as broad leaved weeds (51% & 40%) was observed in maize-chickpea cropping system at 30 and 60 DAS respectively. As regards weed control methods, maximum weed control efficiency of grassy weeds (72% and 65%) and broad leaved weeds (60% & 73%) was observed in recommended practice of weed control than that of weedy check at 30 DAS and 60 DAS respectively. The unchecked weeds caused 31% grain yield reduction in unweeded control over recommended practice of weed control. Whereas 13% yield reduction was observed in maize-pea cropping system over maize-chickpea cropping system. The cropping system of maize-chickpea recorded significantly highest yield (Equivalent yield of the system) than rest of the cropping systems which was found at par with maize-wheat and maize-*rabi* sorghum cropping system. As regards weed control treatments the significantly highest yield (Equivalent yield of the system) was observed in recommended weed control practice.

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Control of *Cuscuta chinensis* through integrated weed management practices in lucerne (*Medicago sativa* L.)

P. Revathi, K. B. Suneetha Devi, M. Madhavi and M. Padmavathi Devi
Department of Agronomy, ANGR Agri.Univ., Rajendranagar, Hyderabad (A.P.)
e-mail : revathi.pallakonda@gmail.com

Lucerne (*Medicago sativa* L.) is an important high yielding, multicut, nutritious and palatable fodder crop of India. Severe weed competition especially *Cuscuta chinensis* is one of the major constraints in achieving high fodder productivity. Yield losses as much as 90 per cent was reported due to cuscuta infestation. Hence, present study was conducted during *rabi* season of 2008-09. The Lucerne was sown in first week of November at a spacing of 30 cm x Solid rows with seed rate 15 kg/ha. The herbicides were sprayed using a spray volume of 600 l/ha as per the treatments. The recommended fertilizer dose of 20 kg N, 80 kg P_2O_5 and 30 kg K_2O/ha were applied as basal in the form of urea, single super phosphate and muriate of potash. After each cut, 30 kg N was applied through urea. Three cuts of green fodder were taken at 68, 103 and 135 days after sowing. Cuscuta twines attached to lucerne plants in an area of 0.25 m^2 were removed at each cut and oven dried to record dry weight and cuscuta control efficiency was calculated. Green fodder taken from 0.25 m^2 area in each treatment was kept in an oven at 65^{o}C until a constant weight was obtained and expressed as dry fodder yield in t/ha.

Results revealed that *Cuscuta* was not observed at 30 DAS and started its appearance at 45-50 DAS. The effect of integrated weed management practices on dry weight of cuscuta and its control efficiency was more conspicuous. Dry matter production of cuscuta was higher at I cut and reduced towards increasing the number of cuts. Application of imazethapyr 75 and 100 g/ha at 12 DAS and in combination with salt (10 %) treatment to seeds, pendimethalin 0.5 and 0.75 kg/ha as PE and pure seed of lucerne + farmers practice eliminated the infestation of cuscuta. It was clearly showed that application of herbicides is an effective measure to control cuscuta in Lucerne as it causes disruption of mitosis, cytokinensis and microtubules on shoot tips of *cuscuta*. Total green and dry fodder yield of lucerne over three cuts was significantly higher with application of imazethapyr 75 g/ha at 12 DAS and was found on par with pure seed of lucerne + farmers practice, salt (10 %) treatment to seeds + imazethapyr at 75 g/ha at 12 DAS and could be attributed to better control of weeds including cuscuta right from crop emergence upto critical period of crop weed competition i.e. 30 DAS. Green and dry fodder yield of lucerne was significantly less with the application of pendimethalin 0.5 and 0.75 kg/ha as PE and in combination with salt (10 %) treatment to seeds at 12 DAS and this might be that pendimethalin controlled grasses and sedges only but could not controlled broad leaved weed i.e. *Parthenium hysterophorus* which contributed to higher proportion of weed dry weight in these treatments. Sowing pure seed of lucerne collected from cuscuta free lucerne plants in combination with farmers practice effectively controlled all the weeds and prevented cuscuta infestation thereby resulted in higher green and dry fodder yield. Salt (10 %) treatment to seeds + T10 alone recorded less total green and dry fodder yield but its combination with pendimethalin 0.5 kg/ha and imazethapyr 75 g/ha at 12 DAS increased the green and dry fodder yield to an extent of 40.0 and 64.0 per cent over green and dry fodder yield of salt (10 %) treatment to seeds + T10 alone. Hence, it was concluded that application of imazethapyr at 75 g/ha at 12 DAS and in combination with 10% salt treatment to lucerne seeds before sowing and sowing pure seed of lucerne followed by farmers practice of hand weeding at 30 DAS and after each cut were effective in controlling weed flora in lucerne including cuscuta and achieved higher green and dry fodder yield of lucerne.

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Management of clodinafop and fenoxaprop resistant biotypes of *P. minor* in wheat in rice-wheat cropping system

S. S. Punia, Dharam Bir Yadav, Rupa Dhawan and Samunder Singh
Department of Agronomy, CCS HAU, Hisar (Haryana)
E-mail: jagir@hau.ernet.in

During 1997, three herbicides namely clodinafop-propargyl, fenoxaprop-p-ethyl and sulfosulfuron were recommended to control isoproturon resistant population of *P.minor* in wheat crop. Due to excellent efficacy against *P.minor* and *Avena ludoviciana*, use of these herbicides led to their quick adoption not even in rice-wheat cropping system. During 2005 & 2006, complaints of poor or no efficacy of clodinafop against *P.minor* also were received from many farmers of Kurukshetra, Karnal, Kaithal, Ambala and Fatehbad districts using these herbicides continuously since 1997. As the resistance to isoproturon is of metabolic nature, hence there are chances of development of cross-resistance in *P. minor* against new herbicides as well. Cross resistance and multiple resistance are known to evolve in herbicide resistant after continuous use of new herbicides in many weeds. (Heap, 1999). Keeping possibility of cross resistance in view, five field trials were conducted at farmers fields in villages Chanarthal (Kurukshetra) at 2 locations and Barhi in Ambala districts of Haryana Another experiment to study the effect of continuos or rotational use of these three herbicides on control of *P. minor* and productivity of wheat is in operation at two permant sites Sagga and Uchana in Karnal district since 1997.

In field trials, clodinafop and fenoxaprop herbicides showed only 20-35 % control of *P. minor* even at 2x (double to recommended) dose but new herbicide pinoxaden 5 EC, meso + iodosulfuron (R.M.) at 12 + 2.4 g/ha, sulfosulfuron+metsulfuron (R.M.) at 32 g/ha showed excellent efficacy (88-100 % control) of *P.minor* at all the locations. The pot-culture studies with *P. minor* biotypes (Teek, Geong, Teontha, Budanpur, Solu Majra, Chandlana, Manjura, Sambhli, Majra Rodan, Shahpur, Chirao biotypes) from farmers' fields indicated that clodinafop and fenoxaprop were not satisfactory against most of the biotypes except 'Sambhli' biotype. Sulfosulfuron was better than clodinafop and fenoxaprop against most of the biotypes and performed well against Teontha, Sambhli and Chandlana biotypes. Pinoxaden provided >80% control of most of the biotypes except 70% control of Budanpur and Shahpur biotypes. All herbicides were good against Uchani and Sambhli biotypes indicating to be sensitive biotypes. However clodinafop was slightly weak against Uchani biotypes (65%). In another study at Hisar, fenoxaprop did not show any mortality in 6 biotypes (Sirsa, Hansi 1, Karnal, Ladwa, 2 biotypes from Chanarthal (KKR) while clodinafop did not show any mortality in 10 biotypes. Pinoxaden showed more than 50% mortality in 24 biotypes during 2008-09. Results of long term trial on use of herbicides at Sagga and Uchana indicated that use of alternate herbicides *viz*. fenoxaprop, clodinafop and sulfosulfuron resulted in decline in density of *P.minor* till 2003-04 after which it efficacy of these herbicides started to decrease and *P.minor* population in these treatments was nearly equal weedy plots. GR 50 values of surviving populations showed 10-fold increase than the initial values in sulfosulfuron, 8-fold increase in fenoxaprop and 3-4 fold increase in clodinafop indicating the evolution of cross resistance to these herbicides in this weed. Poor efficacy of fenoxaprop, sulfosulfuron and clodinafop in some biotypes of *P.minor* has earlier been reported by Dhawan *et.al.* (2009)

Based on above results it seems that Chanarthal, Barhi, Uchana, Sagga and some other biotypes of *P.minor* in Haryana has developed resistance to clodinafop and fenoxaprop. Application of sulfosulfuron+metsulfuron (RM) at 32 g/ha, meso+iodosulfuron at 15 g/ha or pinoxaden at 50 g/ha can be used presently to control these biotypes of *P.minor* in wheat crop.

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Chemical weed control in wheat

M. S. Dandge, V. M. Bhale and A. P. Karunakar
Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (M.H.)
e-mail : msdandge@rediffmail.com

Success of wheat depends largely on effective weed control. 2, 4-D controls broad leaf weeds but timing of application of 2,4-D is critical to avoid injury to wheat crop. Various herbicides have been used for controlling weeds in wheat, but efficiency of chemical methods based on a single herbicide treatment may be unsatisfactory because of their narrow spectrum of weed control. Therefore, application of herbicides in sequence or combinations can be more useful. The present investigation was proposed to control weeds though chemicals involving pendimethalin, 2, 4-D and metsulfuron methyl sequence and combinations in wheat crop.

A field experiment was carried out to evaluate the comparative efficacy of metsulfuron methyl and 2,4-D applied alone and in combination, in terms of weed control and yield performance of wheat crop at Akola during 2007-08.

A field experiment was carried out in Randomize Block Design with three replication and eight treatments having gross plot size with 8.0m x 1.8m and net 7.0m x 1.4m. Variety selected for this experiment was AKAW-3722. Sowing of wheat crop was done on 11th November, 2007 with spacing of 22.5cm.

Hand weeding twice at 20 and 40 DAS resulted in maximum weed control efficiency and recorded significantly higher grain yield (42.07 q/ha). However, it was at par with treatment of pendimethalin PRE 500 g/ha + metsulfuron methyl POE 2 g/ha with 0.1% surfactant (40.00 q/ha) and pendimethalin PRE 500 g/ha + 2,4-D POE 500 g/ha (38.78 q/ha). GMR, NMR and B : C ratio showed similar trend. Hence, where labour is a problem, herbicide application proves an effective option in wheat crop.

Growing wheat year after year in the same field under high level of fertilizer and irrigation has lead to the development high infestation of the crop with grassy weed. Effective weed control measures increases the uptake of nutrient by the crop and decreases the removal through weeds. When the field is infested with complex weed flora of grasses and broad leaved weeds, the unacceptable control of weed due to single herbicides results in significance loss in seed yield of wheat. Pendemethalin is effective against broad leaved but ineffective in controlling problematic weeds (Nisha Chopra et. al.,2000) Metsulfuron methyl has been found effective against most broad leaved and problematic weeds, specially Canada thistle (Cirsium arvense) and objectionable weed field bind weed (Convolvulus arvensis) (Nisha Chopra et. al.,2000). Singh and Ghosh (1992) reported, yield loss of 15 to 35 % only due to crop-weed competition in wheat crop. Wheat being a closely spaced crop, mechanical/cultural weed control is often difficult to carry out.

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Plasticulture applications for weed management in horticultural crops - An Overview

D. Sharma, J. Tivedi, H. K. Panigrahi, S. P. Tiwari, D. Upadhyay and Anita Mishra
Department of Horticulture, Indira Gandhi Krihi Vishwavidyalaya, Raipur (C.G.)
e-mail : apalsingh@yahoo.com

India is a developing country and cost effective management practices are very important. Hand or manual weeding, though very effective and commonly adopted in India is expensive and time consuming. The manual weeding is not feasible in all situations and had many problems with varying crop and soil types. Spray of chemicals to control weeds is quiet effective and economical but due to associated residual hazards, changing towards resistant biotypes and polluting the ecosystem have necessitated development of alternate eco-friendly means. In view of the above soil solarization, plastic mulch, organic mulch and soil mulch for management of weeds including soil born diseases and insects will be the key prepositions to reduce the dependency on chemicals and also save nutrients and make readily available to crop plants. Amongst above four techniques soil solarization with transparent polyethylene sheet and black plastic mulch are most effectively used in horticultural crops.

Solarization is not new to horticulture, it is a trapping of solar energy during hot summer for killing weed seeds and pathogens. In modern horticulture transparent polyethylene is used for solarization. It is a simple technique that captures the radiant heat energy. The clean transparent polyethylene film is placed on moist soil. The moist soil helps in conduction of heat due to moisture, which makes weed seeds more sensitive to heat. The polyethylene sheet was kept for 2-6 weeks during peak summer, this resulted physical, biological and chemical changes in rhizosphere. The mean maximum temperature of polyethylene solarized soils are $8\text{-}12^0$ C higher than corresponding non-solarized soil. The increase in yield of various horticultural crops was reported by many workers. It is also reported by several workers that rainy and winter season annual weeds were susceptible to solarization. Besides reducing the problem of weeds, soil born fungal and bacterial diseases including nematodes were also controlled. Mulching is a horticultural technique in which the use of organic materials (plant residues-straw, hay, groundnut hulls, leaf and compost; peat; wood products-saw dust; and animal manures), and synthetic materials (paper, polyethylene, wax coated papers, aluminum and steel foils, and asphalt spray wax emulsions), *etc*., with or without shallow tillage, for the purpose of increasing soil productivity is involved. This technique is very useful in protecting the roots of plants from heat, cold, or drought or to keep weed free condition by making fovourable changes in rhizosphere for plant growth. It checks evaporation and modifies the soil and air microclimate in which a plant is growing. Mulching is also applicable to most field crops. However, it is preferred in gardens, especially gardens, nurseries and orchards where frequent cultivation is not required for raising the crops to make the field free from weeds. It is well known that after germination seeds requires light for growth, the plastic (polyethylene) mulches especially black in colour completely check the light and little warm condition that is unfavourable for growth of weed seed and seedlings. Earlier workers reported efficient weed management using plastic mulch with increase in yield and yield attributes under drip assisted cultivation. The thickness of plastic mulch for annuals (vegetables), biennials (banana *etc*.) and perennials (fruits) would be 25-30, 50-100 and 100-250 microns.

Weed population also affected the nutrient uptake of plants. The internal level of nitrogen, phosphorus and potash was found significantly higher in mulched plots as compared to weedy plots. Overall the findings of various experiment revealed that use of plasticulture techniques was more beneficial in terms of yield and controlling weeds.

P-75 Nominee gold 10% sc–a post-emergence rice herbicide

Vishwanath Gade and K. Satyanarayana
Dept. of Technical & Product Devp., PI IL, Millennium Plaza, Tower-A, Sector Gurgaon (Haryana)
e-mail : c.krishana@piind.com

Nominee Gold with its active ingredient bispyribac-sodium 10% SC is a selective, systemic, broadspectrum, post-emergence foliage rice herbicide. It has excellent foliar application efficacy against commonly occurring grasses, sedges and broadleaf weeds with wide application window of 2-7 leaf stages of rice mimic weeds Echinochloa spp. that are likely to be ignored during hand weeding operations. The rapid absorption of bispyribac-sodium through leaf surface of susceptible weeds and its translocation, initiates its herbicidal activity by inhibiting the plant enzyme acetolactatesynthase thus preventing the biosynthesis of branched chain amino acids – valine, lucine and isoleucine. This inhibition interferes with cell division and causes cessation of growth with concomitant chlorosis, necrosis and death of susceptible weeds; the initial yellowing and cessation of growth can be observed between 3-5 days, necrosis of terminal tissues 6-12 days and complete necrosis of leaf, stem and root 14-21 days after application. The recommended dosage is 25 g a.i./ha. Nominee Gold is highly selective to rice since it is rapidly metabolized before its translocation; even applied at higher dosages than recommended does not cause phytotoxicity to rice. Extensive studies conducted on safety assessment in Japan, U.S.A. and Europe had confirmed its favourable toxicological and environmental profiles. In India, PI Industries Ltd., provided the soil, water, straw and grain samples from various field sites of research institutes of Agricultural Universities where the field bioefficacy evaluations were conducted. The samples were given to the Dept. of Agricultural Chemicals, B.C.K.V., Mohanpur, West Bengal. The results indicated that the dissipation of the product followed first order kinetics in soil and water with half life values 18-25 days and 1-4 days respectively. No residues were found in paddy plant as well as harvested samples of grain, husk or straw irrespective of dosage and season.

The product has been released to the market in *kharif* 2009 and has been widely accepted by the farmers. Before its release the product was widely tested in different eco-systems and in nursery, transplanted and direct seeded conditions in farmer fields across major rice growing regions. The results were excellent as the commonly occurring weeds – *Echinochloa* spp, *Ischaemium rugosum* among grasses, *Cyperus difformis, C.iria, Fimbristylis miliacea, Scirpus maritimus* among sedges and *Monochoria vaginalis, Marsilea minuta, Sphenoclea zeylanica, Ludwigia actovalvis, Eclipta alba, Commelina bengalensis* among BLW are controlled at the recommended dosage of 25 g/ha.; *Leptochloa chinensis* remained unaffected after showing initial transitory chlorotic symptoms.

One of the cardinal principles with the foliage herbicides is they act only when they hit the target at the right vulnerable stage of weed growth. Hence, farmers are educated on key points of method of application, adopting recommended dosage, right type of nozzle and uniform coverage of weeds besides steps to be followed in the application of the herbicide. The rice farming community is satisfied with the performance of Nominee Gold and are adopting the technology.

P-76 Planting geometry and weed management in maize + blackgram intercropping system under rainfed vertisols

Sanjay K. Dwivedi, G. K. Shrivastava, A. P. Singh and G. S. Tomar
Department of Agronomy, College of Agriculture, IGKV, Raipur (C.G.)
e-mail:sanjay_dwivedi2000@yahoo.com

Field experiments were conducted at Instructional Farm of Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh) during *kharif* season of 2004 and 2005 under split plot design with three replications. The experiment consisted of five planting geometry *viz*., sole maize (45 cm), sole blackgram (30 cm), maize (45 cm) + blackgram (1:1), maize (30 cm) + blackgram (2:1) and maize (30 cm) + blackgram (2:2) and four weed management practices *viz*., weedy check, HW at 30 DAS, alachlor at 2.0 kg/ha and alachlor at 1.5 kg/ha + HW at 40 DAS.

The results confirmed pivotal role of planting geometry and weed management practices in improving productivity of maize with blackgram intercropping system under rainfed situation of Chhattisgarh state. Planting geometry had significant impact on reduction of weed density of weeds. At important growth stages of crop i.e., 50 and 75 DAS, the maximum reduction in number of total weeds were found with maize + blackgram (1:1) intercropping system. The yields of maize were significantly higher under maize + blackgram (2:1), however, it was at par with the maize + blackgram (1:1) and sole maize treatment. Maximum yield of blackgram was found under sole cropping of blackgram. Alachlor at 1.5 kg/ha + HW at 40 DAS treatment produced maximum grain yield of maize and blackgram and significantly superior to other treatments. Maize equivalent yield and land equivalent ratio were highest under maize + blackgram (1:1). Use of alachlor 1.5 kg/ha + HW at 40 DAS recorded maximum maize equivalent yield. Out of seven weed species, *Alternanthera triandra* and *Cyperus rotundus* among sedges, *Cynodon dactylon* among grasses and in broad leaf weeds *Cynotis axillaries* were predominant weeds. In general, total weed population was highest at 75 DAS and thereafter decreased with the advancement in crop age in weedy check treatment. Differences in number of total weeds due to planting geometry and weed management were found significant during both the years and on mean basis at all the growth stages. Lowest weed population was recorded with the maize + blackgram (1:1) treatment at 25, 50 and 75 DAS. Whereas, at harvest, sole blackgram recorded lowest weed population which was significantly superior than others.

Generally, individual crop yields are low when intercropped, but the total productivity remains higher than the sole crop (Jain and Jain, 1986). Therefore, maize equivalent yield (MEY) of main crop and land equivalent ratio (LER) are the ways of the evaluating intercropping efficiency. Various planting geometry and weed management practices brought significant difference in maize equivalent yield during both the years and on the basis of two years. Maize + blackgram (1:1) gave significantly higher maize equivalent yield than rest of planting geometry during both the years and on mean basis. Next in superiority order was maize + blackgram (2:2) which registered higher maize equivalent yield over maize + blackgram (2:1) during both the years and on mean basis. All the weed management practices recorded higher values of maize equivalent yield over weedy check during both the years and on mean basis. Alachlor at 1.5 kg/ha + HW at 40 DAS gave significantly higher maize equivalent yield over others during second year and on mean basis. Although in first year, it was found at par to alachlor at 2.0 kg/ha and HW at 30 DAS.

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Weed management in groundnut

R. R. Upasani, A. N. Puran

Department of Agronomy, Birsa Agricultural University, Ranchi (Jharkhand)

e-mail : upasani.ravikant@gmail.com

A field experiment to evaluate the efficacy of weed control methods on productivity and profitability of groundnut was conducted at research farm of Birsa Agricultural University during *kharif*, 2006 and 2007. The treatments comprised of pendimethalin (0.75 kg) pre-em, fluchloralin (0.75 kg) PPI, Alachlor (1.0 kg) pre-em, metolachlor (0.75 kg) pre-em, dimethazone (0.75 kg) pre-em, sethoxydim (0.5 kg) post-em, pendi. (0.75 kg) pre-em. *fb*. weeding by grubber (25 DAS), fluchloralin (0.75 kg) PPI *fb*. weeding by grubber (25 DAS), alachlor (1.0 kg) pre-em *fb*. weeding by grubber (25 DAS), metolachlor (0.75 kg) pre-em. *fb*. Weeding by grubber (25 DAS), dimethazone (0.75 kg) pre-em. *fb*. weeding by grubber (25 DAS). Weeding by grubber (15 & 25 DAS) and Weedy check. Application of fluchloralin (0.75 kg) PPI *fb*. weeding by grubber (25 DAS) recorded significantly reduced weed density (62.5/m^2) and was at par with fluchloralin (0.75 kg) PPI, metolachlor (0.75 kg) pre-em and Weeding by grubber (15 & 25 DAS) whereas significantly reduced dry matter accumulation by weeds were recorded by application of metolachlor (0.75 kg) pre-em. *fb*. weeding by grubber 25 DAS (10.73 g/m^2) which was at par with metolachlor (0.75 kg) pre-em, sethoxydim (0.5 kg) post-em., fluchloralin (0.75 kg) PPI *fb*. weeding by grubber (25 DAS), alachlor (1.0 kg) pre-em *fb*. weeding by grubber (25 DAS), dimethazone (0.75 kg) pre-em. *fb*. weeding by grubber (25 DAS) and weeding by grubber (15 & 25 DAS). Significantly higher pod yield and net profit was observed by the application of sethoxydim (0.5 kg) post-em (2353 kg/ha and Rs 9296/ ha respectively) possibly owing to significantly higher number of pods /plant (18).

Groundnut is an important rainy season crop grown mainly under upland situation of Jharkhand. Heavy infestation of weeds has become serious problem for increasing sustaining productivity of groundnut. Groundnut yield losses due to weeds have been estimated as high as 24 to 70 percent (Jhala A, et al 2005) as weeds compete with crop for natural resources during its cultivation. For weed control in ground nut herbicides like fluchloralin (PPI) and pendimethalin (PE) have been used commonly however report on effect of integrated weed control methods on productivity of ground nut are meager. A field experiment was conducted at research farm of Birsa Agricultural University, Ranchi during *kharif* season of 2006 and 2007 to evaluate the efficacy of herbicides alone and also in combination with mechanical weeding. The soil of experimental field was sandy loam with pH of 5.8 and low in available N (180 kg/ha), phosphorus (18kg/ha) and medium in potash (230 kg/ ha). The treatments comprised of Pendimethalin (0.75 kg) PE, fluchloralin (0.75 kg) PPI, alachlor (1.0 kg) PE, metolachlor (0.75 kg) PE, dimethazone (0.75 kg) PE, sethoxydim (0.5 kg) post-em, pendimethalin (0.75 kg) PE. *fb*. weeding by grubber (25 DAS), fluchloralin (0.75 kg) PPI *fb*. weeding by grubber (25 DAS), alachlor (1.0 kg) PE *fb*. weeding by grubber (25 DAS), metolachlor (0.75 kg) PE *fb*. weeding by grubber (25 DAS), dimethazone (0.75 kg) PE. *fb*. weeding by grubber (25 DAS), The crop was fertilized with recommended level of nutrient N:P_2O_5 : K_2O :: 40 : 60 : 20 Kg/ha. The sowing of groundnut was done on 12th and 15th July and harvested manually on 23rd and 20th October, 2006 and 2007 respectively. The major weeds associated with groundnut were *Dectyloctaneum aegiptium, Cyperus rotendus, Digitaria sanguinalis, Commelina benghalensis, Elusine indica, Cynodon dectylon, Ageratum conzoides, Cleom viscosa*. The lowest weed density (62.5/M^2) at 60 DAS was found with application of fluchloralin (0.75 kg) PPI *fb* weeding by grubber (25 DAS) remaining at par with fluchloralin (0.75 kg) PPI, metolachlor (0.75 kg) pre-em. *fb*. weeding by grubber (25 DAS) as well as weeding by grubber (15 & 25 DAS). Significantly reduced weed dry matter accumulation was recorded by weeding by grubber (15 & 25 DAS) and was at par with application of metolachlor (0.75 kg) pre-em, sethoxydim (0.5 kg) post-em, fluchloralin (0.75 kg) PPI *fb*. weeding by grubber (25 DAS), alachlor (1.0 kg) pre-em *fb*. weeding by grubber (25 DAS, . metolachlor (0.75 kg) pre-em. *fb*. weeding by grubber (25 DAS), and dimethazone (0.75 kg) pre-em. *fb*. weeding by grubber (25 DAS). Among herbicides treatments, highest pod yield (2353 Kg/ ha) as well as net return (Rs 9296 /ha) was found with application of sethoxydim (0.5 kg) post-em. It was possibly due to better weed control a pre flowering stage resulting in higher number of pod per plant (18) as reflected with reduced dry matter accumulation by weeds similar to weeding by grubber (15 & 25 DAS). Application of alachlor or metolachlor at 1.5 kg/ha with adequate weed control and pod yields comparable with that of the hoe-weeded check has also been reported by (Lagoke, 2006).

P-78 Quantification of weed seed bank in organically grown maize - sunflower cropping system

J. Bhuvaneswari, C. Chinnusamy and P. Muthukrishnan
Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu)
e-mail: agribhuvana@gmail.com

A soil seed bank is the reserves of viable seeds present on the surface and in the soil. Seed bank is indicator of past and future weed problems. In this respect, knowledge of the weed seed bank is very important because it provides evidence of past field management and may facilitate forecasts on future weed problems. Field experiments were conducted during *kharif* and *rabi* seasons of 2007-08 and 2008-09. The treatments includes stale seedbed technique (SSB), *insitu* green manure cowpea incorporation at 45 DAS, crop residue mulch at 5 t/ha, twin wheel hoe weeding twice at 20 and 40 DAS, HW twice at 20 and 40 DAS, SSB + *insitu* green manure cowpea incorporation at 45 DAS, SSB + crop residue mulch at 5 t/ha, SSB + twin wheel hoe weeding at 40 DAS, SSB + HW at 40 DAS, twin wheel hoe weeding at 20 DAS + HW at 40 DAS along with unweeded control. Individual weed seed germination was recorded cumulatively upto seven days. After 15 days, the germinated weed seedlings were uprooted and the soil was treated with GA_3 to induce dormant weed seeds for germination and further seed germination was recorded for every kg of soil. Weed flora in soil weed seed bank were *Dactyloctenium aegyptium*, *Panicum javanicum*, *Echinochloa colonum*, *Cynodon dactylon*, *Chloris barbata*, *Trianthema portulacastrum*, *Parthenium hysterophorus*, *Digera arvensis* and *Cyperus rotundus*. In maize, density of grasses, broad leaved weeds and total weeds were influenced by weed management methods during both the years. Hand weeding twice recorded lower density of grasses, broad leaved weeds and total weeds while unweeded control recorded higher density of grasses, sedge and broad-leaved weeds and total weeds in both the years maize crops. In sunflower, weed control treatments failed to influence the density of all groups of weeds. During both the years, there was significant difference observed only in grasses and broad leaved weeds. Hand weeding twice, twin wheel hoe weeding at 20 DAS + HW at 40 DAS and twin wheel hoe weeding at 20 and 40 DAS recorded lower density of grasses, broad leaved weeds and total weeds than unweeded control in sunflower during both the years. Higher density of grasses and broad leaved weeds and total weeds were observed in 0-15 cm depth of soil compared to 15-30 cm depth of soil in maize and sunflower cropping system. Among three groups of weeds, incidence of grasses in the soil weed seed bank was higher in maize and sunflower cropping period compared to broad-leaved weeds in all the treatments at 0-15 and 15-30 cm depth of soil. In general, grasses contributed the major share of mean relative density to the weed seed bank composition followed by broad-leaved weeds. Sedge was recorded only in unweeded control during both the years.

P-79 Weed management in vegetables crops

Vijay Kumar, Neeraj Shukla, Deo Shankar and D. Sharma
Department of Horticulture, CAIGKV, Raipur (Chhattisgarh)
e-mail : shuklaniraj@rediffmail.com

The areas under vegetable production has drastically increasing in Chhattisgarh state. Recently vegetables are cultivated in around 3.0 lakh ha area with a production of 29.2 lakhs metric tones in the state. There has been a proportionate increasing in weed problems with the liberal use of inputs like fertilizer and irrigation in vegetable crops. The problem is further aggravated in vegetable crops because and sewage water particularly in the urban areas. Moreover the short stature and slow initial growth of most of the vegetable crops invite the weed infestation. The integration of measures is prerequisite to control of weeds in vegetable crops. Proper crop rotation, fertilizer management, sowing and transplanting time, proper seed rate, water management, mulching and use of selective weedicides are the important integrated measures for the control of weeds in vegetable crops. It is easier and economical to obtain effective weed control by use of selective weedicide along with one mechanical hand weeding that ensures quick results in short period of time. Hence low productivity of vegetable crops (110 q/ha) can be enhanced by way of adopting proper weed management practices.

P-80 Yield and economics of maize - sunflower cropping system as influenced by non-chemical weed control methods

J. Bhuvaneswari, C. Chinnusamy and P. Muthukrishnan
Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu)
e-mail: agribhuvana@gmail.com

In India, maize occupies 7.42 million hectares with a production and productivity of 14.72 million tonnes and 1983 kg/ha, respectively. Total area under sunflower in the World is about 21.7 million hectares and the total production is about 26.8 million tonnes. Presently, India has the 4th largest area of 2.01 million hectares under sunflower cultivation in the world. Its share in World production is about five per cent and accounts for ten per cent of the world acreage. However, the yield of 539 kg/ha is lower among the major sunflower producing countries in the World. The experiment conducted during *kharif* and *rabi* seasons of 2007-08 and 2008-09 and treatments consisted of stale seedbed technique (SSB), insitu green manure cowpea incorporation at 45 DAS, crop residue mulch at 5 t/ha, twin wheel hoe weeding twice at 20 and 40 DAS, HW twice at 20 and 40 DAS, SSB + insitu green manure cowpea incorporation at 45 DAS, SSB + crop residue mulch at 5 t/ha, SSB + twin wheel hoe weeding at 40 DAS, SSB + HW at 40 DAS, twin wheel hoe weeding at 20 DAS + HW at 40 DAS along with unweeded control for both the crops In maize, HW twice at 20 and 40 DAS registered higher maize grain (5638 and 5831 kg/ha) and stover yields (9090 and 9270 kg/ha) which were comparable with twin wheel hoe weeding at 20 DAS + hand weeding at 40 DAS. In sunflower also, hand weeding at 20 and 40 DAS registered higher sunflower seed (1288 and 1410 kg/ha) and stalk yields (3500 and 4035 kg/ha) which was comparable with twin wheel hoe weeding at 20 DAS + HW at 40 DAS during both the years. In maize, higher net returns of Rs.16,566 and 18,285 /ha with twin wheel hoe weeding at 20 DAS + HW at 40 DAS during both years. Higher benefit of Rs.1.59 and 1.65 were obtained with twin wheel hoe weeding at 20 DAS + HW at 40 DAS during both years, respectively. In sunflower, higher net returns of Rs.12843 and 16163/ha with twin wheel hoe weeding at 20 DAS + HW at 40 DAS and twin wheel hoe weeding twice during first and second years respectively. Higher benefit of Rs.2.17 and 2.38 were obtained with twin wheel hoe weeding at 20 DAS + HW at 40 DAS during both years. Hand weeding twice at 20 and 40 DAS, increase the productivity and per day return of maize-sunflower cropping system in the western zone of Tamil Nadu. Twin wheel hoe weeding at 20 DAS + hand weeding at 40 DAS could be adopted as suitable weed management method to obtain higher economic returns per rupee invested on cost of cultivation in maize-sunflower cropping system in labour scare areas.

P-81 Prospects of integrated weed management in vegetable crops

Deo Shankar, Vijay Kumar, Neeraj Shukla, D. Sharma and Saket Dubey
Department of Horticulture, College of Agriculture I.G.K.V., Raipur (Chhattisgarh)
e-mail: deotcr@yahoo.com

Yield loss caused by the weeds are more than pest and diseases. The weed control can be done by the different ways. The vegetable crops are herbs and so they are very sensitive to tolerate the strong chemicals like weedicides. The most effective, time saving and economical approaches include feasible integrated weed control management in vegetable crops. The preventive methods like use of clean seed, prevention of soil and sand from infected area and prevention of the flowering of weeds near the cultivated area would also be beneficial to reduce the weed population. The mechanical methods like hand plucking hand weeding, hoeing and burning are the physiological methods which also be beneficial to reduces the weed populations. The cultural methods are also beneficial for reducing weed populations. The proper crop rotation, use of plastic methods and drip irrigation drastically reduces the weed population. The chemical weed control is also effective to control weeds during vegetable cultivation. The use of plastic mulch checks the germination and growth of weeds and also effective to reduce water evaporation. The drip irrigation also effective to suppress weed population with increasing yield of vegetables. The integrated weed management not only reduces the weed population, but also gives the additional advantages to farmers.

P-82 Integrated weed management in sugarcane ratoon

D. Singh, D. K. Roy, N. K. Sinha and D. N. Pandey
Department of Agronomy, Rajendra Agricultural University, Bihar Pusa, (Samastipur)
e-mail: dr_dhirendra_krroy@yahoo.com

A field experiment was conducted at Sugarcane Research, New Area Farm under Rajendra Agricultural University, Pusa, Bihar,during the cropping seasons of 2006-07, 2007-08 and 2008-09 to study the integrated weed management in Sugarcane. The experiment was laid out in a randomized block design with three replications. The experiment comprised of six weed management treatments *viz*. T_1 : atrazine 2.0 kg/ha PE on 3 DAP; T_2 : atrazine 2.0 kg/ha PE on 3 DAP + 2, 4-D 1.25 kg/ha as POE on 75-90 DAP; T_3 : 2, 4-D 1.25 kg/ha as POE on 75-90 DAP; T_4 : metribuzine 0.88 kg/ha as PE *fb* one hoeing at 45 DAP *fb* 2, 4-D (Na salt) 2.5 kg/ha a 90 DAP; T_5 : hand weeding thrice on 30, 60 and 90 DAP and T_6 : weedy check. The results revealed that the lowest weed count and weed dry weight and the highest weed control efficiency were recorded under hand weeding thrice on 30, 60 and 90 DAP which was followed by the treatment metribuzin 0.88 kg/ha PE *fb* one hoeing at 45 DAP *fb* 2, 4-D (Na-Salt) 2.5 kg/ha at 90 DAP. The highest number of millable cane and cane yield were also recorded by hand weeding thrice on 30, 60 and 90 DAP which was at par with the treatment metribuzin 0.88 kg/ha PE fb one hoeing at 45 DAP *fb* 2, 4-D (Na Salt) 2.5 kg/ha at 90 DAP and atrazine 2.0 kg/ha PE on 3 DAP + 2, 4-D 1.25 kg/ha as POE on 75-90 DAP. However, the highest net gain over weedy check was recorded by atrazine 2.0 kg/ha P.E. on 3 DAP + 2, 4-D 1.25 kg/ha as POE on 75-90 DAP followed by 2, 4-D 1.25 kg/ha as POE on 75-90 DAP.

P-83 Studies on herbicide application in wheat under zero and conventional tillage

Geet Sharma, H. P. Agrawal, K. L. Nandeha and O. P. Kashyap
IGKV, TCB College of Agriculture And Research Station, Sarkanda , Bilaspur (C.G.)
e-mail- sharmageet@yahoo.co.in

Zero tillage aggravates the problems of perennial and annual weeds, which are difficult to control. If these weeds are not controlled in time, they reduces the wheat yield up to 10 to 50 percent. Therefore, present study was conducted to evaluate the requirement of herbicides and their combination for raising wheat crop with different tillage method. A field experiment was carried out in two *rabi* season of 2004-05 and 2006-07 after harvesting of rice at Reseach Station, Sarkanda, Bilaspur in split –plot design with three replications. Two tillage method *viz* .zero and conventional tillage taken as main plot and two herbicides namely isoproturon as pre and post , 2,4-D as post and their combination along with control taken in sub-plot. All the recommended package of practices were applied to raise the experimental crop. Under conventional tillage treatment land of plots was prepared by tractor drawn cultivator and rotavator.

The tillage practices did not influence the intensity as well as dry biomass of weeds at 25 DAS, however at 50 DAS under conventional tillage significantly higher density of weeds were recorded in comparison to zero tillage but dry weight of weeds were statistically at par under both tillage. After 25 day of sowing, pre-emergence application of isoprotoron resulted in significantly lower weed density and biomass. After 50 day of sowing combination of pre-emergence isoproturon followed by post-emergence 2,4-D recorded lower weed density & biomass which was statistically at par with pre-emergence application of isoproturon followed by post emergence application of isoproturon combination of pre and post emergence application of herbicides were found significantly better is reducing the dry weight and intensity of weeds then their alone application and weedy check.

P-84 Reasons of poor efficacy of herbicides in wheat

O. P. Lathwal, Hari Om, Surender Tamak[1], S. S. Punia[2] and Ashok Yadav[2]
Krishi Vigyan Kendra, Department of Agriculture, Kurukshetra (Haryana)[1]
Department of Agronomy, CCSHAU, Hissar (Haryana)[2]
e-mail : jagir@hau.ernet.in

There are specific recommendations of different herbicides and their application techniques. Though there is extension web for disseminating the recommended and latest technologies, yet the adoption pattern of recommended package of practices including usage of herbicides in wheat is not worth satisfying and full efficacy of herbicides has not been obtained in wheat at farmers' fields. Therefore, it has become important to find out the reasons of partial efficiency of applied herbicides to realize the maximum control of weeds in wheat crop. In order to assess the adoption pattern of herbicide spraying techniques in wheat a comprehensive survey was undertaken in potential wheat growing district Kurukshetra (Haryana) where rice-wheat cropping sequence is prevalent for the last four decades. Also the herbicide resistance was first noticed here itself during early nineties of previous century. During survey in 2008-09, the 240 farmers were interviewed across the district to collect the information on time of application of weedicides, type of nozzle used in spraying and volume of water per unit area for spraying of herbicides. Only 54.2 % farmers applied herbicides at 35-40 days after sowing (DAS) in 52% area under wheat irrespective of brands of different herbicides. A large number of farmers accounting 34.6% and 11.2% applied herbicides late and extra late (40-45 and 45-60 DAS, respectively) covering 36.5 and 11.3% area of wheat grown during 2008-09. The late application resulted in 27 and 16% yield reductions when compared with timely application. Maximum farmers (61.5%) used flood jet nozzle) in 64.5% of total wheat area and realized about 8% yield losses. All the farmers used less quantity water per unit area in spraying of herbicides. About 14% farmers used less than half of recommended quantity of water covering about 20% wheat area getting 13% less grain yield. Majority of the farmers (74%) used 300-337.5 liters water per ha in 72% area registering about 8% yield loss in comparison to users of more volume (375 liters) accounting 11.5% farmers covering only 8% area under wheat. The farmers apply herbicides late for controlling the second flush of weeds. The use of non-recommended nozzle along with less volume of water facilitates the farmers and hired professionals engaged in spraying of herbicides for their convenience of consuming lesser time in spraying.

P-85 Integrated practices for weed management in rainfed corn in northern hill region of Chhattisgarh

A. K. Tripathi, S. K. Sinha and J. P. Harinkhere
IGKV, RMD College of Agriculture &Research Station, Ambikapur (C.G.)
e-mail : arunkumartripathi@rediffmail.com

Hand weeding twice and pre-emergence spray of atrazine-HW registered significantly minimum weed density and biomass at 60 DAS, as compared to other weed control treatments in Front Line Demonstrations conducted in different villages of district Surguja during the years 2008 and 2009. Mechanical weeding by spade between two rows with a follow up HW could also restrict weed growth satisfactorily,but mechnical weeding without HW could not prove much effective. Comparatively weed free environment provided by atrazine-HW resulted better growth and yield (57 quintal/ha)and hand weeding twice also gave comparable yield (54.2 q/ha). Integration of mechanical weeding ith spade and hand weeding produced 52.6 q/ha which is at par with twice HW. Mannual weeding or mechanical weding with implements without HW did not prove effective as evident from an yield loss of 30 to 50.5 %. Being cost effective with better WCE, atrazine + hand weding resulted maximum B:C ratio (4.87) as compared to 4.36 wih HW twice. Though maize yields are marginally lower with mechanical weeder like spade with or without HW, B:C ratios were higher (4.30 and 4.21), respectively)compared to HW twice(2.09). As mannual weeding is labour intensive and chamical weeding cause environmental concern. One HW with pre emergence application of atrazine is the best available alternative.

P-86 Efficacy of carfentrazone and pinoxaden with and without surfactant against grassy and broady leaf weed in wheat

Naushad Khan, R. A. Yadav and R. N. Dixit
Dept. of Agronomy, CSAUA Technology, Kanpur (U.P.)
e-mail : ramashish94@yahoo.in

A field experiment was carried out during *rabi*, 2008-2009 at Student's Instruction Farm of C. S. Azad University of Agriculture and Technology, Kanpur to find out efficacy of carfentrazone and pinoxaden with and without surfactant against grassy and broad leave weed in wheat. The experimental field having neutral pH, normal salt concentration, low organic carbon and medium available phosphorus and potassium. The Experiment comprising 10 treatments *viz* weedy, weed free, carfentrazone 15 g/ha fb pinoxaden 30 g/ha carfentrazone 20 g/ha fb pinoxaden 35 g/ha carfentrazone 25 g/ha fb pinoxaden 40 g/ha pinoxaden 30 g/ha fb carfentrazone 15 g/ha with ammonium sulphate (1%), pinoxaden 35g/ha fb carfentrazone 25 g/ha, pinoxaden 40 g/ha fb crafentrazone 25 g/ha with ammonium sulphate (1%), carfentrazone 25g/ha and pinoxaden 40 g/ha were tested in Randomized Block Design with three replications. The weed populations /m^2 of broad leaved weeds *viz*, *Coronopus didymus* (5.33), *Chenopodium album* (11.33) and *Anagallis arvensis* (6.6) was found significantly minimum with the application of carfentrazoine 25g fb pinaxoden 40 g and were observed significantly higher in unweeded plot at 60 days after sowing. The poputation of *P.minor* (2.66) was counted significantly minimum with application of pinoxaden 40 g fb carfentrazone 25 g with ammonium sulphate (1%) and recorded significantly higher in unweeded plot (28.00) at harvest. The population of broad leave weeds *viz Convolvulus arvensis* and *Chenopodium album* was significantly minimum with the application of carfentrazone 25 g/ha fb pinoxaden 40 g and higher in unweeded plot. It is a revealed that the weed dry weight (g/m^2) was significantly affected by different treatment at 60 day after sowing and at harvest. The significantly minimum weed dry weight was observed with the application of carfentrazone 25 g/ha fb pinoxaden 40 g and minimum under unweeded plot. The significantly better response regarding yield attributing characters and yield was manifested with the application of carfentrazone 25 g fb pinoxaden 40 g. The significantly maximum yield (49.20 q/ha) and net return (Rs. 38867/ha) was f*etc*hed under that treatment.The unweeded plot treatment showed significantly minimum yield (43.12 q/ha) and net return (Rs.31573/ha)

P-87 Nutrient uptake relationship between weeds and wheat (*Triticum aestivum* L.*)* as influenced by different weed management practices

Purshotam Singh[1], Parmeet Singh, Rekhi Singh, F. A. Bahar, K. N.Singh and O. P.Mishra
SKUAST-K, Post Box No. 1405, GPO, Srinagar, Kashmir (J&K)
E-mail: drpurshotam@gmail.com

A field experiment was conducted during the *winter* seasons of 2001-02 and 2002-03 at CRC of GBPUA&T Pantnagar, Udam Singh Nagar. Isoproturon 1.5 Kg/ ha + 2,4-D with organic matter through *Sesbania aculeate* in summer and Isoproturon 1.5 Kg/ ha+ hand weeding were found effective in increasing nutrient uptake by wheat and reducing nutrient uptake by weeds, thus resulting in higher grain and straw yield. Uptake of nutrients by weeds showed a significant negative correlation with uptake of nutrients by wheat and wheat yield. The association was strongly significant with nutrient uptake by wheat straw and straw yield. The magnitude of reduction in uptake of nutrients by the crop with one kg/ ha increase in uptake of nutrients by weeds was estimated to be 6.433 and 2.928 kg/ ha of nitrogen by grain and straw respectively, 4.946 and 11.647 kg/ ha of phosphorus by grain and straw respectively and 3.186 and 13.275 kg/ ha of potassium by grain and straw respectively. Also the magnitude of reduction in yield of wheat grain and straw for one kg/ ha increase in nitrogen uptake by weeds was estimated to be 439.394 and 600.939 kg/ ha of wheat grain and straw respectively, for one kg/ ha increase in phosphorus uptake by weeds was estimated to be 1379.931 and 1904.422 kg/ ha of wheat grain and straw respectively and for one kg/ ha increase in potassium uptake by weeds was estimated to be 662.692 and 930.405 kg/ ha of wheat grain and straw respectively.

P-88 Evaluation of pinoxaden in combination with metsulfuron against complex weed flora in barely

Sanjeev Kumar, Naresh Sangwan and S. S. Punia
Department of Agronomy, CCS HAU, Hisar (Haryana)
e-mail : jagir@hau.ernet.in

Barley (*Hordeum vulgare* L.) crop is infested with both grassy and broadleaf weeds. In south-western Haryana, infestation of *Avena ludoviciana* is increasing at an alarming rate in barely crop and in north-eastern Haryana, crop being grown after rice is mainly infested with *P.minor* along with broadleaf weeds such as *Rumex martimus*, *Anagallis arvensis* and *C.album*. So there is urgent need for broad-spectrum herbicides which can provide effective control of complex weed flora in barley.

An experiment to evaluate the bioefficacy of pinoxaden (5 EC) in combination with metsulfuron in barley was conducted at CCS HAU Hisar during *rabi* seasons of 2008-09, at Agronomy Research Area of CCS Haryana Agricultural University, Hisar. The treatments comprising of pinoxaden (5 EC) at 40, 45 and 50 g /ha alone and in combination with metsulfuron at 4 g/ha either as tank mixture or their sequential application 7 days before or after pinoxaden use, were applied at 35 and 42 DAS by flat fan nozzle delivering 375 l/ha volume. To see the residual toxicity of this herbicide, sorghum crop was planted after harvesting of barley without disturbing the original layout. The dominant weeds in experimental field were little seed canary grass (*Phalaris minor* Retz.) and *Avena ludoviciana* among grassy weeds, *Chenopodium album* L.(40.8%) *Rumex retroflexus* L. (13.3%), and other weed species (10%) were present as broadleaf weeds.

Application of pinoxaden at 40, 45 and 50 g/ha provided excellent control of grassy weeds. Metsulfuron at 4 g/ ha gave 100 % control of broadleaf weeds The tank mix application of pinoxaden with metsulfuron in various combinations proved significantly effective in reducing density and biomass of weeds and gave 100 % control of broadleaf and 97 % control of grassy weeds. Tank mixing of pinoxaden + metsulfuron at 45 + 4 and 50 + 4 g/ha caused complete mortality of all grassy as well as broadleaf weeds. Sequential application of metsulfuron either 7 days before or after use of pinoxaden also provided excellent (95-100%) control of both grassy as well as broadleaf weeds without any phytotoxic effect on crop. Number of grains per spike, spike length and plant height were also maximum with the use of pinoxaden+ metsulfuron as tank mixture at 50+4 g/ha. All the herbicide treatments registered significantly higher crop yield over weedy check. Maximum grain yield (4913 kg/ha) was recorded in pinoxaden+ metsulfuron at 50+4 g/ha which was statistically at par with weed free and all treatments involving pinoxaden and metsulfuron .Residues of pinoxaden alone or in any combination with metsulfuron did not cause any residual effect on succeeding sorghum crop in terms of no. of plants per metre row length, plant height and fodder yield.

P-89 Studies on residual effect of herbicides applied in *rabi*-maize on succeeding rice crop

S. S. Singh, R. K. Pathak and A. K. Singh
Dept. of Agronomy, N.D. University of Agriculture and Technology, Kumarganj, Faizabad (U.P.)
e-mail: aksnduat@gmail.com

Field trials were laid out during *kharif* 2008 and 2009 in a randomized block design with four replications at Agronomy Research Farm as well as weed science laboratory of Faizabad. The application of arazine 1.5 and 3.0 kg/ha, pendimethalin 1.0 and 2.0 kg/ha at pre-emergence in *rabi* maize did not show their significant observations regarding weed density/m, weed dry weight/gm and grain yield of rice q/ha. Results revealed that atrazine 1.5 and 3.0 kg/ha, pendimethalin 1.0 and 2.0 kg/ha and isoproturon 1.0 and 2.0 kg/ha, at pre-emergence applied in *rabi*-maize to control the weeds did not show any residual effects on weed density, weed dry weight and succeeding crop rice yield.

P-90 Influence of tillage on weed density in maize - sunflower cropping system

P. Murali Arthanari, N. K. Prabhakaran and C. Chinnusamy
Department of Agronomy, TNAU, Coimbatore (Tamil Nadu)
e-mail : agronmurali@gmail.com,

Tillage or soil surface manipulation to obtain desired seedbed is a major input in agricultural production and helps in controlling weeds by different ways. Weeds cause considerable yield losses to the crops. The optimum tillage practices combined with effective weed control method is to be identified for efficient weed management. Hence, a field experiments to develop information on weed population dynamics in cropping system as influenced by tillage and weed management methods under irrigated condition was conducted at Tamil Nadu Agricultural University farm in split plot design during *kharif 2009* and *rabi 2009* with the objective of the long term effects of tillage on weed population dynamics in maize - sunflower cropping system. The main plot treatments of experiment consisted of four tillage methods and two weed management methods were adopted for both the crops in the system. They are zero tillage – zero tillage [ZT – ZT, (T_1)], zero tillage – conventional tillage [ZT – CT (T_2)], conventional tillage – zero tillage [CT – ZT (T_3)] and conventional tillage – conventional tillage [CT – CT (T_4)]. The sub plots consists of hand weeding on 25 & 45th DAS (W_1) and unweeded control (W_3) for both the crops, atrazine 0.5 kg/ha hand weeding on 45 DAS to maize and pendimethalin 1.0 kg/ha hand weeding on 45 DAS to sunflower (W_2). General weed flora of the experimental fields consisted of six species of grasses, nine species of broad leaved weeds and a sedge weed. *Cynodon dactylon, Dactyloctenium aegyptium, Panicum repens, Echinochloa colonum, Setaria verticiliata and Rotobella cochinsinensis* under grasses. *Cyperus rotundus* under sedges and *Trianthema portulacastrum, Amaranthus viridis, Boerhaavia diffusa, Digera arvensis, Datura metal, Parthenium hysterophorous, Euphorbia prostrate, Corchorus trilocularis, Portulaca quadrifida* under broad leaved weeds. The density of weeds in the cropping system was significantly higher in ZT-ZT followed by CT-ZT at 60 DAS and harvest stages. The same trend was observed for different species of grass and broad leaved weeds under different tillage methods. Total weed density was significantly lower in CT-CT followed by ZT-CT. Under weed management methods, W_1 recorded significantly lower sedge, grass and broad leaved weed density. The weed density was higher in W_3. Generally the relative density of grass weeds was higher and followed by broad leaved weeds and sedges. At 60DAS, relative density of sedges and grassy weed were higher in CT-ZT. Relative density of broad leaved weeds was higher in CT-CT. At harvest, relative density of grasses and sedge weeds were higher in ZT-CT followed by ZT-ZT. With respect to Weed control efficiency, it was higher in CT-CT and was comparatively lower in ZT-ZT and moderate in ZT-CT and CT-ZT at both 60 DAS and harvest among tillage methods. Under weed management methods, W_2 recorded comparatively higher weed control efficiency at both 60 DAS and harvest. From the results, it is concluded that continuous zero tillage encourages more of grass weeds and increases the compaction of soil and Conventional Tillage practice reduces the weed density which enhances the good crops growth.

P-91 Organic weed management in maize-sunflower cropping system in western zone of Tamil Nadu

J. Bhuvaneswari, C. Chinnusamy and P. Muthukrishnan
Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu)
Email: agribhuvana@gmail.com

Organic weed management emphasizes balancing the detrimental effects of weeds (like loss of crop quality or yield) with the beneficial aspects (like biodiversity or pest control). Weed control is a major concern for organic farmers around the world and a perceived hurdle for those thinking of converting. Non-chemical weed control methods are now the subject of many research and development programmes that strive towards

overcoming one of the major challenges remaining in organic agriculture. The experiment conducted during *kharif* and *rabi* seasons of 2007-08 and 2008-09 and treatments consisted of stale seedbed technique (SSB)(T_1), *insitu* green manuring cowpea at 45 DAS (T_2), crop residue mulch at 5 t/ha (T_3), twin wheel hoe weeding twice at 20 and 40 DAS (T_4), HW twice at 20 and 40 DAS (T_5), SSB + *in situ* green manuring of cowpea at 45 DAS (T_6), SSB + crop residue mulch at 5 t/ha (T_7), SSB + twin wheel hoe weeding at 40 DAS (T_8), SSB + HW at 40 DAS (T_9), twin wheel hoe weeding at 20 DAS + HW at 40 DAS (T_{10}) along with unweeded control (T_{11}) for both the crops. Maize variety CoH (M)5 and sunflower variety Co 4 were used for the experiment.

Weed flora of the experimental field were *Dactyloctenium aegyptium*, *Panicum javanicum, Chloris barbata*, *Cynodon dactylon*, *Trianthema portulacastrum*, *Digera arvensis*, *Parthenium hysterophorus* and *Cyperus rotundus*, in both maize and sunflower, lower density of total weeds and dry weight were recorded with HW at 20 and 40 DAS (T_5), followed by twin wheel hoe weeding at 20 and 40 DAS (T_4) and twin wheel hoe weeding at 20 DAS + HW at 40 DAS (T_{10}). Obviously, higher total weed density was recorded under unweeded control. All the mechanical weeding (T_4, T_5, T_8, T_9 and T_{10}) treatments significantly reduced the density of late emerging weeds and dry weight compared to other treatments. In the second year (2008-09) maize and sunflower also similar trend was observed in reducing the total weed density and dry weight. In maize, HW twice registered higher WCE of 87.6 and 92.4 per cent at 40 and 60 DAS, respectively. Lower WCE was recorded in the treatment of SSB (T_1), SSB + twin wheel hoe weeding at 40 DAS (T_8) and SSB + HW at 40 DAS (T_9) at 40 DAS and SSB (T_1) (34.6 per cent) at 60 DAS. In the second crop (2008-09), HW twice (T_5) registered higher WCE of 90.1 and 93.5 per cent at 40 and 60 DAS, respectively. In sunflower, HW twice (T_5) registered higher WCE of 86.5 and 91.9 per cent at 40 and 60 DAS, respectively. In the second crop (2008-09) also, HW twice (T_5) registered higher WCE of 92.7 and 94.7 per cent at 40 and 60 DAS, respectively. Hand weeding twice at 20 and 40 DAS can keep the weed density and weed dry weight below the economic threshold level and increase the weed control efficiency in maize-sunflower cropping system.

P-92 Influence of *Chromolaena odorata* compost on growth and yield of finger millet (*Eleusine coracana* Gaertn.)

Kumar Naik, A. H., Ramachandra Prasad, T. V., Kiran Kumar, V. K and Pramod, G.
DWSRC, UAS, Main research Station, Hebbal, Bengaluru (Karnataka)
E- mail: kumarnaikah@gmail.com

Chromolaena odorata is an invasive weed posing problems in plantation crops and replacing existing fauna in high rainfall areas of Karnataka. *Chromolaena* produces 3 to 4 kg biomass/m2 in non-cropped areas in high rainfall areas and contains nutrients (2.63 % N, 0.46 % P, 2.10 % K, 1.31 ppm Ca and 0.14 ppm S) equivalent to that of traditional green manure crops- Glyricidia (2.0 % N, 0.38 % P, 1.9 %K, 2.2 ppm Ca and 0.27 ppm S). It's utility for composting or green manure can serve as alternative strategy to contain the weed. Field study was planned under this context at Main Research Station, Hebbal, University of Agricultural Sciences, Bengaluru, during *kharif* 2003 in irrigated finger millet. The treatments comprised of various combinations of *Chromolaena* compost with recommended dose of fertilizer (RDF- 100 kg N, 50 kg P2O5, and 50 kg K2O), RDF+ farm yard manure (FYM), RDF alone and unfertilized control. Finger millet receiving recommended fertilizer alone resulted in significantly lower total dry matter production per plant, yield (3637 kg/ha) and yield components than various combination of *Chromolaena* compost with RDF and RDF+ FYM. Grain yields due to application of *Chromolaena odorata* (90%) + cow dung slurry (10%) + microbial slurry + rock phosphate at 7.5 t/ha+RDF (5367 kg/ha) and *Chromolaena odorata* (90%) + cow dung slurry (10%) + microbial culture at 7.5 t/ha+RDF (5142 kg/ha) were comparable to yield obtain in RDF+ FYM 7.5 t/ha (5269 kg/ha). Absolute control gave the lowest yield (1580 kg/ha). Thus *Chromolaena* can be used for composting to get yields comparable to FYM and this method will be an alternative strategy to lower the menace of weed.

P-93 Metribuzin phytotoxicity in pea and chickpea

Bhumesh Kumar and Jay G. Varshney
Directorate of Weed Science Research, Jabalpur (M.P.)
Eamil:kumarbhumesh@yahoo.com

Metribuzin is a selective triazinone herbicide which inhibits photosynthesis. It is used for control of annual grasses and numerous broad leaf weeds in field and vegetable crops. Weed management in pulse crops has been a problem and efforts are being made to find some suitable molecule which can provide an effective weed control in pulse crops. The purpose of this study is to understand the differential phytotoxicity of metribuzin in pea and chickpea to study the genotypic variation in metribuzin tolerance in these pulse crops. Metribuzin (0, 125, 250 and 500 g/ha, post-emergence) treatments were given at 21 days of sowing and observations were recorded after 24 h and 7 days (recovery) after metribuzin treatment. Chickpea showed complete mortality and could not survive even at the lowest dose of metribuzin; hence no observations could be recorded. Different varieties of pea used in this study showed wide difference in toxicity to metribuzin. Initially all the varieties showed almost complete cessation of electron transport between the two photosystems even at the lowest dose of metribuzin (125 g/ha) and interfere with the process of CO_2 fixation due to deficiency of reducing equivalents. After 7 days recovery, both rate of electron transport as well as photosynthesis improved and again wide differences were observed within varieties in the extent of recovery. In addition, transpiration rates, stomatal conductance and other related parameters also showed significant variations within varieties. Chlorophyll 'a' and 'b' as well as carotenoids contents were decreased in metribuzin treated plants thus can be a contributing factor to the adverse effects on photosynthesis. Varietal differences in carotenoids content observed in this study may be of significance as these provide protection against photo-oxidation especially when process of electron transport inhibited by metribuzin application. Unlike chickpea, most of the pea varieties used in this study can tolerate metribuzin upto 250 g ai ha^{-1}, however some varieties even can survive at the 500 g ai ha^{-1} of metribuzin. Another important aspect was the accumulation of reactive oxygen species and again differential behavior was observed in terms of hydrogen peroxide accumulation at recovery which can serve as a good indicator for screening of varieties for metribuzin toxicity.

P-94 Integrated weed management in mungbean (*Vigna radiatus* L.)

R.B. Yadav, Vivek, Raghuvir Singh and S.S. Tomar
Sardar vallabh bhai patel university of Agriculture & Technology, Meerut (U.P.)
e-mail : wc-sst@yahoo.co.in, desrvskvv@rediffmail.com

A field experiment was conducted at Meerut to study the effect of weed management practices of Mungbean, during *kharif* 2008-09 and 2009-10. The soil of experiment site was sandy loam in texture low in organic carbon, medium in available phosphorus and potassium with pH 7.7. Ten weed control treatments consisting weedy, weeding at 20 and 45 DAS, weeding at 20 DAS fb (followed by) hoeing at 45 DAS, weeding at 20 DAS fb hoeing (5 tined hoeing) 45 DAS, hoeing at 20 and 45 DAS (5 tined hoeing), hoeing at 20 and 45 DAS, pendimethalin at 1.0 kg/ha, pendimethalin at 0.5 kg/ha + weeding at 30 DAS, pendimethalin at 0.5 kg/ha + hoeing at 30 DAS and pendimethalin at 0.5 kg/ha + hoeing (5 tined) at 30 DAS. Pendimethalin was applied as pre emergence with 1000 liter of water while SML 668 cultivar of mungbean was used. *Echinochloa spp., Trianthema monogyna, Parthanium hysterophorus, Ccysrus rotundus, Digra* arvensis, a*nd Cynodon dectylon* were the major weed species in the experiment site. All the weed control measures lead to significant reduction in the weed population and weed dry matter accumulation as compare to weedy check. Application of pendemethalin at 0.5 kg/ha followed by one hand weeding at 30 DAS demonstrated intended weed control (69.65 and 67.35 % WCE), produced the highest grain yield of mungbean (1226 and 1198 kg/ha), attributed lowest of weed density and weed dry matter accumulation however treatments namely two hand weeding at 20 and 45 DAS, weeding at 20 DAS fb (followed by) hoeing at 45 DAS, weeding at 20 DAS fb hoeing (5 tined hoeing) at 45 DAS, pendimethalin at 1.0 kg/ha, and pendimethalin at 0.5 kg/ha + hoeing at 30 DAS during both the years.

P-95 Influence of organic sources of nutrients on weed infestation in rice-chickpea and rice-wheat cropping system

Alok Tiwari, S. K. Sarawgi, Srikant Chitale and J. S. Urkurkar
Indira Gandhi Krishi Vishvavidyalaya, Raipur (C.G.)
e-mail : alok.1617@rediffmail.com

A field experiment was conducted during of 2008-09 at Raipur to investigate the Influence of organic sources of nutrients on weed infestation in rice - chickpea and rice - wheat cropping system. The experiment was laid in spilt plot design (three replications) with cropping system in main plot and nutrient sources in sub plot. In this study, four organic sources of nutrient (*viz*. NS1 - ½ each Enriched compost (EC) + Cow dung manure (CDM) , NS2 - ½ each Non edible oil cake (NEOC) + CDM, NS3 - ½ each NEOC + EC, and NS4 - ½ each NEOC + CDM + EC and NS5 - control i.e. no nutrient) were practiced in two cropping system. The green manure (GM) of sunhemp was sown on 10.06.2008 in all the plots except control under irrigated conditions. The green manure was incorporated at 42 days after seeding (22.07.2008). An overall average biomass production of sunhemp was 18.56 and 17.68 t/ha in rice- chickpea and rice-wheat system, respectively. Nitrogen, P and K contents of green manure were 2.60, 0.54 and 1.76%, in rice-chickpea system and 2.63, 0.48 and 1.76% in rice-wheat cropping system, respectively. The N, P and K addition to soil through green manure were 90.24, 18.54 and 61.05 kg/ha in rice-chickpea system and 88.93, 17.37 and 59.86 kg/ha in rice-wheat system, respectively. The phosphorus dose was calculated based on system requirement i.e. rice-wheat and rice-chickpea cropping system and phosphorus present in different sources of organic nutrients applied during *rabi*. The balanced quantity of phosphorus was applied by rock phosphate having 23% P_2O_5 during *kharif*. Each cropping system (main plot) was divided into four sub plots. Out of them GM crop was allowed to grow in four sub plots and/ one was taken as absolute control. Therefore, the results were tabulated and arranged after averaging the above treatments.Since, treatment during *rabi* was imposed on common treatment of GM and chickpea and wheat crop was grown after rice during *rabi*.

Seed yield of chickpea was significantly affected by various organic nutrient amendments over control. It was noticed that NS4 recorded significantly highest grain yield i.e. 8.27 q/ha and lowest 6.53 q/ha in control plots. However, all the sources of organic nutrients were at par with each other. Thus, the effect of different organic sources of nutrients did not visualize in respected of grain yield. However, the performance of control plot was comparable with different nutrient supply treatments. Effect of organic nutrient packages on stover yield of chickpea was also found non significant. Total dry weight of weeds was recorded at 30 DAS. In general, the dry weight of weeds was higher in chickpea as compared to wheat due to wider spacing in chickpea. Among organic packages, maximum dry weight of weeds (44.6 g/m^2) was recorded in NS1 in chickpea and minimum weed dry matter (30.8 g/m^2) was observed under NS3. While, in the control plot, lowest (28.6 g/m^2) weed dry weight was observed. The major weed flora was *Chenopodium album, Melilotus indica, Melilotus alba, Convalvulus arvensis* and *Phalaris minor* in chickpea.

Maximum dry weight of weeds (32.5 g/m^2) was recorded in NS1. Among different organic sources, minimum weed dry matter was observed under NS3. While, the control plot produced lowest (18.2 g/m^2) weed dry weight was observed. The major weed flora was *Chenopodium album, Melilotus indica, Melilotus alba, Convalvulus arvensis* and *Phalaris minor* in chickpea *Melilotus indica, Melilotus alba Chenopodium album Phalaris minor* and *Convalvulus arvensis* in wheat.

Results indicated that the grain and straw yields of wheat were significantly increased with different levels of organic sources over control. The yield of wheat was ranged between 15.3 to 18.9 q/ha in 2008-09 due to different nutrient sources. The NEOC+CDM+EC nutrient source gave significantly highest wheat grain yield (18.93 q/ha) over rest of the combinations. The control plot, where nutrient was not applied, produced 7.53 q/ha wheat which was far below (more than 100%) as compare to the treated plot.

P-96

Efficacy of diclosulam, on weeds and yield of soybean

S. P. Singh, V. Pratap Singh, R. C. Nainwal, Neeta Tripathi and A. Kumar
Deptt. of Agronomy, G. B. Pant Univ. of Agril. & Tech., Pantnagar (Uttarakhand)
e-mail : spdrsingh@gmail.com

Weeds are known to compete with cultivated soybean crop and reduce about 76 per cent yield due to weed infestation in India. Increased seed moisture content, seed contamination and seed splits when soybean were grown in high density of weeds. To overcome the deleterious effects of weeds in soybean, it is imperative that weed populations be kept below the economic threshold level. For this purpose, several pre-emergence and pre-plant incorporated herbicides are recommended to control the weeds in soybean crop. Fluchloralin and pendimethalin provide effective control of grassy weeds, but are less effective on broadleaf weeds and sedges. Thus, a research work was carried out at Pantnagar to evaluate the bio-efficacy of the pre-emergence herbicide diclosulam (84 WDG) for controlling the weeds in soybean crop.

The experiment was conducted during the rainy season of 2007 and 2008 at CRC of G.B.P.U.A.&T., Pantnagar. The experiment was laid out in randomized block design with three replications and 8 treatments consisting diclosulam 18, 22 and 26 g/ha, pendimethalin and fluchloralin each at 1.0 kg/ha, two hand weeding (30 and 45 DAS), along with weedy and weed free. All the herbicidal treatments except fluchloralin were applied at same day after sowing of treatment, whereas, fluchloralin was applied as pre plant incorporated one day before seed sowing.

The experimental plot was mainly infested with *Eleusine indica, Brachiaria ramosa, Digitaria sanguinalis, Eragrostis japonica, Echinochloa colona* among the grasses, *Lindernia ciliata, Eclipta alba* and *Trianthema monogyna* among the broad leaf weeds and only *Cyperus rotundus* among the sedges. Grasses, broadleaf weeds and only sedges accounted about 63, 19 and 18 percent of the total weed population in weedy plot at 60 days after sowing. Among the all herbicide treatments, diclosulam (84WDG) 26 g/ha was found most effective to suppress broad spectrum of weed species at all stages of crop growth as it resulted the lowest density and dry weight of all weed species. Among the herbicidal treatment, the highest weed control efficiencies 81 and 83 % during 2007 and 2008, was obtained with application of diclosulam 26 g/ha, followed by its 22 and 18 g/ha, which was also higher than the application of pendimethalin as pre emergence and fluchloralin as pre plant in

Amongst all the yield attributes, significant differences were obtained on number of pods per plant and grain yield during both the year of experimentation. Weedy plot recorded 57 per cent lower grain yield as compared to weed-free treatments. Application of diclosulam (84 WDG) at higher doses 22 and 26 g/ha yielded higher soybean yield which was similar to weed- free treatments during both the years. Application of lower dose of diclosulam (84 WDG) 18 g/ha also resulted statistically equal to plots treated with pendimethalin and fluchloralin. However, application of diclosulam at 22 to 26 g/ha was found as most promising herbicide to control the broad spectrum of weed species and yielded similar to the weed free situation of the crop.

P-97 Database management of invasive weeds through imported wheat samples in Maharashtra

Kambale R. S., Gaikwad, C. B, Bodake P. S and Kharde, S. G.
Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist- Ahmednagar(Maharashtra)
e-mail : cbgaikwad@inidiatimes.com

Some of the major alien invasive weeds that have entered the country include *Lanatana camara, Eichhornia crassipes Savlinia molesta, Parthenium hysterophorus*, *Chomolaena odorata, Mikania micrantha, Mimosa* spp. *etc*. Even in the wheat imported recently during 2006-07, seeds of five regulated weed species, *viz*., *Cenchrus tribuloides, Solanum carolinese, Viola arvensis, Cynoglossum officinale* and *Ambrosia trifida* have been intercepted by the Plant Quarantine Officials

The weeds *viz*. *Parthenium hysterophorus* and *Phalaris minor* which got introduced into India through imported wheat and their impact on agriculture and environment reviewed to learn from past and get prepared to overcome the potential threat new weed getting established and spread in the agricultural eco system through imported wheat. Therefore, early detections and eradication of these weeds is very much important. Otherwise they may spread and establish and may cause damage to our agriculture. National Invasive Weed Surveillance (NIWS) Project started form 8th May 2008 in 10 districts, *viz*. Solapur, Beed, Osmanabad, Latur, Jalana, Jalgaon, Aurangabad, Satara, Ahmednagar and Pune districts under this project imported wheat samples in 250 gm were collected from Public Distribution System FCI godowns and Taluka Kharedi Vikri Sangh of 5 districts, *viz*. Jalgaon, Aurangabad, Beed, Ahmednagar and Satara districs. Total 41 samples were collected from 41 different places in these districts. Weed seeds were separated from these samples and sown in earthen pots in *kharif* 2009-10.

P-98 Weed management in finger millet (*Eleusine indica* (L) Gaerth) under rain-fed region

Adikant Pradhan, Ashwani Thakur and Ashish singh[1]
S.G. College of Agriculture and research Station, Jagdalpur (C.G.)
[1]Department of Agronomy, JNKVV, Jabalpur (M.P.)
e-mail : zars_igau@rediffmail.com

An experiment was conducted on finger millet during *kharif* season of 2005, 2006 and 2007 at S.G. College of Agriculture and Research Station, Jagdalpur. The predominant weeds found in weedy check plot were *Echinocloa colona, Digitaria sangunalis, Cyperus rotundus,* and *Eleusine indica, and Celosia agirentium, Commelina benghalensis*, *Euphorbia geniculata* which were accounted as broad leaved and narrow leaved weeds flora respectively. Weed population and dry matter accumulation by weeds was significantly varied due to weed control treatments in three years of experimentation. The maximum weed population of broadleaved (120, 416 and 432) and narrow leaved (916, 858 and 959) were found in weedy check in 2004, 2005 and 2006 while dry matter of broad leaved (696, 663 and 662) and narrow leaved weeds (1271, 1134 and 514 g/m^2). The application of pre-emergence spray of isoproturon at 0.5 Kg ai/ha + two hand inter-cultivation (20 and 40 DAS) gave significantly minimum weed population and dry matter accumulation. T_8 (pre-emergence spray of isoproturon at 0.5 kg/ha + Two intercultivations produced maximum grain yield (19.02, 18.87 and 18.80 q/ha) after hand weeding.

P-99 Effect of different doses of atrazine on soil microflora, soil health parameters and plant microbial interaction in maize.

M. G. Patil, A. K. Gore, G. Y. Sonwane P. L. Sontakke and G. L. Sawargaonkar
DWSRC, Department of Agronomy, M.A.U. Parbhani (M.H.)
e-mail : plsontakke@gmail.com

A field experiment was conducted in a split ploat design with three replications to study the effect of different doses of atrazine on soil health parameters at DWSR Centre during *kharif* 2008. Different five treatments were used i.e (T1 = weedy check, T2 = mechanical weeding, T3 = atrazine at 0.75 kg/ha, T3 = atrazine at 1.50 kg/ha, T4 at 0.75 kg/ha Fb 2,4-D at 0.5 kg/ha). The soil sample were collected from rhizo sphere for all the microbial and bio-chemical analysis of soil. Soil was collected at 3 stages of crop growth *viz*. maximum vegetative growth stage (30 DAS), florwering state (50 DAS) and at harvest. Result during *kharif* season among various treatment were analysed statically. There were no significant changes in soil pH, EC and OC (organic carbon) due to different doses of atrazine. Basal soil respiration and microbial biomass carbon was influenced due to weed control treatment at 30 and 50 DAS. Where as differences were non significant at harvest. The significantly highest soil respiration was observed in T3 over rest of the treatment, at harvest where as microbial biomass carbon was highest T2 at 50 DAS and at harvest. Regarding microbial population the bacterial and fungal population were influenud due to weed control treatment at 30 and 50 DAS were as differences were non significant at harvest. Significantly highest microbial population were observed in T2 which was at par with T3 where as differences were non significant at harvest.

P-100 Impact analysis of chemical method of weed management in maize in the western zone of Tamil Nadu.

K. Govindarajan, C. Chinnusamy and P. Ayyadurai
DWSRC, Dept. of Agronomy, TNAU, Coimbatore (Tamil Nadu)
Email: kgr640@gmail.com

A study has been contemplated in the western zone of Tamil Nadu to assess the impact of the use of herbicides on yield, attitude of maize farmers towards integrated weed management in the western zone of Tamil Nadu. The study has observed that most of the farmers followed a cropping system of maize followed by pulses. Weed control in maize is a highly cumbersome operation as it involves more labour (both men and women) and capital intensive. The cost of chemical weed management was Rs. 573 per hectare while the mechanical method required Rs. 1938 per ha. It has reiterated the need for chemical mode of weed control. The difference in income realization between the adopters and non-adopters of IWM was studied and the results of the study revealed that adopters of integrated weed management has obtained an increased crop yield of 6.35 q/ha and Rs.7600/ha as difference in income than the non adopters. It clearly indicated the importance of IWM in controlling the weeds of maize. Among the various sources of technological information, the private input dealers were the primary source. The major factor that came in the way of farmers adopting the IWM was the technical reason (54.16%) which was followed by expenditure to be incurred (24.35%) in the purchase of modern inputs.

Results revealed that adoption of integrated weed management practices has increased the yield of maize and thereby increasing the farm income of farmers cultivating maize. This was proved by the partial budgeting analysis which has revealed a positive change in the income level of the farmers due to the adoption chemical means of controlling the weeds. The probability of farmers adopting the herbicide application for the control of weeds was mainly attributed to the factors like educational level and their awareness levels of the farmers about the benefits of the technology.

P-101 Efficacy of carfentrazone and pinoxaden with and without surfactant against grasses and broad leaf weed in wheat

D. Singh, D. K. Roy, N. K. Sinha and D. N. Pandey
Rajendra Agricultural University, Bihar, Pusa, Samastipur (Bihar)
e-mail : dr_dhirendra_krroy@yahoo.com

A field experiment was conducted at Crop Research Centre of Rajendra Agricultural University, Pusa, Bihar from 2007-08 and 2008-09 to evaluate the efficacy of carfentrazone and pinoxaden with and without surfactant against grasses and broad leaf weeds in wheat. The results revealed that the maximum reduction of weed indices was recorded in weed free condition followed by pinoxaden 40 g/ha *fb* carfentrazone 25 g (ammonium sulphate 1%), and pinoxaden 35 g/ha *fb* carfentrazone 20 g (ammonium sulphate 1%). The lowest weed dry weight were recorded under weed free condition which was closely followed by pinoxaden 40 g/ha *fb* carfentrazone 25 g/ha (ammonium sulphates 1%). The highest grain and straw yields were recorded by weed free condition which was found to be at par with pinoxaden 40 g/ha *fb* carfentrazone 25 g/ha (ammonium sulphate 1%).

P-102 Effect of tillage system and weed control measures on chemical and biological properties of wheat rhizospheve

A. K. Singh, Raj Kumar, S. S. Singh and Ved Prakash
Dept. of Agronomy, N.D.U.A.T., Kumarganj, Faizabad (U.P.)
e-mail: aksnduat@gmail.com

Field experiment was conducted during *rabi* season of 2008-09 at Faizabad to study the effect of tillage system and weed control measures on chemical and biological properties of wheat rhizosphere. Soil of the test site was silt loam with pH 8.1, EC 0.22 (dS/m) and OC 0.31%, available NPK 172.5, 18.5 and 257 kg/ha, respectively. The experiment was laid out in a split plot design with three replications. The treatments comprised of four tillage systems zero tillage and conventional in a main plots and three weed control measures (hand weeding, sulfosulfuron and weedy check in a sub plots. Results revealed that tillage system did not show any significant effect on chemical and biological changes at various stages of crop growth. Maximum microbial population was observed under zero tillage as compared to wheat sown through conventional tillage. In case of weed control treatments the significant impact was observed on biological properties at various growth stages. Interaction effect between tillage system and weed control measures was found non significant at all the days of intervals with respect to chemical and biological properties.

P-103 Integrated weed management in wheat (*Triticum aestivum* L.)

Vikas Kumar and Dheer Singh
Deptt. of Agronomy, G.B. Pant University of Agri. and Tech., Pantnagar (Uttarakhand)
e-mail : rohitash_1961@rediffmail.com

In a field experiment conducted during winter season of 2007-08, weeds were reduced significantly in weed management treatments over weedy check. Isoproturan 1.0 Kg/ha + one hand weeding (45 DAS) was found most effective for controlling weeds in wheat and recorded higher grain yield (41.07q/ha). Higher weed control efficiency (77.65%) and lowest weed index (3.41%) were also recorded in this treatment. Nutrient uptake by crop (wheat) was recorded highest in the treatments isoproturan 1.0 kg/ha (35 DAS)+ one hand weeding (45 DAS) which was at par to the treatment isoproturan 1.0 kg/ha + 2,4-D applied 0.5 kg/ha (35 DAS). Predominant weed flora in wheat crop was *Phalaris minor* (36.84%), *Chenopodium album* (20.89%), *Polypogon monspeliensis* (20.15%), *Medicago denticulata* (8.69%) and other weeds (*Rumex acetocella, Melilotus indica, Cyperus rotandus, Cronopus dedymus, vicia setiva and Anagallis arvensis*) were 13.43%. Reduction in grain yield due to weed infestation in weedy check was recorded 36.07%.

P-104 Integrated weed management in Urdbean

D. K. Chandrakar, N. K. Choubey, Hemlata Nirala and H. C. Nanda
Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.)
e-mail : dk_chandrakar@Rediffmail.com

In Chhattisgarh the pulse are grown in around 14.07 lac hactare area, out of which 4.97 hactare area is in *kharif* and 9.10 lac hactare in *rabi*. Urdbean is one of the major *kharif* pulse of upland grown in 2.12 lac hectare with productivity of 436 kg/ha.Slow initial growth of urdbean and favourable conditions for weed multiplication and a wide spectrum of heterogeneous weed flora, which gradually become a serious limitation for low productivity of urdbean. Hence present investigation was under taken to identify the integrated weed management in urdbean during *kharif* season. A field experiment was conducted during the rainy (*kharif*) season of 2009 at Research Farm of Indira Gandhi Agricultural University, Raipur (Chhattisgarh). The soil of the experimental field was clayey in texture (Vertisols), neutral in pH and had low nitrogen, medium phosphorus and high potassium content. The experiment consist of twelve treatments (W1-Weedy check, W2- hand weeding twice at 20 & 40 DAS, W3- pendimethalin 1.0 kg/ha as PE, W4- quizalofop ethyl 37.5 g/ha POE, W5- chlorimuron ethyl 4.0 g/ha POE, W6- fenoxapropp ethyle 50 g/ha POE, W7- quizalofop ethyl 37.5 g/ha+ chlorimuron ethyl 4.0 g/ha, W8- fenoxapropp ethyle 50 g/ha+ chlorimuron ethyl 4.0 g/ha, W9 imazethapyr 25 g/ha POE 15-20 DAS, W10- imazethapyr 40 g /ha POE 15-20 DAS, W11- chlorimuron ethyl 4.0 g/ha PPI, W12- Weed free plot.) was laid out in randomized block design with three replications. Sowing was done (variety: T U 94-2) with a seed rate of 20 kg/ha with a spacing of 30 cm row to row. A basal dose 20 kg N, 16 kg P_2O_5, 20 kg K_2O and 20 kg S was applied uniformly. Weed management treatments indicated that highest seed yield (712.66 kg/ha) of urdbean was recorded in the treatment weed free plot with maximum weed control efficiency (76.52%) followed by hand weeding twice at 20 and 40 days after sowing (695.00 kg/ha). Among the weedicide applied treatment the use of imazethapyr 40 g /ha as post emergence 15-20 days after sowing gave significantly higher seed yield (617.66 kg/ha) with highest wed control efficiency of 41.23%) thought it was at par to imazethapyr 25 g/ha as post emergence 15-20 days after sowing.

P-105 Performance of lentil to planting techniques, irrigation and integrated weed management

G. K. Shrivastava, D. K. Chandrakar, G. S. Tomar and N. Pandey
Department of Agronomy, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.)
e-mail : dk_chandrakar@rediffmail.com

Lentil is an important food legume, among more than a dozen pulse crops grown in Chhattisgarh. It is not only a rich source of improved nutrition for people but also provide nutritioun straw for cattle. It is grown in around 29 thousand hectare area with average productivity (269 kg/ha) of too less in comparison to national average (791 kg/ha). Slow initial growth of lentil and favourable conditions for weed multiplication and a wide spectrum of heterogenous weed flora, which gradually become a serious limitation for low productivity of lentil. A field experiment was conducted during *rabi* season of 2004-05, 2005-06 and 2006-07 at Research Farm. The soil of the experiment field was clayey in texture (Vertisols). The soil was neutral in pH and had low nitrogen, medium phosphorus and high potassium content. Experiment consisted of three planting techniques i.e. raised bed, flat bed and zero tillage and two irrigation levels i.e. no irrigation and one irrigation at flowering in main plot and three weed management practices i.e. weedy check, one hand weeding at 25-30 DAS and pendimethalin 1 kg/ha/glycel, 1 kg/ha PPI in zero tillage was laid out in split plot design with three replications. Sowing were done (variety JL-3) with a seed rate of 40 kg/ha with a spacing of 25 cm row to row and 5 cm plant to plant. A basal dose of N:P:K:S 20:17:16:20 kg/ha was applied uniformly. On the basis of three year experimentation among the various planting techniques, raised bed gave significantly higher seed yield (636 kg/ha) than zero tillage and flat bed. Among the irrigation treatments one irrigation at flowering proved superior over no irrigation. Use of pendimethalin 1 kg/ha/glycel 1 kg/ha in zero tillage produced significantly higher seed yield than one hand weeding at 25-30 DAS and weedy check.

P-106 Observations on effect of pigeonpea plant type on weed intensity

R. N. Sharma, H. C. Nanda, P. L. Johnson and N. K. Motiramani
Department of Genetics and Plant Breeding, I.G.K.V., Raipur (C.G.)
e-mail : rn.raipur@gmail.com

Pigeonpea [*Cajanus cajan (*L.) Millsp.] is an ancient pulse crop of India and is grown throughout the country under varied agro-climatic conditions. Among pulses, pigeonpea is the fourth most important pulse crop in the world where, India alone accounts for 78 per cent of the world's supply. Pigeonpea is used for food, feed and fuel. Pigeonpea produces more nitrogen from plant biomass per unit area of land than many other legumes although it usually produces fewer nodules than other legumes. Pigeonpea can fix about 70 kg N/ha per season by symbiosis until the mid-pod-fill stage. This is around 88% of the total nitrogen content of the plant at that stage of growth. The residual effect on a following cereal crop can be as much as 40 kg N/ha. Rarely does the plant need to be inoculated because it can nodulate on Rhizobium naturally present in most soils. Pigeonpea has been used as a green manure crop. It grows well even in soils with a low phosphorus level. The plant is remarkably hardy to both low temperatures (as low as 5° to 10°C) and high temperatures (up to 40°C) and, thus, is an ideal crop to fit into cropping systems in many parts of the world. Infestation of weeds is one of the major constraints in achieving higher yield as they compete with crop plants for moisture, light, nutrient and space. Weeds caused 29% losses in grain yield of pigeonpea. At early stage of growth, especially after the emergence i.e. seedling stage, weeds followed by phytopthora is the major constraints with this crop. At later stages of growth weed intensity depends largely on its growth habits i.e. erect, semi-erect, and spreading. During $2009^{-1}0$ no hand weeding operation was done in the germplasm experiment of pigeonpea at IGKV, Raipur till 100 days. Moreover, weedicides *viz*. 'Pursuit' and 'Whip Super' were applied as pre-emergence to the crop which were effective against the major weeds. Observations on *Alternanthera triandra, Xanthium strumerium, Ageratum conyzoides, Commelina benghalensis* and *Nukia maderaspatana* were noted at 90 days after the sowing in the germplasm trial wherein 50 accessions were sown in two replications in augmented design. Results of the investigation revealed that in general, lower weed intensity was observed in the semi-erect type accessions than the erect ones. The minimum weeds were noted under the accession ICP 6994 followed by ICP 7005 and ICP 7362.

P-107 Integrated weed management in little millet (*Panicum sumatrense* Roth ex Roemer and schultes) under rain-fed condition

Adikant Pradhan, Ashwani Thakur[2] and Ashish singh[2]
S.G. College of Agriculture and research Station, Jagdalpur (C.G.)
[2]Department of Agronomy, JNKVV, Jabalpur (M.P.)
e-mail : adi_197753@rediffmail.com

The experiment was conducted on little millet during *kharif* season of 2006 and 2007 at Jagdalpur with Ten treatments. The predominant weeds found in weedy check plot were *Echinocloa colona, Digitaria sangunalis,* and *Eleusine indica, and Celosia agirentium, Commelina benghalensis*, *Euphorbia geniculata* accounted as broad leaved and narrow leaved weeds flora respectively. Weed population and dry matter accumulation by weeds was significantly differed due to weed control treatments in two years of experimentation. The maximum weed population of broadleaved (80, 216 and 332) and narrow leaved (516, 758 and 859) were found in weedy check in 2005 and 2006 while dry matter of broad leaved (396, 363 and 362) and narrow leaved weeds (971, 834 and 314 g/m^2). The application of pre-emergence spray of oxyfluorfen at 0.5 Kg ai/ha + two hand inter-cultivation (20 and 40 DAS) gave significantly minimum weed population and dry matter accumulation. T_8 (Pre-emergence spray of oxyflourfen at 0.5 kg/ha + Two intercultivations produced maximum grain yield (9.02, 8.87 and 8.80 q/ha) after hand weeding and economics of the treatment was also effective for the futher recommendation.

P-108 Weed dynamics and yield of dill seed as influenced by weed management practices and irrigation schedules under middle Gujarat conditions

S. M. Patel, P. M. Patel, R. B. Patel and T. G. Meisheri
DWSR Anand Centre, B.A. College of Agriculture A. A.U., Anand (Gujarat)
e-mail : rbpatel33@yahoo.com

The field experiment was conducted at Agronomy Farm during *rabi* season of the year 2002-03 to find out effect of weed management practices and irrigation schedules based on critical growth stages on weed dynamics and growth and yield of dill seed crop. The soil of the experimental field was sandy loam in texture having 7.5 pH with a good drainage. The soil was low in organic carbon and nitrogen, medium in available phosphorus and high in potassium. The treatments comprised of combinations of four irrigation schedules and seven weed management practices. The experiment was laid out in split plot design with four replications. Result revealed that the differences in the counts of monocot, dicot and total weeds at 3 and 6 WAS (weeks after sowing) were not significantly influenced by weed management practices while, dry weed weight recorded at 3 and 6 WAS and at harvest were significantly lower in the application of oxadiargyl at 100 g/ha as pre emergence and was at par with hand weeding carried out at 3WAS *fb* earthing up at 6 WAS. Among irrigation schedules, irrigation at 0.40 IW/CPE showed significantly lower dry weed weight which was at par with irrigation applied at vegetative stage. Significantly the highest seed yield of dill seed was recorded under treatment of hand weeding carried out at 3 and 6 WAS. Among herbicides, application of fluchloralin at 1.0 kg/ha as pre emergence proved its superiority and at par with pre emergence application of pendimethalin at 1.0 kg/ha. The seed yield of dill seed increased with increasing levels of irrigations. Irrigation applied at 0.4 IW/CPE showed significantly the highest seed yield of dill seed. The lowest seed yield was recorded in the one irrigation applied at vegetative growth stage. Significantly higher seed yield of dill seed crop was obtained with combination of irrigation applied at 0.4 IW/CPE (4 irrigations) with hand weeding carried out at 3 and 6 WAS which was at par with the combination of three irrigations applied at vegetative, 50% flowering and at dough seed stage with hand weeding carried out at 3 and 6 WAS.

P-109 Efficacy of quizalofop ethyl on weed control in soybean (*Glycine max*)

B.N. Aravinda kumar, shivamurthy, D., hosmath, J.A. and Ramesh Babu
Dept. of Agronomy, CAUAS, Dharwad (Karnataka)
e-mail :bnakumar@gmail.com

A field experiment was carried out during *kharif* season of 2007 in medium deep black soils at Main Agricultural Research Station, to study the effect of different weed control treatments on growth, yield, yield components and weed control efficiency in soybean (*Glycine max*). In a randomized block design with three replications treatment consisted of eight treatments *viz*., T_1: weedy check, T_2: weed free check, T_3: Farmers' practices (two hand weedings and one inter cultivation), T_4: pendimethalin 30 EC (pre-emergent), T_5: pendimethalin 30EC (pre-emergent) + one hand weeding at 30 DAS, T_6: quizalofop ethyl at 0.04 kg/ha at 15 and 30 DAS (post emergent), T_7: quizalofop ethyl at 0.04 kg/ha at 20 DAS (post emergent) + one hand weeding at 40 DAS and T_8: pendimethalin 30EC (pre-emergent) + quizalofop ethyl at 0.04 kg ai/ha at 20 DAS (post emergent). The results indicated that, the T_8: pendimethalin 30EC (pre-emergent) + quizalofop ethyl at 0.04 kg/ha at 20 DAS (post emergent) was recorded significantly higher seed yield, yield components, growth components and weed control efficiency (WCE) compared to spray of pendimethalin (T_4), quizalofop ethyl (T_6), pendimethalin 30EC (pre-emergent) + one hand weeding (T_5), quizalofop ethyl at 0.04 kg/ha at 20 DAS (post emergent) + one hand weeding at 40 DAS (T_7) and weedy check plot (T_1). T_8 recorded highest WCE (86.45%), increased seed yield (44.9%) over weedy check and was on par with farmers' practice and weed free check.

P-110 Performance of mechanical weeders on vertisols of Marathwada region in soybean

A. K. Gore, G. D. Gadade, and J. K. Jadhav
Directorate of Weed Science Research Centre, M.A.U., Parbhani (M.H.)
e-mail : anandk.gore@rediffmail.com

Soybean (*Glycinemax* L.) in important oilseed crop has emerged as a potential crop and brought about perceptible change in the economy of most of the farmers of Maharashtra. Among the several constraints to productivity of soybean, weeds have been recognized as an important one, which competes with crop plants for water, nutrients space and solar radiation resulting in reduction of yield by 20-46%. To bridge the gap between actual and potential levels of production, an effective weed management practices has to be found out. The mechanical weeders are becoming popular among the farming community due to their more field efficiency, weeding efficiency, eco-friendly, easy availability resulting into effective and economical weed control. A field experiment was conducted during *kharif* 2009 on medium vertisols of Marathwada region at DWSR Centre, MAU, Parbhani. Six weed control treatments were replicated four times in randomized block design. The treatment consists of T1-Twin wheel hoe, T2-Grubber, T3-Cycle hoe, T4-hand hoe, T5-2 hand weedings and two hoeings and T6-weedy check. Weeding interval for two weeding for each treatment was scheduled at 20 & 40 DAS. The crop was sown on 25th July, 2009 at 45 x 5 cm spacing in plots of 36m^2 .Weed flora of the experimental field comprised of 37% grassy weeds and 63% broad leaved weeds. *Cynodon dactylon, Dincbra retraflexa Brachiaria eruciformis, Euphorbia geniculta, phyllanthus medraspentasis, Abutilon indicum and Parthenium histerphorus* were found as dominant weeds. The four weeders were used for weeding in soybean crop with the treatment of hand weedings and hoeings. The results indicated that the highest weed control efficiency was observed in two hand weedings & two hoeings (85% and 77%) and (74% & 79%) for grassy as well as broad leaved weeds at 30 & 60 DAS respectively but it was followed by cycle hoe (69% & 44%) and (63 & 67%) for grassy and broad leaved weeds at 30 & 60 DAS respectively. The yield loss to the tune of 43%was observed due to weed infestation in soybean crop. The highest grain yield (2610 kg/ha) was observed in two hand weedings and two hoeings which was found at par with cycle hoe(2452 kg/ha) and found significantly superior over rest of the four treatments. Thus among four weeders, cycle hoe produced significantly highest grain yield and found to be effective in controlling grassy as well as broad leaved weeds over rest of the weeders.

P-111 Direct and residual effect of different herbicides on chickpea crop field

R. A. Yadav and Naushad Khan
Dept. of Agronomy C.S.A.U.A.T., Kanpur (U.P.)
e-mail : ramashish94@yahoo.in

A field experiment was conducted at Student's Instructional Farm of this university. Five treatments i.e. isoproturon (0.75 kg and 1.50 kg/ha) and pendimethaline (1 kg and 2 kg/ha) were compared with the control in Randomized Block Design with five replication. The fertility status of the experimental field was having neutral pH, normal salt concentration, low organic carbon and medium available phosphorus and potash. Plant height (cm), fresh and dry weight per plant (g) was recorded at 25, 35, 50, 65, 75 and 90 days after sowing. Fertility status of experimental field was recorded after harvest of the crop. After harvest of the crop, soil samples were taken from each plot and bio-assay study was conducted on cucumber as indicator plant. Ten seeds of cucumber was sown at 10th day interval and germination % , shoot length, fresh and dry weight/plant of 10 days old seeding of cucumber recorded at 150, 160 and 170 day after herbicides application. Result revealed that pre-emergence application of pendimethalin and isoproturon gave beneficial results on fresh and dry weight/chickpea plant at 90 days stage in comparison to control treatments. In the bio assay study, there was no significant difference between treated soil and control plot soil regarding germination percent, shoot length, fresh and dry weight / plant of cucumber indicator plant. It revealed that there was no residual effect of isoproturon and pendimethalin application on soil after harvest of the chickpea crop.

P-112 Performance of manually operated weeders in soybean

A. K. Gore, J. K. Jadhav and G. D. Gadade
Directorate of Weed Science Research Centre, M.A.U., Parbhani (M.H.)
e-mail : anandk.gore@rediffmail.com

Soybean (*Glycinemax* L.) a miracle crop with 40% protein and 20% oil is gaining quite popularity among the farmers due to its short duration and better market price. Yield losses as high as 46% caused by weeds have been reported in this crop. Seasonality of labour and escalating wages in many areas has given impetus for weed management using herbicides and mechanical weeders for weed management. Herbicides are proved to be very potent against number of weeds in soybean. But looking to another effective and economical alternatives as per the existing situation the use of different mechanical weeders may be made available for the farmers. Therefore this study was undertaken to evaluate the field and weeding efficiency of mechanical weeders in soybean. FLD experiment was conducted during 2009 on a medium black soil at DWSR, Centre, MAU, Parbhani. Six weed control treatments including 4 weedings were replicated four times in a randomized block design. Treatment consists of 4 weeders *viz*. twin wheel hoe, grubber, cycle hoe, hand hoe and two hand weedings followed by two hoeings and weedy check. Weeding interval for 2 weedings for each treatment was scheduled at 20 & 40 DAS. Soybean crop was sown on 25th July 2009 at 45x5 cm in plots of 36 sq.m.

Weed flora of the experimental field comprised of 37% grassy weeds and 63% broad-leaved weeds. *Cynodon dactylon, Dinebra retraflexa Brachiaria eruciformis, Euphorbia geniculta, Phyllanthus medraspentasis, Abutilon indicum and Parthenium hysterphorus* were found as dominant weeds. Considering the working depth, speed of operation, time required to cover the area, theoretical field capacity, the field capacity of each weeder was calculated. The highest field efficiency was observed with cycle hoe (80 and 95.23%) respectively at 20 and 40 DAS for controlling grassy as well as broad leaved weeds followed by twin steel hoe. As per as economics is concerned twin wheel hoe was found most economical for weeding (Rs.450/ weeding) whereas, cycle hoe was found at par with twin wheel hoe but recorded highest field efficiency and weeding efficiency as against of Rs. 600/weeding. Thus on the basis of field efficiency, weeding efficiency and economics of the weeders the effective and economical weed control in soybean was observed in plots weeded by cycle hoe.

P-113 Productivity of urdbean as influenced by planting methods and weed management practices

Vivek Tripathi, Rakesh Banwasi, Anjeet Jangre and Rajendra Lakpale
Regional Agricultural Research Station, Raigarh, IGKV, Raipur (CG)
e-mail : apalsingh@yahoo.com

An experiment was conducted during *kharif* season of 2007 and 2008 at Regional Agricultural Research Station, Raipur to find out the effect of planting methods and weed management practices on productivity of urdbean. The experiment consist of three methods of planting-M1- Flat planting, M2- bed planning (2 rows) (60 cm bed width) and M3- bed planting (4 rows) (120 cm bed width) and five weed management Practices-W1- weedy check, W2- HW 20 and 40 DAS, W3- imazethapyr 75 g/ha PE + HW 40 DAS, W4- quizalophop ethyl 50 g/ha + chlorimuron ethyl 9 g/ha (POE) and W5- imazethapyr 75 g/ha PE + hoeing at 30 DAS. The design was Split-plot with three replication. Results indicated that significantly maximum plant height and branches /plant are recorded with M2. Pods/plant, and 100 seed wt are found significantly maximum with M3. Significantly maximum seed and straw yields were recorded with M2- bed planting (2 rows), which was found on par with M3. In case of weed management practices, significantly maximum plant height, number of branches and seed /pod were observed with imazethapyr 75 g/ha PE + HW 40 DAS. Whereas, significantly maximum pods/plant was recorded with with HW 20 & 40 DAS. Significantly maximum 100 seed wt was observed with imazethapyr 75 g ha + chlorimuron ethyl 9 g/ha (POE). Significantly maximum seed and straw yield were recorded with HW 20 and 40 DAS. Interaction effect of methods of planting and weed management practices revealed that significantly maximum plant height, pods plant and seed yield were found with M2 + W2- HW 20 and 40 DAS, which was found comparable to M2+ imazethapyr 75 g/ha PE + HW 40 DAS.

P-114 Effect of tillage and herbicides on weed dynamics and grain yield of soybean

A. K. Gore, J. K. Jadhav, M. G. Patil and G. Y. Sonwane
Directorate of Weed Science Research Centre, MAU, Parbhani (M.H.)
e-mail : anandk.gore@rediffmail.com

A field experiment was conducted in *kharif* season of 2009-10 to quantity the weed flora under various tillage systems and to evaluate the cropping system on weed growth. Five tillage systems *viz*. zero tillage–zero tillage, zero tillage-conventional tillage, conventional tillage–zero tillage, minimum tillage - minimum tillage and conventional tillage-conventional tillage as main treatment and three weed control treatments *viz*. two hand weedings, PE-alachor at 2.0 kg/ha and weedy check as sub plot treatments were tested in split plot design with three replications in regions popular cropping system of soybean-wheat. In first crop of soybean the significantly lowest dry weed weight of grassy weeds at 30 DAS and broad leaved weeds at 30 & 60 DAS was observed in conventional-conventional tillage system which was found at par with minimum-minimum tillage system. Whereas the lowest dry matter of grassy weeds at 60 DAS was observed in CT-CT which was found at par with rest of the tillage systems except that it was found significantly lowest than ZT-ZT.

Whereas, as regards weed control treatments the significantly lowest dry matter of grassy and broad leaved weeds at all stages of observations was observed in 2HW which was found at par with PE-alachlor at 2.0 kg/ha and significantly superior over weedy check. The maximum weed control efficiency for grassy weeds was observed in CT-CT (75% and 32%) at 30 and 60 DAS respectively. It was also highest in CT-CT for broad leaved weeds (80 and 78%) at 30 & 60 DAS respectively. The unchecked weeds caused 40% grain reduction in soybean. Significantly highest grain yield of soybean was recorded in CT-CT system which was found at par with minimum-minimum tillage system and conventional-zero tillage system and found significantly superior over rest of the treatments. In 2nd crop of wheat taken in *rabi* season the lowest dry weed weight of grassy & broad leaved weeds and maximum weed control efficiency at 30 and 60 DAS was observed in CT-CT which was found close to the minimum-minimum tillage system. The significantly highest grain yield of wheat was also observed in CT-CT which was found at par with MT-MT and found significantly superior over rest of the treatments. Whereas the 2HW weed control treatment produced lowest dry matter of weeds, maximum weed control efficiency and highest grain yield which was found superior over weedy check but it was found at par with herbicide treatment i.e. PE-pendimenthalin at 1.0 kg/ha. In case of sub-treatments 2 HW recorded significantly highest grain yield over weedy check and found at par with herbicide treatment.

P-115 Efficiency evaluation of imazethapyr 10% SL and its phytotoxicity in soybean and on succeeding crops

C. Sangeetha, C. Chinnusamy, N. K. Prabhakaran and P. Muthukrishnan
Department of Agronomy, TNAU, Coimbatore (Tamil Nadu)
e-mail: chandrusan2007@gmail.com

The soybean (*Glycine max*) is often called the miracle crop. It is pre-eminent for its high (38–45%) protein content as well as its high (20%) oil content. Is productivity is not being sustained due to severe crop-weed competition, resulting in yield loss of 71%. It is a short duration crop and weeds are to be controlled in the first 30 days after sowing (DAS). During rainy season, frequent rains do not permit to weed removal mechanically or manually, timely. Also weed removal by manual weeding under such circumstances is costly and cumbersome, and sometimes not possible by the use of pre-emergence herbicides due to frequent rains. During this period, some early pos-emergence can be thought of. With this view, an experiment was

conducted at Agricultural Research Station, Bhavanisagar to study the bioefficacy and phytotoxicity of early post emergence herbicide (EPOE) imazethapyr in soybean and its residual effect on suceeding crops, during *kharif* 2008-09. The treatments were imazethapyr as early post-emergence at 50, 75, 100, 200 g/ha with one hand weeding on 45 DAS, these treatments were compared with checks (pendimethalin 30% EC at 750 g/ha) and hand weeding at 25 and 45 DAS. The treatment were replicated thrice in randomized block design. The experimental field was dominated with *Boerhaavia diffusa, Digeria arvensis, Parthenium hysterophorus, Eragrostis amabilis, Arachne racemosa, Digitaria ciliaris*. Phytotoxicity symptoms like yellowing of leaves, leaf discolouration, cupping of leaves were occurred in weeds. There was slight chlorosis occurrence observed on 3 DAHS , but it get diminished in 2 weeks . But complete drying of crop was not found in any of these treatments At 20 and 40 DAS, total weed dry weight was impressively lower in early post-emergence imazethapyr at 200 g/ha which was on par with imazethapyr at 100 g/ha The grain yield was significantly higher in EPOE of imazethapyr 100 g/ha(1660 kg/ha). Higher dose of imazethapyr at 200 g/ha (1560 kg/ha) has phytotoxicity effects on crops. There was no carry over toxicity of imazethapyr on the succeeding pearlmillet, sunflower. Yield of these succeeding crops were not significantly influenced by preceding EPOE application of imazethapyr.

P-116 Effect of herbicide on soil health in chickpea under rice-chickpea cropping system

Raj Kumar, B. N. Singh, A. K. Singh and R. S. Singh
Department of Agronomy, N.D.U.A.T., Kumarganj, Faizabad (U.P.)
e-mail: rkpnduat@gmail.com

A field experiment was conducted during *rabi* season of 2008-09 at Faizabad to evaluate the effect of herbicide on soil health in chickpea. The soil of the experiment field was silt loam in texture and medium in fertility with pH of 8.13, EC 0.22 dsm-1, bulk density 1.47 g/cc and OC 0.33%. The treatment comprised of four weed control measures in *kharif* season and four in *rabi* season. The rhizospheric soil samples were collected randomly from each plant at 30, 50 DAS and at harvest stage and were analyzed for pH, EC, OC bulk density and total bacterial population as influenced by various treatments. However on bacterial population significant effect was observed at various DAS. Further results revealed that pendimethalin butachlor and anilophos applied in rice (*kharif*) and chickpea (*rabi*) under rice-chickpea cropping system did not leave any harmful effect on chemical and biological properties of soil.

P-117 Performance evaluation of power weeder in maize (*Zea mays L.*)

S. Shekhar, S. Chandra and D.K. Roy
Rajendra Agricultural University, Pusa, Samastipur (Bihar)
e-mail : dr_dhirendra_krroy@yahoo.com

A field experiment was conducted at Pusa to evaluate the field performance of power weeder for inter culturing operation in maize crop and to compare the cost of operation of power weeder in maize vis-à-vis grubber, wheel hoe as well as khurpi as control treatment. The results revealed that the power weeder having the higher field capacity (679.73 m^2/hr) has been found as the most efficient tool for weeding particularly in view of timeliness in operation followed by the wheel hoe (95.01 m^2/hr), grubber (86.37 m^2/hr) and *Khurpi* (24.69 m^2/hr). The highest weed control efficiency (99.44%) were recorded by control treatment *khurpi* followed by grubber (96.8%) and wheel hoe (94.64%) where as the power weeder recorded the lowest weed control efficiency (89.8%). The cost of operation of *khurpi* was found maximum (Rs. 4051/ha) followed by power weeder (Rs. 1350/ha), grubber (Rs. 1158/ha) and wheel hoe (Rs. 1152/ha). Inspite of the marginal higher cost of operation of Power weeder over wheel hoe and grubber. Power weeder has the benefit of timeliness in operation than the wheel hoe and grubber.

P-118 Weed flora of mustard in Hisar, Sirsa, Fatehbad and Bhiwani districts of Haryana

Dharam Bir Yadav, S. S. Punia and Anil Mehta
Department of Agronomy, CCS HAU, Hisar (Haryana)
e-mail : jagir@hau.ernet.in

Indian mustard (*Brassica juncea L.* Czern & Coss) is the major cash crop of south-western Haryana grown after pearlmillet, sorghum, fallow and clusterbean. Crop type, soil properties, quality of irrigation water, cropping pattern, weed control measures and environmental factors has a significant influence on the intensity and infestation of weeds. So, knowledge of weed species associated with crops in a region is therefore pivotal and necessary to plan and execute a sound and economical weed management schedule. To study the floristic composition of weeds in mustard in south-western Haryana, 73 fields were surveyed in Hisar, Bhiwani, Sirsa and Fatehbad, districts of state during November -December, 2008. Four observations on density of individual weeds were recorded per field from four fields at one spot by using quadrate of (0.5 x 0.5 m), 100 meter deep inside the fields. Pooled average values of observations of weed density and relative frequency of individual weeds were thus calculated.

Out of total 16 weed species, six weeds namely *Asphodelus tenuifolius, C. album, Melilotus indica, Trigonella polycerata, C.murale* and *Convolvulus arvensis* were found to be highly aggressive and dominating over other weed species present. *Chenopodium album* was the most dominant weed in all the districts with a weed density of 29.7- 64.5 plants/m^2 with a relative density of 25.3 - 39.7% with IVI values ranging from 37.1-59.7%. Broadleaf weeds *C.album* and *Asphodelus tenuifolius* occurred at 100 % of sites surveyed. In all the districts, *C. album* was the third most important weed and its infestation was more in Bhiwani and Fatehbad districts. Although, parasitic weed *Orobanche aegyptiaca* infestation is observed in these areas but at the time of survey it did not come out of soil because its emergence is generally after January month. Typical dry land weeds such as *Aerva javanica* and *Zizyphus rotundifolia*, were present in all districts. Grassy weed *A. ludoviciana* showed significant presence in all districts where as *P. minor* was found only at 17 % locations in Sirsa district. *Vicia sativa* used to be considered a weed of wheat showed its presence in Bhiwani only with relative density of 1.3 plants /m^2 at 12% sites surveyed.

P-119 Efficacy of imazethapyr against weeds in soybean (*Glycine max* L.)

Prachi Kautoo, M.L. Kewat and J.K. Sharma
Dept. of Agronomy, College of Agriculture, J.N.K.V.V., Jabalpur (M.P.)
e-mail - prachikautoo@yahoo.com

A field experiment was conducted during *kharif* season of 2008 and 2009 at livestock farm, JNKVV, Jabalpur, to study the efficacy of imazethapyr against weed in soybean. The experimental field was infested with grassy weeds *Echinochloa colona* (14.52 and 11.67%), *Dinebra retroflexa* (32.54 and 13.47%), and sedge *Cyperus iria* (21.57 and 29.49%) at 40 DAS and harvest respectively. The efficacy of imazethapyr as post emergence when applied at the lowest rate 50 g/ha was poor, which improved slightly with the increase in application rates upto 300 g/ha. However, combined application of imazethapyr at lower rate (100 g/ha) along with chlorimuron 24 g/ha, paralized the weed growth identically (75.87%) but it found inferior to hand weeding twice (89.28%). The latter treatment also attained the superior values of yield attributes pods/plant (57.08), seeds/pod (2.46) and seed yield (2068 kg/ha) and found more remunerative as it f*etc*hed the highest value of net monetary returns (Rs 25037.05/ha) and benefit : cost ratio (2.57) being at par to recommended practice of weed control i.e. hand weeding twice (Rs 24832.25/ha and 2.15) and both proved superior over other herbicidal treatments.

P-120 Eco-biological characterisation of *Orobanche cernua* and its management in tobacco planted in alfisols of western zone of Tamil Nadu

C. Chinnusamy, N. K. Prabhakaran and P. Lakshmanakumar
Department of Agronomy, T.N.A.U., Coimbatore (Tamil Nadu)
e-mail : chinnusamy@hotmail.com

Tobacco (*Nicotiana tabacum* L.) is one of the important commercial crops of India. In Tamil Nadu, tobacco is cultivated in an area of 5,102 ha producing around 7,792 tonnes of tobacco with an average productivity of 1,463 kg/ha. Due to the infestation of *orobanche* the tobacco productivity has declined. *Orobanche* is generally seen on the above ground portion from 45 to 55 days after transplanting.With this background, a research project has been formulated to quantify the biological characters and effective management of *Orobanche cernua* in tobacco planted in *alfisols* of western zone of Tamil Nadu.

Pot culture experiment was conducted by collecting soil samples from twelve locations and tobacco seedlings were planted to stimulate the germination of *orobanche cernua* seeds and biological characteristics like days for emergence and flowering, biomass partitioning and seed production potential were quantified. The experiment on management of *orobanche* consisted of manual weeding at 20 days interval, growing fodder sorghum as preceding crop to tobacco, pre plant incorporation of fluchloralin 1 kg/ha, pre emergence application of oxyfluorfen 0.1 kg/ha and pendimethalin 1 kg/ha on 3 DAT, post emergence directed application of paraquat 0.6 g/l, glyphosate 2 g/l, metribuzin 0.5 kg/ha, imazethapyr 30 g/ha on 55 DAT, soil drenching $CuSO_4$ 0.5 per cent on 55 DAT, plant hole application of neem cake 200 kg/ha on 30 DAT and unweeded check. Observations on *Orobanche cernua* were recorded along with growth and leaf yield of tobacco with economic analysis.

Results of pot culture study showed that fresh and dry shoot weights at 15 days after emergence (DAE) were in the range of 36.45 to 41.12 and 3.213 to 6.653 g/shoot respectively and the average weights were 39.20 and 4.410 g/shoot respectively. Shoot production (no. of tillers) varied from 4 to 15 with an average of nine per plant. Flower initiation was recorded on 10 to 13 DAE of *orobanche* shoot with an average of 11 DAE. Capsule number per shoot varied from 45 to 57 with an average of 50. Similarly, capsule weight was observed to be in the range of 0.083 to 0.121 g with an average weight of 0.095 g. Number of seeds per capsule varied from 3,654 to 4,216 with an average of 3,966 seeds per capsule.

Substantial reduction in orabanche shoots (61.7%) was recorded with the plant hole application of neem cake either at followed by 100 kg/ha (51.6%). Drenching of plant holes with CuSO4 5% solution also reduced the orabanche infestation by 37.1%. As a result, the dry leaf yield with these three treatments was increased by 28.3 to 50.9% (maximum being with neem cake 200 kg/ha) over uncontrolled *orabanche* tobacco crop. Among the total herbicides applied, glyphosate (either at 0.1 or 0.2%) reduce the orabanche better than with other two herbicides *viz.,* paraquat or glufosinate. From the results of management of *orobanche cernua* it is concluded that, post emergence application of imazethapyr 30 g/ha on 55 DAT or plant hole application of neem cake 200 kg/ha on 30 DAT is effective for control of *orobanche cernua* in tobacco and higher tobacco leaf yield.

P-121 Weed management in groundnut (*Arachis hypogaea* L.)

S. S. Tomar, K. S. Yadav, Asha Arora and A. M. Jaulkar
Dept. of Agronomy, College of Agriculture, RVSKVV Campus, Gwalior (M.P.)
e-mail : wc_sst@yahoo.co.in

A field experiment was conducted at the Research Farm during *kharif* season of 2008 and 2009 to find out an effective and economical weed control measures for groundnut crop. The soil was sandy clay loam having low in organic carbon and available nitrogen and medium in phosphorus and potash with pH 8.4. There were 15 treatments comprising 6 herbicides *viz*. fluchloralin 1000 g/ha, pendimethalin 1000 g/ha, oxyfluorfen 120 g/ha, oxadiargyl 90 g/ha as pre emergence application, quizalofop ethyl 50 g/ha and Imazethapyr 100 g/ha as post emergence applied alone and in combination with one hand weeding at 30 days after sowing (DAS) having one hand weeding, two hand weedings and weedy check. The experiment was laid out in randomized block design with 3 replications. The groundnut variety TPG-41 was sown at 30 cm x 10 cm apart with seed rate of 120 kg/ha on 19th and 16th July in 2008 and 2009, respectively and harvested on 18th and 10th November in 2008 and 2009, respectively. All the recommended package of practices were followed to raise the crop except weed control treatments. The dominant weed species infesting the experimental plots were *Cyperus rotundus* and *Echinochloa crusgalli* among the narrow leaf weeds and *Commelina benghalensis, Digera arvensis, Trianthema monogyna, Celosia argentea* and *Phyllanthus niruri* among broad leaf weeds. All the treatments markedly reduced the weed density of different weed species, total weed population and their dry weight as compared to weedy check. The lower weed population and their dry weight were recorded in weed free, (two hand weeding treatment at 15 and 30 DAS) at 60 DAS. Highest weed control efficiency (96.94%) was obtained under weed free treatment (2 hand weedings) followed by T9 (oxyfluorfen 120 g/ha PE + one hand weeding with WCE of 96.0% and T12 (imazethapyr 100 g/ha, POE + one hand weeding with WCE of 95.25%). Yield attributes were improved under treated plots in comparison to weedy check. There was mild phytotoxic effect on crop (leaf yellowing) due to oxyfluorfen 120 g/ha (PE) but it was recovered later on. All the treatments recorded significantly higher seed yield of groundnut except T5 (quizalofop 50 g/ha POE) over weedy check in both year. Maximum pod yield of groundnut (2513 kg/ha) obtained under weed free treatment T14 (Two hand weeding at 15 and 30 DAS) followed by T12 i.e. application of imazethapyr 100 g/ha at 20 DAS + 1 hand weeding at 30 DAS (2285 kg/ha), T9 i.e. application of oxyfluorfen 120 g/ha as pre emergence + 1 hand weeding at 30 DAS (2099 kg/ha), T8 i.e. pendimethalin 1000 g/ha PE + 1 hand weeding (2059 kg/ha) and T10 i.e. oxadiargyl 90 g/ha (PE) + 1 hand weeding (2010 kg/ha). Treatments weed free and imazethapyr 100 g/ha + one hand weedings were at par in pod yield. The study revealed that maximum net return of Rs. 30384/ ha with BCR of 3.05 was realized from weed free plot (two hand weeding) followed by combination of imazethapyr 100 g/ha as post emergence + one hand weeding (net return of Rs. 27230 /ha and BCR of 2.96), T9 i.e. oxyfluorfen 120 g/ha PE + 1 hand weeding (net return Rs. 24012 /ha and BCR of 2.74), T8 i.e. pendimethalin 1000 g/ha (PE) + 1 hand weeding (net return Rs. 23247/ha and BCR of 2.68) and T4 i.e. oxadiargyl 90 g/ha (PE) + 1 hand weeding (net return 22430/ha with BCR of 2.63).

P-122 Weed management in hot chilli (*Capsicum chinese* L)

J. Deka, N. C. Deka, Nilay Borah and I. C. Barua
Department of Agronomy, Assam Agricultural University, Jorhat (Assam)
e-mail : nilayborah@rediffmail.com

Chilli occupies about fourteen thousand hectares with a production of nine thousand kilogram in Assam. Hot chilli (*Capsicum chinese* L), though with a small share in the total chilli growing area, is one of the emerging commercial crops of the state having tremendous export potential. Its diversified use from spice, prickle to medicine has increased its importance and popularity among the small and marginal farmers. However, both the establishment and productivity of the crop are influenced due to several constraints including weeds. Being a long durational crop, its effective weed management needs integrated approach.

The present experiment was aimed to sort out promising weed management options for hot chilli. A trial was conducted in the horticultural orchard of the University to assess the relative effectiveness of different weed management treatments in hot chilli. The soil of the experimental site was sandy loam with acidic pH (pH 5.4), and medium nitrogen, low phosphorous and medium potash content in soils. Twenty five days old seedlings were planted on 30.11.2007 with 60 cm x 60 cm in row x plant. Fertilizers were applied 120 kg N, 60 kg P_2O_5 and 60 kg K_2O per hectare as basal application, out of which half of the nitrogen was applied at 45 days after transplanting. Other crop management practices were followed as per recommendation. The weed management treatments comprised of pendimethalin 1.0 kg/ha, metolachlor 1.0 kg/ha, oxyfluorofen 15 g/ha, quizalfop-p-ethyl 50 g/ha – all followed by garden hoeing at 40 days after planting (DAP), garden hoeing 20 and 40 DAP, mulching with rice straw, hand weeding at 20 and 40 DAP and weedy. Major weeds in hot-chilli included the broad-leaved weeds like *Ageratum houstonianum, Alternanthera philoxeroides, Amaranthus viridis, Solanum nigrum, Xanthium indicum* and *Mikania micrantha,* grasses like *Paspalum conjugatum*, *Setaria pumila* and *Eleusine indica* and sedges like *Cyperus rotundus* and *Fimbristylis bis-umbellata.* Application of metolachlor 1.0 kg/ha or oxyfluorofen 15 g/ha or quizalfop-p-ethyl 50 g/ha followed by garden hoeing at 40 DAP resulted significantly better weed control over other treatments.

P-123 Effect of different soybean based cropping sequences on productivity and weed management under organic, integrated and inorganic nutrient supply system

Shrikant Chitale, S.K. Sarawgi , Alok Tiwari, J.S. Urkurkar, Rajendra Sahu, A. P. Singh and S. S. Kolhe

Department of Agronomy, Indira Gandhi Krishi Vishwavidyalaya, Raipur, (C.G.)
e-mail: shrikantmadhukar@yahoo.co.in

Several forms of organic farming have been successfully practiced in diverse climate, particularly in rainfed, tribal, mountains and hill areas of the country as well as in Chhattisgarh state. It can be an ideal option for using farm derived organic resources to reduce not only the expenditure on fertilizers in soybean based cropping system and getting premium prices of produce but being a leguminous crop, built-up of soil fertility as well. Weeds are considered to be a potential havoc which cause more yield losses than insects, diseases and other pests. The experiment was conducted during 2004-05 to 2006-07. In Vertisol with neutral pH (7.67) and medium organic C (6.4 g/kg). It was low in available N (237kg/ha) medium in available P (23 kg/ha) and high in exchangeable K (274 kg/ha). Three nutrient sources i.e. NS1 - 100% organic (1/3 of recommended N each from enriched compost, cowdung manure and non edible oil cake), NS2 - 100% inorganic (from chemical fertilizer) and NS3 - integrated (50% organic and 50% inorganic) and 4 cropping systems *viz*. CS1 - soybean - wheat, CS2 - soybean - berseem, CS3 - soybean - mustard and CS4 - soybean - chickpea were studied in the strip plot design with three replications having nutrient sources in vertical strip and cropping systems in horizontal strip. Weed dry weight was recorded at 25 days after sowing. Under organic nutrient supply, the performance of soybean-wheat and soybean-berseem was found better and these systems gave maximum total productivity. The integrated nutrient sources produced maximum total productivity with soybean-wheat system. While, soybean-mustard system under inorganic nutrient sources recorded highest total productivity. In the third year of experimentation, the total net return was found to be higher under organic treatment in soybean-chickpea and soybean-berseem systems when compared to respective systems under inorganic source. The same trend was found in case of soybean-mustard system when 25% premium price assigned to organic produce than inorganic sources.

The weed dry biomass was higher in mustard and recorded 33.2, 30.6 and 25.6 g/m^2 in organic, inorganic and integrated treatments respectively. The mustard crop had 8.4% higher weeds in organic treatments when compared to inorganic treatment (30.59 g/m^2). The results clearly show the effect of cropping systems on weed growth during *Rabi* in third cycle of experimentation. The soybean-berseem and soybean-chickpea cropping system allowed less weeds than soybean-mustard and soybean-wheat system.

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Efficacy of weed management on weed dynamics and performance of seed yield of soybean under Chhattisgargh Region

Sandeep Sharma, D. K. Gupta and S. S. Kolhe
Indira Gandhi Agricultural University, Raipur (C.G.)
e-mail : wc_sst@yahoo.co.in

Soybean is mainly grown during *kharif* season in sandy loam to clay loam soils in Chhattisgarh which, by virtue of their water holding capacity, do not turn up in working condition, hindering the timely weeding and interculture operation. Weed flush come at the same time in almost all the *kharif* crops, which also restrict the availability of manpower for weeding operation in this crop. The untimely and poor weed management adversely affect proper growth and yield of soybean. It is estimated that the loss in yield of soybean in the tune of 30 to 77 per cent due to poor weed control. These losses can be alleviated by effective integrated weed management practices. Integrated weed management is an integration of effective and workable weed management practices that can be used ecologically and economically by the farmers. Now-a-days a few herbicides like metribuzin, chlorimuron, imazethapyr, quizalofop, fenoxaprop are available, which can be used safely in soybean. It has also been reported that most of the selective herbicides do not control all the weeds present in the crop. A field experiment was carried out during *kharif* 2004 at instructional farm of Indira Gandhi Agricultural University, Raipur (C.G) in randomized block design having of fourteen treatments and three replication. The soybean variety JS-335 was grown as test crop. The treatments was metribuzin at 300 g/ha as(PE), imazethapyr at 80 g/ha (PE), metribuzin at 300 g/ha (PE) fb quizalofop at 50 g/ha(POE), metribuzin at 300 g/ha(PE) fb fenoxaprop at 80 g/ha (POE), imazethapyr at 80 g/ha (PE) fb fenoxaprop at 80 g/ha (POE), imazethapyr 80 g/ha (PE) fb quizalofop at 50 g/ha (POE), chlorimuron at 4 g/ha (POE), chlorimuron at 4 g/ha + fenoxaprop at 80 g/ha (POE), chlorimuron at 4 g/ha + quizalofop at 50 g/ha (POE), fenoxaprop at 80 g/ha (POE), quizalofop at 50 g/ha (POE), hand weeding at 40 DAS, hoeing at 40 DAS and unweeded control. Therefore, integrated approach of chemical and cultural control may be more feasible and practicable.An experiment entitled "Effect of weed management on weed dynamics and performance of soybean" was carried out at instructional farm during *kharif* 2004. The experiment was laid out in randomized block design having of fourteen treatments and three replications. The soybean variety JS-335 was grown as test crop. The soil of experiment field was low in nitrogen, medium in phosphorus and high in potash with neutral in reaction. The result of the experiment indicated that seed yield was the maximum under metribuzin 300 g/ha fb quizalofop 50 g/ha. In the experimental field, *Cynotis axillaries, Brachiaria ramosa, Cyperus rotundus, Echinochloa colona, Phyllanthus niruri* were the dominant weeds and were found throughout the crop growth period. The maximum weed control efficiency was recorded under metribuzin 300 g/ha fb quizalofop 50 g/ha, which was followed by hand weeding and imazethapyr 80 g/ha fb quizalofop 50 g/ha.

The seed yield is the result of yield attributing characters of the crop. The yield was maximum in metribuzin at 300 g/ha fb quizalofop at 50 g/ha. The treatments, metribuzin at 300 g/ha, imazethapyr at 80 g/ha, metribuzin at 300 g/ha fb fenoxaprop at 80 g/ha, imazethapyr at 80 g/ha fb fenoxaprop at 80 g/ha and imazethapyr at 80 g/ha fb quizalofop at 50 g/ha were found at par with each other. The yield and yield attributing character like seeds/pod, pod/plant and 100-seed weight followed the similar trend to that of seed yield. This has been supported by the finding of Singh and Kharwara (1984). The treatment metribuzin at 300 g/ha fb quizalofop at 50 g/ha produced maximum 100-seed weight and seed/pod. This was due to better suppression of weeds, more availability of nutrients, production of higher crop growth and favorable influence on sink capacity and its effective translocation towards the maximum seed and pod/plant under metribuzin at 300 g/ha fb quizalofop at 50 g/ha.

Significantly higher seed yield was observed under metribuzin at 300 g/ha fb quizalofop at 50 g/ha, metribuzin at 300 g/ha fb fenoxaprop at 80 g/ha, imazethapyr at 80 g/ha fb fenoxaprop at 80 g/ha, imazethapyr at 80 g/ha fb quizalofop at 50 g/ha, metribuzin at 300 g/ha imazethapyr at 80 g/ha than rest of the treatments. It was owing to high growth and yield attributes as well as low crop-weed competition under these treatments.

High growth in terms of LAI produced large amount of photosynthetic which acts as source and helped in developed of high yield attributes. The capacity of plants to produce seed yield depends not only on the size of photosynthetic system, its efficiently and length of the time for which it is active but also on translocation of dry matter in to the economic sink. The final build up of yield is the cumulative function of yield components. Weed control efficiency was recorded at 20, 40, 60 80 DAS and at harvest and data are presented in Table 2.0. In the initial period of 40 DAS, the maximum weed control efficiency was noted under application of metribuzin 300 g/ha fb quizalofop 50 g/ha. Whereas, during later stages i.e. 60 DAS, 80 DAS and at harvest, maximum weed control efficiency was observed under hand weeding, hand weeding and imazethapyr 80 g/ha fb quizalofop 50 g/ha, respectively. It was also noted that there was enhancement in weed control efficiency due to herbicides applied either in sequence or tank mixed. Weed control efficiency is directly proportional to dry matter production of weed. Maximum weed control efficiency was observed under application of pre-emergence herbicide metribuzin at 300 g/ha fb quizalofop 50 g/ha at 20 and 40 DAS and hand weeding at (60 and 80 DAS). This might be owing to less dry matter production and population of weed in the above treatment.

P-125 Efficiency evaluation of imazethapyr 10% SL in irrigated groundnut in western zone of Tamil Nadu

C. Babu, K. Siddeswaran, C. Chinnusamy and P. Murali Arthanari
Department of Agronomy, T.N.A.U., Coimbatore (Tamil Nadu)
e-mail : agribabu@yahoo.com

Groundnut is the major oilseed crop in India accounting for 45 per cent of oilseed area and 55 per cent of oilseed production in the country. Weed management in irrigated groundnut is one of the most expensive farming activities faced by farmers.The second flush of weeds emerged during late season will seriously affect the pegging and pod development apart from disrupting digging and harvesting operations and causes pods to be stripped from vines, thus rendering them unharvestable. The uncontrolled late emerged weeds make the land unproductive for subsequent season. To overcome this situation early post emergence herbicide application may necessary for better control of weeds. Therefore, an experiment was carried out in randomized block design with three replications to evaluate the bio-efficacy of imazethapyr 10% SL against weeds in groundnut. EPOST imazethapyr 10% SL at 50 g/ha earthing up on 45 DAS, EPOST Imazethapyr 10% SL at 75 g/ha earthing up on 45 DAS, EPOST imazethapyr 10% SL at 100 g/ha earthing up on 45 DAS, EPOST imazethapyr 10% SL at 200 g/ha + earthing up on 45 DAS, pre emergence pendimethalin 30 % EC at 750 ml/ha on 3 DAS earthing up on 45 DAS, Hand weeding twice on 25 and 45 DAS earthing up on 45 DAS, Unweeded control + earthing up on 45 DAS.

The major weed flora of the experiment field were recorded grasses like *Cynodan dactylon, Dactyloctenium aegyptim, Digitaria sanguinalis and Panicum repens* was the predominant weed species. *Cyperus rotundus* was one of the major sedge weed observed in the experimental field. *Acalypha indica, Amaranthus viridis, Boerhaavia diffusa, Commelina benghalensis, Phyllanthus niruri, Phyllanthus maderaspatensis* were the predominant weed among broad-leaved weeds. *Eclipta prostrala* and *Parthenium hysterophorus* were the other dominant broad-leaved weeds. Among the total weeds, broad leaf weeds were dominated throughout the crop growth period followed by grasses and sedges.

At 30 and 60 DAS, total weed density was significantly lower in early post-emergence imazethapyr at 200 g/ha 15 DAS earthing up on 45 DAS, which was on par with early post emergence imazethapyr at 100 g/ha on 15 DAS earthing up on 45 DAS, This was followed by pre emergence of pendimethalin at 750 g/ha on 3 DAS earthing up on 45 DAS and early post-emergence imazethapyr at 75 g/ha 15 DAS earthing up on 45 DAS. Total weed density was higher in unweeded control.

Pod and haulm yield were distinctly higher in early post-emergence imazethapyr at 100 g/ha 15 DAS earthing up on 45 DAS which was on par with early post emergence imazethapyr at 200 g/ha on 15 DAS earthing up on 45 DAS when compare to other treatments.

P-126 Propaquizafop 10ec (agil) an effective post emergent herbicide against weeds infesting soybean [*Glycine max* (l.) merrill]

J. A. Hosmath, R. H. Patil, G. T. Basavaraja, Shamarao Jahagirdar, B.T. Nadagoud and B. K. Athoni
DWSRC, University of Agriculture Sciences, Dharwad (Karnataka)
e-mail : hosmathja@yahoo.co.in

Evaluation was done to know the efficacy of new post-emergent herbicide propaquizafop 10 EC molecule against weeds in soybean (cv.JS335) during *kahrif* 2007 and 2008 at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad, (Karnataka, India). A field experiment was executed in medium black soil (organic carbon-0.43%, available N-420 kg, P_2O_5-45.8 kg, K_2O-312 kg /ha and soil pH 7.8), replicated thrice in completely randomized block design with treatments, propaquizafop 10 EC at 50, 75 and 100 g ai/ha and checks (quizalofop ethyl 15 EC 50 g ai/ha as POE, Fenaxy-p-ethyl 9EC 100 g ai/ha as POE) and recommended practice. The crop was sown on 24th July during 2007 and on 26th July during 2008 with recommended agronomic practices (FYM 5t, 40:80:25 kg NPK per hectare). Soybean crop experienced well distributed rainfall in both the seasons. Pooled data indicated that significantly higher soybean seed yield was obtained with propaquizafop 10 EC at 50g (1901kg/ha), 75g (1945 kg/ha) and 100 g (1815 kg/ha) ai/ha and checks than propaquizafop 10 EC at 200 g (1535 kg/ha) ai/ha. propaquizafop 10 EC at 50, 75 and 100 g/ha proved effective in higher weed control efficiency and no phytotoxicity effect on soybean crop growth compared to propaquizafop 10 EC at 200 g ai/ha and were at par with check herbicides (quizalafop 5 EC 50 g/ha and Fenaxy-p-ethyl 9 EC 100 g/ha) and University recommendation. The product propaquizafop 10 EC at 50 g/ha can be recommended as an effective post emergent herbicide in soybean.

P-127 Effect of chemical weed management on weed dynamics and yield of Pigeonpea + Soybean cropping System

P. S. Patil, V. S. Shinde, A. K. Gore and G. D. Gadade
Directorate of Weed Science Research Centre, M.A.U., Parbhani (M.H.)
e-mail : anandk.gore@rediffmail.com

Pulses are gaining more important position in Indian agriculture. After green revoluation, India became self sufficient in case of food grain production. However, India is still lagging behind in case of pulses production and is dependent on their imports for the domestic consumption in present days. Therefore, there is immediate need of another revolution in case of pulses production. As there is little scope to increase area under pulses, the production can be increased by enhancing the productivity by various agro techniques. Among various constraints in crop production weeds are the major problems but weed control is neglected. Due to weeds crop yield losses upto 20 to 77 per cent. Hence weed management is an important factor to increase the crop productivity. Intercropping supresses the growth of weeds upto 25%. Due to slow growth of pigeonpea the weed grow little faster and it affect the growth and yield of pigeonpea. Soybean + pigeonpea inter cropping system with ratio of 4:2 had given higher soybean equivalent yield, monetary returns and also found more convenient for sowing, intercultural operations and harvesting of the crop. At present many promising and selective herbicides are also available which can control weeds effectively. Thus it is possible to reduce loss in yield due to weeds by applying herbicides and cultural practices or combination of both. In this view, a study was undertaken to study the effect of different herbicides on weed control, growth and yield of soybean pigeonpea intercropping system. A field experiment was conducted on medium deep soils at MAU, Parbhani during *kharif* season 2008-09. The results indicated that the significantly highest grain yield of soybean pigeonpea intercropping system was observed in application of quizalfop (POE) at 25 g//ha at 10 DAS (17.6 q/ha) which was found at par with pendimethalin CPE at 750 g//ha. followed by one HW-hand weeding and H-hoeing at 6 WAS. Whereas the highest weed control efficiency of grassy weeds was also observed in quizalfop (POE) at 25 g/ha at 10, 30, 60 and 90 DAS. Whereas it was found highest for broad leaved weeds in case of weed free situation followed by pendimenthalin (PE) at 750 g/ha followed by one hand weeding and one hoeing.

P-128 Influence of time of weed removal on nutrient uptake by weeds and zero-till cotton under rice fallows

P. Ayyadurai And R. Poonguzhalan
SSI, DWSRC, Dept. of Agronomy, TNAU, Coimbatore (T.N.)
e-mail: ayyaagridurai@yahoo.co.in

Cotton being a widely spaced crop and slow in growth during early stages in the field, faces severe competition with weeds. Timely weed control in cotton crop is one of the important agronomic practices for higher production. A field experiment was conducted at Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Karaikal during summer (February to July) 2007 to find out the influence of time of weed removal on nutrient uptake by weeds and zero-till cotton under rice-fallow condition. The treatments consisted of weedy for 20, 40, 60, 80,100 DAS and upto harvest this is compared with weed free upto 20, 40, 60, 80, 100 DAS and upto harvest.

The maximum NPK depletion by weeds was observed when weeds were left unchecked for entire season (32.6, 3.33 and 18.46 kg/ha, respectively) followed by that in weedy for 100 DAS (31.0, 3.16 and 18.28 kg/ha, respectively). The least NPK depletion by weeds (0.8, 0.07 and 0.63 kg/ha, respectively) was observed in weed free upto 100 DAS followed by that in weedy for 20 DAS (2.8, 0.20 and 1.50 kg/ha, respectively) which were on par with each other. All the weedy for specific period treatments except weedy for 20 DAS (weedy for 40 DAS to harvest) depleted significantly higher quantity of nutrients than weed free for specific period treatments (weed free upto 20 DAS to harvest). The nutrient depletion by weeds increased with increase in the duration of weed infestation. Maintaining the field weed free for first 40 days reduced the nutrient depletion by weeds by more than 60 per cent.

The nutrient uptake by cotton was significantly higher in all weed free for specific period treatments than all weedy for specific period treatments. However, weed free upto 20 DAS recorded significantly lower nutrient uptake (15.91:1.95:7.63 kg/ha) than weedy upto 20 DAS (48.5:5.45:27.34 kg NPK/ha) or 40 DAS (31.32:3.30:18.80 kg NPK/ha). Maintaining the crop weed free beyond 60 DAS (weed free upto 60 to 100 DAS) recorded significantly higher nutrient uptake by cotton, which were comparable among themselves. However, the maximum uptake of nutrients (68.58:6.54:35.02 kg NPK/ha) was noticed in weed free upto harvest closely followed by that weed free upto 80 DAS (68.87:6.54:33.92 kg NPK/ha). The nutrient uptake by cotton was lowest in weedy upto harvest (3.21:0.33:1.27 kg NPK/ha) followed by weedy for 100 DAS (9.10:1.00:4.70 kg/ha) which were on par with each other. Interestingly, weed free upto 20 DAS recorded significantly lower nutrient uptake by cotton than weedy upto 20 or 40 DAS.

P-129 Weed dynamics of *rabi* crops in northern hill zone of Chhattisgarh

A. K. Tripathi and Somnath Choudhury
RMD College of Agriculture and Research Station, Ambikapur (C.G.)
e-mail : arunkumartripathi@rediffmail.com

The weed flora associated with wheat (*Triticum aestivum* L.), pulse and oilseed crops were investigated by surveying 13 villages of Surguja district in northern hill zone of Chhattisgarh. Based on Importance Value Index (IVI) wheat crop consisted of *Chenopidum album* L., *Phalaris minor* Retz., *Melilotus indica*(L)All., *Fleveria contryerba* L., *Vicia sativa* L., *Anagallis arvensis* L., *Medicago denticulata* L., *Avena fatua* L., *Cynodon dactylon* (L)Pers., *Cyperus rotundus* L., *Fumaria parviflora* Lamk. *etc*. In the fields of pulse and oilseed crops main weed species comprised of *Chenopoduim album* L., *Vicia sativa* L., *Anagallis arvensis* L. and *Cynodon dactylon* (L) Pers.

P-130 Estimation of yield loss due to weeds in cotton growing area in *rabi* season of the north western zone of Tamil Nadu

K. Govindarajan, C. Chinnusamy and P. Ayyadurai
DWSRC, Dept. of Agronomy, TNAU, Coimbatore (Tamil Nadu)
Email: kgr640@gmail.com

India ranks first in area and fourth in production in the world. Cotton fiber accounts for almost 70% of the raw material mix of the textile industry. The requirement of cotton will be 220 - 230 lakh bales by 2010 AD and 250 - 270 lakh bales by 2025 AD. But the overall area in the country has shown increasing trends. The production and yield of the crop has also exhibited the same pattern as that of the area under cotton. It is good to note that the area, production and yield has started showing increasing signs during 2007-08 due to the introduction of BT cotton varieties, IPM, INM, IWM and better prices prevailing in the market. During 2007-08, the north western zone (study area) of Tamil Nadu has accounted for 24.48 percent of the area and 28.54 percent of the production in state. Hence the study was carried out in north western zone in Tamil Nadu to determine the level of yield loss due to weeds, to identify the major weeds and to analyze the awareness and adoption levels of weed management practices. The major crop rotation was cotton followed by pulses in the north western zone. The major weeds observed in the farmers' field are *Cynodon dactylon, Cyperus rotundus, Panicum ripens, Trianthema potulacstrum* and *Dactyloctenium aegyptium*. The results have indicated that about 19% of loss in cotton yield is observed if the weeds were not properly controlled. The results further showed that manual weed control was difficult and costly due to the paucity and high wages of labour. Majority of the farmers (71.23 percent) adopt herbicide spraying in conjunction with hand weeding for effective control of weeds to minimize the yield losses. Application of herbicide namely pendimethalin 1.00 kg /acre as pre-emergence herbicides was done as a measure of chemical weed control by the majority of the farmers in the study area.

Almost all the sample farmers are aware of the weed management practice by chemical means and nearly 92 per cent of the farmers are adopting chemical method of controlling weeds. The private firms or the input dealers, SAU's technical staffs and Agricultural Department do facilitate the technology dissemination process and the farmers are supplied with the tech-know-how about improved weed management practices. The results obtained from this study have indicated that modern chemical method of weed control combined with traditional hand weeding methods are being practiced by majority of the farmers. The cultural practices followed by the farmers had greater impact on effective weed management. Hence, extensional activities of SAU's and Agricultural Department should be strengthened to create awareness about different cost effective implements for weeding and to increase adoption rate of weeding implements and herbicides to mitigate scarcity of labour. Because cotton crop responds very well to mechanical weeding combined with chemical application at early stages as cotton is most sensitive to weed competition during early growth period which would greatly influence the yield levels of the crop.

P-131 Weed management in coriander

D. K. Roy; D. Singh; N. K. Sinha and D. N. Pandey
Dept. of Agronomy, R.A.U., Pusa, Samastipur (Bihar)
e-mail : dr_dhirendra_krroy@yahoo.com

A field experiment was conducted at Crop Research Centre Pusa to findout the suitable herbicide for coriander under zero tillage, conventional tillage and bed planting system during *rabi* seasons of 2007-08 and 2008-09. Pre-emergence application of pendimethalin at 1.0 kg/ha (PE) in bed planting system recorded significantly higher grain yield which was followed by zero tillage and conventional tillage with the same treatment of pendimethaline 1.0 kg/ha (PE). The weed count and weed dry weight was recorded higher in weedy check under zero tillage system followed by conventional and bed planting system. The lowest weed count and weed dry weight were recorded under the treatment of pendimethalin 1.0 kg/ha (PE) in bed planting system. The highest weed control efficiency was recorded by the treatment pendimethalin 1.0 kg/ha (PE) in bed planting system which was followed by the same treatment i.e. pendimethalin 1.0 kg/ha (PE) in zero tillage.

P-132 Role of imazethapyr on weed dynamics and yield of soybean

D. S. Meena, Chaman Jadon and Baldev Ram
Agricultural Research Station, M.P.U.A.T., Ummedganj farm, Kota (Rajasthan)
e-mail : meenads1967@yahoo.co.in

Presently, so many herbicides are available in the market for management of weed complex in soybean but most of these are applied before or after sowing of the crop. The sowing time for soybean is very short in rainy (*kharif*) season and farmers also give first priority to sow the crop rather than to herbicide application for weed management. The various grassy and broad leaf weeds emerge simultaneously with the crop plants and compete for essential nutrients, space and moisture, causing substantial loss in yield (35-55%), depending on the types of weed flora and density of weeds. During rainy season, intermittent rainfall and scanty labour availability, costly and time consuming manual weeding is rarely adopted by the farmers. Now a days some new molecules of post emergence herbicide *i.e.* imazethapyr is being marketed with the assurance of selective control of post emergence weeds in soybean. Keeping in view, a field experiment was conducted to evaluate the efficacy of post-emergence herbicide against weed flora in soybean. A field experiment was carried out for evaluating the efficacy of imazethapyr on weed dynamics and yield of soybean. The experimental field's soil was clay loam, alkaline in reaction (pH 7.5) having organic carbon (0.56 per cent), available nitrogen (275.0 kg/ha), phosphorus (23.0 kg/ha) and potassium (320.0 kg/ha). The experiment was laid out in randomized block design comprised of seven treatments *viz*. imazethapyr XL 10 % SL (500 ml/ha) as post-emergence; imazethapyr XL 10 % SL (1000 ml/ha) as PoE; imazethapyr XL 10 % SL (1500 ml/ha) as PoE; Market sample of imazethapyr 10 % SL (1000 ml/ha) as PoE; Market sample of imazethapyr 10 % SL (1500 ml/ha) as PoE; Hand weeding twice at 20 and 40 DAS and weedy check and replicated thrice. The Recommended dose of nitrogen, phosphorus & potassium (20, 60 and 40 kg/ha) were applied by drilling just before sowing through Di-ammonium phosphate and Murate of potash**.** Weed data on total weed density and weed dry weight were recorded at 60 DAS using 1.0 m^2 random quadrate at 2 places. While observations on grain yield and yield attributing parameters were recorded at harvest. All the data were subjected to statistical analyses.

Results revealed that hand weeding twice at 20 and 40 DAS recorded significantly lower down grassy as well as broad leaf weeds and their dry weight at 60 DAS and produced maximum number of branches/plant, pods/plant, seeds/pod and seed yield as compared to weedy check and imazethapyr XL 10 % SL at 500 ml/ha. Among the graded dose of imazethapyr, application of imazethapyr XL 10 % SL at 1500 ml/ha was found most effective for controlling grassy and broad leaf weeds and their dry weight at 60 DAS and maximum number of branches/plant, pods/plant, seeds/pod and seed yield was recorded and remained statistically at par with lower grades i.e. imazethapyr XL 10 % SL at 1000 ml/ha, market sample of imazethapyr 10 % SL at 1000 and 1500 ml/ha as PoE, but proved significantly superior over the weedy check and imazethapyr XL 10 % SL at 500 ml/ha. The imazethapyr gave excellent management of grassy and broad leaf weeds when applied at post-emergence to soybean, the selective action is the reason for the better control of grassy and broad leaf weeds. It may be concluded that weed free environment can be facilitated the better growth and development of the crop and ultimately resulted higher soybean yield.

P-133 Effect of agrochemicals on microbial dynamics in soil and rhizobium legume symbiosis in soybean

M. G. Patil, A. K. Gore, G. P. Jagtap and P. L. Sontakke
Directorate of Weed Science Research Centre, M.A.U. Parbhani (M.H.)
e-mail : plsontakke@gmail.com

The present investigation is an attempt to see the effect of different agrochemicals and bioinoculants, on soil microorganism was conducted of the DWSR Centre, MAU, Parbhani. The soil was clay type in soybean field (sand 15.5%, silt 23.5%, clay 62.3 %), pH of soil is 7.6, EC- 0.7 70 dsm 1 and available N,P, K were

135, 19, 463 kg/ha The $CaCO_3$, organic carbon values of there field were 17 mg/ 100g soil and 6.75 g/kg. In case of Nodule count the result at 30 DAS on various tretment indicate that the treatment T1 (seed inoculate with Rhizobium) at 2.5 g/kg seed shows maximum number of nudules (6) per plant, while lowest nodule count per plant 4.26 was observed in T4 i.e. pre-emergence spray to alachlore at 4kg/ha. Wheather in case of dry weight of nodules at 30 DAS in T1 has highest weight. At the time of harvest the maximum nodule count was observed in T2 (seed treatment with thiram at 3 g/kg 21.5 and T1 and T5 i.e. carbendazim spray at 0.1 % recorded number of nodule count per plant were 17.5 and 16.5 respectively while dry weighteg of nodules is recorded highest in T1 (i.e. 0.25 g/plant) which was stastically superior over rest of all the treatment. Regarding microbial population Maximum bacterical and fungal count was observed in T7 (Control) which was superior over rest of the treatment at 30 DAS where as at 50 DAS T1 shows highest microbial count and that was lowest in T3 i.e. (pre- emergence spray of alachlo at 2 kg/ha. *Rhizobium* population was higher in T1) (i.e. inocultion with *Rhizobium* at 25 g/kg).

P-134 *Biological quantification* and integrated management of *Striga asiatica* (L.) in sugarcane (*Saccharum officinarum.*L) planted in alfisols of western zone of Tamil Nadu

C. Chinnusamy, N. K. Prabhakaran and P. Murali Arthanari
Department of Agronomy, TNAU, Coimbatore (Tamil Nadu)
e-mail: chinnusamy@hotmail.com

One of the major challenges involved in the cultivation of sugarcane to achieve better productivity is weed management practice. Especially in western zone of Tamil Nadu more than 50% cane is cultivated in *alfisols* and infestation of *Striga asiatica* is also more in this soils. Effect of this parasitic weed has been so devastating; the crop yield losses of 10 to 100 per cent have been recorded, leading to complete crop failure and sometimes abandonment of land. Hence, field and controlled condition studies have carried for two years (2007 and 2008) at cultivators' holdings of Tamil Nadu with the objectives to quantify the biological characteristics of *Striga asiatica* and to evaluate an efficient integrated management technique in early planted sugarcane.

For quantifying the biological characteristics of *S. asiatica*, the pot culture experiment was conducted by collecting soil samples from ten locations and cane setts were planted to stimulate the germination of *S. asiatica* seeds. Biological characteristics like days for emergence and flowering, biomass partitioning and seed production potential were quantified. Field experiments were conducted during the main season of 2006-07 & 2007-08 in the farmer's field. Treatments consisted of hand weeding either all weeds or except *Striga asiatica* on 90 and 120 DAP, post-emergence directed spraying of either paraquat 6 ml /l or glyphosate 10 ml/l, post-emergence application of either 2, 4-D Na salt 5 g /l alone or with urea 20 g/l, urea or sodium chloride 200g /l, trash mulching 5 t/ha, and unweeded control.Experiment was conducted in Randomized Blocks Design with three replication. Observations on *Striga asiatica* density, dry weight and weed control efficiency were recorded along with yield attributes and cane and sugar yields. Biological characters of *S. asiatica* indicated that the seeds took on an average of 49 days for emergence after cane planting with average maximum and minimum dry weight of 0.695 g and 0.530 g/plant at seedling stage (15 DAE) and recorded maximum of 1.746 g and minimum of 1.135 g/plant dry weight at active vegetative growth stage (30 DAE). The tiller production varied from 4 to 6 tillers with an average of 4.6 tillers per plant. The average of 3-4 branches/ plant. Flower initiation period of *S. asiatica* varied from 26 to 32 DAE. Capsule production capacity was very high with an average of 306 capsules/plant and with average dry weight of 0.304 g/capsule, with each capsule containing thousands of seeds. Results of integrated management of *S. asiatica* revealed that pre-emergence application of atrazine 1.0 kg/ha on 3rd days after planting + hand weeding on 45 DAP + earthing up on 60 DAP combined with post-emergence spraying of 2, 4-D sodium salt 5 g/litre (0.5%) + urea 20 g/litre (2%) on 90 DAP for effective control of *Striga asiatica* and for higher productivity and profitability in sugarcane cultivation. Pre-emergence application of atrazine 2.0 kg/ha on 3rd DAP + Hand weeding on 45 DAP with an earthing up on 60 DAP combined with post-emergence spraying of 2,4-D Na salt 5 g/l (0.5%) + urea 20 g/l (2%) on 90 DAP reduced the density and dry weight of *Striga asiatica* in sugarcane with better control efficiency and for higher productivity and profitability of cane cultivation under red sandy loam soils.

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Evaluation of herbicide combinations in sugarcane

V. Vasuki and R. Jagannathan
Coconut Research Station,TNAU, Aliyarnagar (Tamil Nadu)
e-mail: vasukimanii@yahoo.com

India ranks first among the cane growing countries of the world with an area of 4.05 million hectares and a production of 270.9 million tons. In Tamil Nadu, sugarcane is cultivated in an area of 0.33 million hectares producing around 36.34 million tonnes of sugarcane, with an average productivity of 110 t/ha. The ever increasing population increased the consumption rate with increased demand for sweeteners. Hence, the country would need to produce 415 million tons of sugarcane. Among the various strategies to increase sugarcane yield, weed management is an important technology.

The field experiments were conducted in the farmer's field located in the problematic weed infested area of Cuddalore District during the late samba and summer seasons for rice followed by mid and special season for sugarcane. The weed management practices in rice *viz*., pre-emergence (PE) application of chlorimuron ethyl + metsulfuron methyl (1:1) + hand weeding (HW) on 40 DAT , PE butachlor + HW on 40 DAT and HW twice on 20 and 40 DAT were assigned to the main plots, while the weed management in sugarcane *viz*., PE atrazine , PE atrazine + post emergence (PtE) 2, 4-D , PE atrazine + post-emergence directed spray (PtEDS) of glyphosate , PE metribuzin , PE metribuzin + PtE 2, 4-D and PE metribuzin + PtEDS glyphosate were assigned to the sub plots. The soil type was sandy loam with neutral pH. The treatments were replicated thrice in split plot design. Pre-emergence application of atrazine and metribuzin reduced the density of annual broad leaved and grassy weeds. The sedge weeds (*C. rotundus*) became dominant and increased in density throughout the cane growth with more density noticed in atrazine applied plots. However, when the post emergence directed spray (PtEDS) of glyphosate was imposed around 60 DAP, it had a better effect on reducing the sedges and in turn the total weed density. Though 2, 4-D had good control over broad leaved and climbers weeds, it failed to control the sedges.

Nutrient removal by weeds had positive relationship with weed dry weight and negative relationship with the plant uptake of nutrients. The PE butachlor + HW on 40 DAT in rice and PE atrazine in sugarcane had little effect on the weeds so recorded the highest weed dry weight and ultimately the highest nutrient removal by weeds and reduced crop uptake of nutrients in rice and sugarcane, respectively.

Weed management practices in sugarcane PE metribuzin + PtEDS of glyphosate enhanced the economic shoot production at 210 DAP to the tune of 76.03 and 78.42 per cent in the mid and special season canes, respectively over the farmer's practice of PE atrazine. The reduction in the economic shoot production under the farmer's practice PE atrazine clearly indicated that due to the higher weed density and higher dry weight of weeds, combined with higher competition along with the crop for all resources resulted in lesser tiller production and thereby recording lesser economic shoot production than that of PE metribuzin + PtEDS of glyphosate in both the crops, respectively. The cane and sugar yield in sugarcane were favourably influenced by the PE metribuzin + PtEDS glyphosate followed by PE atrazine + PtEDS glyphosate. Any management practices that improve the cane yield, would pave the way in obtaining the maximum return is well known. Among the weed management practices in sugarcane PE metribuzin + PtEDS glyphosate recorded higher yield percentage over PE atrazine 89.37 and 88.67 per cent and was followed by PE atrazine + PtEDS glyphosate with 73.11 and 72.25 per cent during both the crop seasons, respectively. Similar results were obtained by Singh (1988) and Singh *et al.* (1997). Subsequently, Srivastava (2001) also stated the effect of chemicals on control of weeds and consequent reduction in competition for moisture, nutrients and sunlight would have ended in the conspicuous enhancement in number of millable cane and cane yield.

Among the weed management practices in sugarcane PE metribuzin + PtEDS glyphosate recorded 87.33 and 88.58 per cent increased sugar yield over that of the farmer's practice PE atrazine during both the seasons, respectively. The increased sugar yield was due to the increase in cane yield along with nutrient uptake resulting from increased availability due to the reduced competition from weeds.

P-136 Efficiency evaluation of new formulation of oxyflourfen (23.5% EC) on weed control in aggregatum onion (*Allium cepa*)

R. Sathya Priya, P. Manickasundaram, C. Chinnusamy and P. Muthukrishnan
DWSRC, Department of Agronomy, TNAU, Coimbatore (Tamil Nadu)
e-mail : sathyaagro.priya@gmail.com

Onion is extensively grown commercial vegetable crop and cultivated on large scale throughout India. Being an irrigated crop, it invites serve infestation of a large number of weeds which reduces the bulb yield of onion to an extent of 40 to 80% depending upon intensity of weed infestation. The effective control of weeds can help for improving the productivity of onion. The weed management is the main problem in cultivation of onion because hand weeding and intercultural operations are expensive due to scanty and high labour cost. It exhibits greater susceptibility to weed competition than most other vegetable crops. It affects the growth of the crop that ultimately reflects in the yield.

Field experiment carried out during *kharif* - 2009 at Agricultural Research Station, Bhavanisagar to evaluate efficiency evaluation of new formulation of oxyfluorfen (23.5% EC) on weed control in onion (*Allium cepa*). The experiment was replicated thrice in randomized block design with treatments, as pre emergence herbicide of oxyfluorfen at 150, 200, 250, 300, 400g/ha with one hand weeding on 45 DAS, these treatments were compared with check (pendimethalin 30% EC at 750g/ha) and hand weeding at 25 and 45 DAS. The experimental field was dominated with *Cynodon dactylon*, *Dactyloctenium aegyptium*, *Panicum repens*, *Cynotis axillaris,* under grasses, *Cyperus rotundus* under sedges and *Boerhaavia diffusa, Amaranthus viridis*, *Trianthema portulacastrum, Digera arvensis*, *Portulaca oleraceae, Parthenium hysterophorus, Tridax procumbens,* under broad leaved weeds. Phytotoxicity symptoms like yellowing of leaves, leaf discolouration, cupping of leaves were occurred in crop with higher dosage. All the weed control treatments have a definite influence on yield parameters and significantly gave higher bulb yield than unweeded control. Among the different weed control treatments pre-emergence application of oxyfluorfen at 200 g/ha recorded lesser weed density and dry weight. The highest bulb yield was recorded with application of oxyfluorfen 200 g/ha. This was followed by application of oxyfluorfen 150g/ha. However, the treatment weed free check recorded the lowest weed dry matter production and weed control efficiency.

P-137 Integrated weed management in tomato

Sanjay Kumar Verma, R. K. Bisen and O. P. Kashyap
TCB CARS, IGKV, Sarkanda, Bilaspur (C.G.)
e-mail : ajeetwilliams@yahoo.co.in

Tomato (*Lycopersicon esculentum* Mill) is grown throughout the country as an fruit vegetable. It extensively grown in all parts of Chhattisgarh during rainy and winter seasons. Field experiments were conducted at Horticultural Farm of TCB College of Agriculture & Research Station, Sarkanda, Bilaspur (C.G.) during winter seasons of 2008 and 2009. The soil of the experimental field was sandy loam in texture and neutral in reaction. Among different weed control treatments. The highest Tomato yield was recorded under weed free treatments (250.72 qtl./ha) followed by fluchloralin at 2.0 kg/ha. Along with one hand weeding at 45 DAT (248.42 qtl./ha). Fluchloralin at 1.0 kg. 1.0 /ha. Along with one hand weeding was statistically equally effective in increasing yield (246.12qt/ha) to that with higher dose along with one hand weeding. Fluchloralin at 1.0 kg. a.i./ha. Along was not found to be effective in improving the yield of Tomato (236.44qtl/ha) The similar trend was observed with regards to plant height. However, the weed control efficiency was also found to be minimum under pendimathalin at 1.0 kg/ha followed by its application along with one hand weeding at 45 DAT (32.89). Therefore, these treatments were observed to be inferior in improving Tomato yields. Conclusively, it may be stated that fluchloralin at 2.0 kg./ha. Along with one hard weeding at 45 DAT may be used for weed control in Tomato crop.

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Crop-weed competition studies in okra under mid-hill conditions of Himachal Pradesh.

Suresh Kumar, N. N. Angiras and S. S. Rana
Deptt. of Agronomy, CSKHPKV, Palampur (H.P.)
e-mail : skg_63@yahoo.com

Uncontrolled weed growth in okra has been reported to cause yield reduction of 80 % (Singh *et.al.* 1991). Removal of weeds through out the crop season may not be beneficial and economical. It is therefore, utmost important to know the critical period of crop-weed competition to optimize herbicide use or adopt integrated weed management practices. Information on this aspect particularly in hills of Himachal Pradesh is meager. Hence, the present investigation was undertaken to find out the critical period of crop weed competition in *kharif* okra.

A field experiment was conducted during *kharif*, 2007 and 2008 at Research farm of Deptt. of Agronomy, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur (32^0 6' N Latitude, 76^0 3' E longitude, 1280 m above msl). Ten treatments comprising the weedy and weed free conditions upto 20, 40, 60 and 80 days after sowing and upto harvest were evaluated in randomized block design with three replications. The okra variety *Arka Anamika* was planted in rows 45 cm apart on June 2 each during 2007 and 2008, using 20 kg seed/ha. Well decomposed FYM at 10 t/ha was applied uniformly at the time of field preparation. In addition, the crop was fertilized with 60 kg N, 50 kg P_2O_5 and 30 kg K_2O/ha as basal dose. Required amount of N, P and K was supplied through urea, single super phosphate and muriate of potash, respectively. Effects on crop weed competition on yield and yield attributes were also recorded.

The predominant weed species infesting the crop were: *Echinochloa colona, Cyperus sp., Panicum dichotomiflourum, Commelina benghalensis, Ageratum conyzoides, Digitaria sanguinalis, Polygonum alatum* and *Aeschynomene indica*. Green okra yield increased with increase in duration of weed free condition and decreased with increased weedy duration during both the years of study. Decrease in okra yield with delayed weed removal was attributed to increased weed competition as progressive increase in dry matter accumulation by weeds was observed. Weedy conditions upto 20 days after sowing only did not have any significant competition with crop as green okra yield was similar with that of whole season weed free conditions which was due to low magnitude of weed infestation. However, the green okra yield reduced drastically when weedy period increased from 20 days after sowing to 40 days after sowing . Increase in weedy period thereafter did not influence the okra yield significantly. Weed free conditions up to 40 days after sowing and thereafter, till harvest weed free conditions upto 40 DAS (and beyond) yielded at par with that of whole season weed free conditions during both the years of study. The green okra yield reduced by 3.5, 3.10, 66.4, 68.1 and 75.2 per cent during 2007 and 1.8, 23.6, 40.0, 41.8 and 61.8 per cent during 2008 due to uninterrupted weed growth up 20, 40, 60, 80 days after sowing and harvest, respectively, compared to weed free conditions upto harvest. On the other hand, enhancement in green okra yield due to weed free conditions upto 20, 40, 60, 80 days after sowing and harvest over full season weedy conditions was 132.1, 267.0, 278, 293 and 363 percent during 2007 and 57.1, 123.8, 138.1, 142.8 and 161.9 per cent during 2008, respectively.

Thus, the results showed that to realize the potential green okra yield higher monetary returns of okra, crop should be kept weed free upto initial 40 days after sowing, which is more crucial from crop-weed competition point of view.

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P-139 Weed management in transplanted onion (*Allium cepa* L.)

K. S. Yadav, S. S. Tomar and A. M. Jaulkar
Directorate of Weed Science Research Centre,
Dept. of Agronomy, College of Agriculture, RVSKVV Campus Gwalior (M.P)
e-mail : desruskvv@rediffmail.com

Onion (*Allium cepa* L.) is one of the most important commercial crop grown in India. Crop yield was reduced by weed infestation due to low initial growth rate, long vegetative period and low competing ability of onion crops. Reduction in bulb yield of onion was observed in the range of 40-80% due to weed infestation. Hence, the present experiment was conducted in 2008-09 at Research Farm, Gwalior to find out the suitable and cost effective methods of weed control in transplanted onion. The soil was sandy clay loam in texture with pH 7.6, low in organic carbon and available nitrogen and medium in available phosphorus and potassium. Nine treatment combinations consisting pre-emergence application of pendimethalin (1.0 kg/ha), sequential application of pendimethalin (0.75 kg/ha) as PE followed by pendimethalin (0.75 kg/ha sand mix broad cast at 30 DAT), oxyfluorfen (0.25 kg/ha as PE), oxadiargyl (0.09 kg/ha as PE) alone and each followed by one hand weeding at 45 DAT, weed free (three hand weeding at 30, 45 & 60 DAT) and weedy check were laid out in randomized block design with three replications. The total weed density, dry weight of weeds and weed biomass were recorded at harvest by random sampling technique by using a quadrate of lm^2. The most dominating weed species found in weedy check throughout the crop growth period were *Cyperus rotundus, Chenopodium album, Medicago hispida, Anagallis arvensis, Phalaris minor, Parthenium hysterophorus, Convolvulus arvensis* and *Spergula arvensis*. Application of pendimethalin 0.75 kg/ha as pre-emergence fb pendimethalin 0.75 kg/ha broadcast as sand mix at 30 days after transplanting (DAT), oxadiargyl 0.09 kg/ha as PE fb one hand weeding at 45 DAT and oxyfluorfen 0.25 kg/ha as PE fb one hand weeding at 45 DAT were at par with weed free (3, hand weedings) treatment in respect to bulb yield as well as weed biomass and weed control efficiency. The lowest bulb yield (5.7 q/ha) was recorded in weedy plot due to severe weed competition. Among the herbicide, pre-emergence application of oxyfluorfen 0.25 kg/ha did not prove effective in controlling weeds in onion, whereas oxadiargyl 0.09 kg/ha as PE was more effective to control of weed as compared to pendimethalin 1.00 kg/ha as PE. Maximum net return and B:C ratio realized with sequential application of pendimethalin 0.75 kg/ha fb pendimethalin 0.75 kg/ha as POE broad cast as sand mix followed by weed free (3, hand weedings at 30, 45 & 60 DAT) treatment and oxadiargyl (0.09 kg/ha) as PE one hand weeding at 45 DAT. Whereas, weedy check gave lowest net return and B:C ratio.

P-140 Prospects of chemical weed control in potato in Chhattisgarh

Neeraj Shukla, Vijay Kumar, Deo Shankar, D. Sharma and Saket Dubey
Dept. of Horticulture, College of Agriculture I.G.K.V., Raipur (C.G.)
e-mail : shuklaniraj@rediffmail.com

Among the major food crops, potato (*Solanum tuberosum* L) is considered to be the kind of vegetable, which produces highest dry matter, edible energy and protein per unit area and time than any other major food crops and has many industrial uses. In Chhattisgarh, potato occupies about 8285 ha of area with production of 1.240 lakh tones. The losses of yield by weed in vegetable crops ranges from 30 to 45 percent. Among the weed control methods, chemical weed control is easier, less time consuming and less costly. The potato is broad leaved and non woody plants due to which, they are very sensitive to strong chemicals like herbicides which may cause injury thus reducing the yield and quality of tuber. All the research trials on weed control in potato indicated that the selective herbicides produced potato yield statistically equal or greater then hand weeding. The pre plant soil incorporation of fluchloralin 1.0 kg/ha is most effective to increase large sized tubers and yield whereas, pre-emergence of alachlor (1kg/ha) or pendimethalin (2.0 kg/ha) also proved good for potato tuber and yield. In case of post emergence, paraquat (1.0 kg/ha) was also effective but just emergence of potato crop. Since the mechanical weed control is costly besides it is labour intensive. Moreover the availability of labourers is scanty in Chhattisgarh. Hence the chemical methods may be adopted by the farmers as and effective means of weed control in potato.

P-141 Integrated weed management in coriander (*Coriandrum sativum* L.)

K. S. Yadav, S. S. Tomar and A. M. Jaulkar
DWSR-C, RVSKVV, College of Agriculture, Gwalior (M.P)
e-mail : desruskvv@rediffmail.com

A field experiment was conducted at Research Farm, College of Agriculture, Gwalior during *rabi* seasons 2007-08 and 2008-09 on sandy clay loam soil to evaluate the effect of weed management practices on weeds and yield of coriander. The experiment comprised of 12 weed management practices *viz*. weedy check, hand weeding (H.W.) at 30 DAS, hoeing at 30 DAS, hoeing at 30 DAS + one hand weeding at 45 DAS, trifluralin 1.00 kg/ha as PPI, pendimethalin 1.00 kg/ha as PE, isoproturon 0.75 kg/ha as PE, isoproturon 0.75 kg/ha as POE alone and each followed by one hand weeding at 30 DAS except post-emergence application of isoproturon and weed free (2 H.W. at 30 & 45 DAS) were laid out in a randomized block design with 3 replications. The coriander variety JD-1 was sown at a row distance of 30 cm apart on 31st and 08th November 2007 and 2008 and harvested on 17th and 08th March 2008 and 2009 respectively. Crop was raised under irrigated condition with recommended package of practices. The dominant weeds of the experimental plot were *Chenopodium album*, *Convolvulus arvensis, Anagallis arvensis, Spergula arvensis*, *Phalaris minor* and *Cyperus rotundus*.

On the basis of two years mean data, all the weed management practices significantly reduced the weed density and its dry weight as compared to weedy check. Application of trifluralin 1.00 kg/ha as PPI, pendimethalin 1.00 kg/ha as PE and isoproturon 0.75 kg/ha as PE gave season long weed free condition and ultimately resulted in lower dry weight of weeds. The cumulative effect of pendimethalin 1.00 kg/ha PE + 1, hand weeding at 30 DAS and isoproturon 0.75 kg/ha as PE + 1, hand weeding at 30 DAS as integrated weed management approach significantly reduced the weed density and weed biomass as compared with other treatments except weed free treatment. Maximum seed yield, net return and B:C ratio were recorded in weed free treatment followed by pendimethalin 1.00 kg/ha + one hand weeding at 30 DAS and isoproturon 0.75 kg/ha + one hand weeding at 30 DAS in coriander.

P-142 Weed control in radish yield, quality and herbicide residue

Bakhshish Singh, M. S. Bhullar, U. S. Walia and S. K. Randhawa
Department of Agronomy, PAU Ludhiana (Punjab)
e-mail : msbhullar1@rediffmail.com

Radish (*Raphanus sativus* L.) is a popular winter season root vegetable in northern plains of India. Very little information with regard to weed control in root crops, in general, and radish crop in particular is available especially in northern plains. Till date, no herbicide is recommended for controlling weeds in radish for northern plains. Hence, the study was conducted to find out effective and safe herbicide/s for radish.

A field experiment was carried out at Ludhiana during winter 2007-2008 to find out effective and safe herbicide for radish (*Raphanus sativus* L). Pre-emergence herbicides *viz*. pendimethalin (0.375, 562 and 0.75 kg/ha), trifluralin (0.6, 0.9 and 1.2 kg/ha), alachlor (1.25, 1.875 and 2.5 kg/ha), oxyfluorfen (0.117, 0.147 and 0.176 kg/ha), two hand hoeing (20 and 40 days after sowing) and unweeded control were evaluated. Uncontrolled weeds reduced the radish root yield by 10.7 to 27.1 %. Crop emergence did not vary among different weed control treatments. All the herbicidal treatments significantly reduced weed density and dry matter as compared to unweeded control. Trifluralin 1.2 kg/ha recorded the highest radish root yield and was at par with trifluralin 0.9 kg, pendimethalin 0.75 kg, alachlor 1.25 and 2.5 kg, oxyfluorfen 0.147 and 0.176 kg/ha and two hand hoeing. Herbicides did not influence the total soluble solids and isothiocyanate content in radish roots. Herbicides residue in crop roots were below detectable level. Results indicated that all the herbicides tested at above doses could be safely used in radish.

P-143 Weed flora of summer crops in Purulia and Bankura districts of West Bengal

A. Mukherjee, B. Duary and M. K. Mandal
Institute of Agriculture, Visva-Bharati, Sriniketan (West Bengal)
e-mail : anupammukhe@gmail.com

A survey of weed flora of summer sesame, green gram, brinjal, okra and boro rice was conducted in Purulia and Bankura districts of West Bengal during summer season, 2009. Eighteen Blocks and 79 villages in Purulia and 19 Blocks and 93 villages in Bankura were surveyed following the standard procedure. Total weed species found in these crop fields were 24, 10, 19, 18 and 8 in sesame, green gram, brinjal, okra and boro rice respectively in Purulia district and 13, 11, 9, and 9 in sesame, brinjal, maize and okra respectively in Bankura district. *Croton bonplandianum,* was the most predominant weed species of sesame in both the district followed by *Digitaria sanguinalis, Euphorbia hirta, Dactyloctenium aegyptium* and *Cynodon dactylon* in Purulia district and *Cyperus difformis, C. rotundus, D. sanguinalis* and *C. dactylon* in Bankura district. The pre-dominant weed species as per the value of importance value index (IVI) was *Echinochloa colonum, Marsilea quadrifolia, E. crus-galli, Amaranthus viridis* and *D. aegyptium* in boro rice, *D. sanguinalis, C. bonplandianum, Euphorbia hirta, Dactyloctenium aegyptium* and *Marsilea quadrifolia* in green gram, *D. sanguinalis, C. dactylon, C. bonplandianum, Argemone mexicana* and *Dactyloctenium aegyptium* in brinjal, *D. sanguinalis, C. bonplandianum, D. aegyptium, Achyranthus aspera* and *E. hirta* in okra in Purulia district. Wheras, in Bankura district *Croton bonplandianum, C. rotundus, D. sanguinalis, C. dactylon* and *C. difformis* in brinjal, *C. bonplandianum, C. rotundus, Sida rhombifolia, Commelina benghalensis* and *D. sanguinalis* in okra and *E. hirta, C. rotundus, D. sanguinalis, D. aegyptium* and *C. compressus* in maize were the pre-dominant weed species in summer season.

P-144 Efficacy of carfentrazone to penoxaden with and without surfactant against grasses and blw in wheat

Jaidev, A. K. Singh, Raj Kumar and R. P. Dwivedi
Department of Agronomy, N.D.U.A.T., Kumarganj, Faizabad (U.P.)
e-mail: jdsnduat@gmail.com

An experiment was conducted during *rabi* season of 2008-09 at Agronomy Research Farm of N.D. University of Agriculture and Technology, Kumarganj, Faizabad (U.P.) to find out the efficacy of carfentrazone and penoxaden against grasses and broad leaf weeds in wheat using wheat cv. PBW-343 in RBD, replicated trice in a plot size of 6 m x 2.5 m. The crop was sown on 20-11-2008 and harvested on 25-4-2009. A new herbicide penoxaden at different doses (30, 35, 40 g/ha) was evaluated after sequential application of carfentrazone (15, 20 and 25 g/ha) with surfactant. The basic herbicides were applied at 35 DAS, while, second herbicide was applied at one week after application of first herbicide.

In weedy plot, grassy and BLW were recorded at 46 and 56 per cent, respectively at 30 DAT. Phalaris minor was the dominant weed (55%) in grassy while *Chenopodium album* (25%), *Rumex retroflexus* (14%), *Coronopus didymus* (6%) and *Melilotus album* (5%) among BLW. There was no effect of carfentrazone alone on grassy weeds but almost all the BLW controlled very effectively when applied alone or in sequential application with penoxaden. Relatively better control of BLW and grassy weeds were recorded when carfentrazone and penoxaden applied first in sequence. Maximum grain yield (4525 kg/ha) was recorded with weed free being at par with carfentrazone fb. penoxaden (25 & 40 g/ha), penoxaden fb. carfentrazone (35 & 20 and 40 & 25 g/ha). Any kind of antagonism between carfentrazone and penoxaden was not noticed. No response of 1% ammonium sulphate used as surfactant with carfentrazone was observed with respect to weed or crop toxicity or crop growth parameters.

P-145 Efficacy of pre-and post-emergence herbicides against weeds, yield attributes and yield of onion (*Allium Cepa.l*) in Chhattisgarh plains

Nisha Jangre, C.R. Gupta, Jitendra Singh and A. P. Singh
Danteshwari College of Horticulture , I.G.K.V., Raipur (C.G.)
e-mail : apalsingh@yahoo.com

Conventional method of weed control (hoeing or hand weeding) in onion is effective but labour expensive. Moreover, it is not advisable to mechanically keep the crop weed free due to increased cost of human labour and their scarcity. The very close spacing of the onion transplants and the shallow root system of seedling make the operation of mechanical methods quite ineffective against uprooting of weeds, on the other hand, the seedlings cannot sustain injury. Manual weeding cannot be practiced effectively in short time on a large scale. The scarcity of the labourers in the vicinity of cities compel farmers to use herbicides for controlling weeds. The present experiment was conducted at Research and Instructional Farm of Department of Horticulture, IGKV, Raipur (C.G.) during *rabi* season (October-March) of 2008-09 to find out the effect of weed management practices on growth and yield of onion, weed dynamics and economics. The ten treatments comprised of pendimethalin 1.25 kg/ha pre-transplanting, pendimethalin 1.25 kg/ha Pre-transplanting + HW at 20 DAT , pendimethalin 1.25 kg/ha post transplanting , oxyfluorfen 0.20 kg/ha Pre-transplanting , oxyfluorfen 0.20 kg/ha pre transplanting + HW at 20 DAT, oxyfluorfen 0.20 kg/ha post-transplanting, butachlor 1.2 kg/ha post transplanting, hand weeding twice at 20 and 40 DAT , weedy check , mechanical weeding thrice in 20, 30 and 40 DAT .The experment was laid out in randomized block design with three replications. Onion variety "Nasik Red" was grown as a test crop. Onion was transplanted on 20th November 2008 with spacing 15x10 cm. The crop was fertilized with 120, 80 and 60, N_2, P_2O_5 and K_2O kg/ha, respectively.

In the experimental field weeds such as *Parthenium hysterophorus, Physalis minima, Chenopodium album, Cyperus rotundus, Cynodon dactylon, Melilotus indica* and *Alternanthera triandra* were the predominant weeds. At initial period of crop growth, broad leaf weeds contributed more as compared to grasses and sedges. The weed density and dry matter of weeds were found minimum under hand weeding twice at 20 and 40 DAT. Whereas, weed control efficiency was found maximum under hand weeding twice at 20 and 40 DAT. All the herbicides treatments improved, weed control efficiency, economics and reduced weed density and their dry weight as compared to weedy check. Significantly highest bulb yield of onion (9.03 kg plot^{-1} & 418.2 q/ha) was noted under hand weeding twice at 20 and 40 DAT, however, it was statistically similar to bulb yield noted under pendimethalin 1.25 kg/ha pre-transplanting + HW at 20 DAT (8.90 kg/plot & 412.5 q/ha) and treatment oxyfluorfen 0.20 kg/ha pre transplanting + HW at 20 DAT (8.80 kg/plot & 412.14 q/ha). Hand weeding twice at 20 and 40 DAT gave maximum gross return (Rs.2,09,100.00/ha), whereas, net return (Rs. 1,40,288.10/ha) and benefit cost ratio (2.13) was highest under oxyfluorfen 0.20 kg/ha pre transplanting + HW at 20 DAT . All these economic parameters were found minimum under weedy check.

P-146 Characterization of ecological parameters of weed flora in sugarcane ecosystem of Belgaum district in Karnataka

G. Sajjanar, R. N. Bhat, M. B. Puradal, Ramesh Babu, B. N. Arvind Kumar and Ramesh Nayak
NIWS, DWSRCentre, MARS, UAS, Dharwad (Karnataka)
e-mail : rameshbabu.niws@gmail.com

A survey on weed flora was carried out during January 2009 in Belgaum district of Karnataka, under National Invasive Weed Surveillance Programme, DWSR Centre, UAS, Dharwad. The dominance of weed species under sugarcane ecosystems was studied. The study revealed that the dominant weeds in sugarcane are *Cyperus rotundus* (59.47), *Portulaca oleraceae* (19.12), *Alternathera sessilis* (18.02), *Physalis minima* (17.73) and *Malvastrum coromandelianum* (15.51); while, *Parthenium hysterophorus* (26.25), *Argemone mexicana* (22.66), *Alternathera sessilis* (17.49) and *Blumea wightana* (14.55) were the dominant weeds in non-cropped area. *Parthenium hysterophorus* (69.55), *Cynodon dactylon* (48.63), *Alternathera sessilis* (45.42), *Croton sparsiflorus* (33.52) and *Argemone mexicana* (17.76) were the major weeds in garbage area. Alien weeds *viz*., *Cyperus rotundus*, *Portulaca oleraceae* and *Alternathera sessilis* are becoming dominant weed species in cropped area in Belgaum district. *Alternathera sessilis* is native to tropical America; previously it was confined to field bunds, irrigation water channels, roadsides. But, now it fast spreading and creating menace in cropped fields in the district.

P-147 Efficacy of imazethapyr against weeds in groundnut (*Arachis hypogaea* L.)

Megha Dubey, M. L. Kewat, J. K. Sharma, Smita Singh
Dept. of Agronomy, College of Agriculture, J.N.K.V.V., Jabalpur (M.P.)
e-mail - meghadubey33@yahoo.com

A field experiment was conducted during rainy (*kharif*) seasons of 2008 and 2009 at Livestock Farm, JNKVV, Jabalpur to study the efficacy of imazethapyr against weeds in groundnut. Treatments comprising of five doses of imazethapyr 50,100,150,200 and 300g/ha alone, combined application of imazethapyr + chlorimuron (100+24 g/ha), hand weeding twice (20 and 40 DAS) including weedy check, were laidout in randomized block design with three replications. The experimental field was infested with sedge *Cyperus iria* (44.08%) and grassy weeds *Echinochloa colona* (30.51%) and *Dinebra retroflexa* (25.39%) at 40 DAS during both the years. The efficacy of imazethapyr at the lowest rate (50 g/ha) was poor, which improved slightly with the increase in application rates from 150 to 300 g/ha. However, combined application of imazethapyr at lower rate 100 g/ha with chlorimuron 24 g/ha paralized the weed growth identically (98.12%) to that of hand weeding twice (98.62%) and attained higher values of yield attributes as well as higher pod and haulm yields (12.83 and 21.21 q/ha). The latter treatment also found more remunerative as it f*etc*hed the maximum values of net monetary returns (Rs 21395.5/ha) and benefit:cost ratio (2.2) and surpassed recommended practice of weed control *viz*., hand weeding twice which recorded the lower values of NMR (Rs 17844.75/ha) and B:C ratio (1.7) due to more cost of manual weed control.

P-148 Effect of tillage system on soil microflora, soil health parameters and plant microbial interaction in soybean

M. G. Patil, J. K. Jadhav, A. K. Gore and N. S. Jadhav
Directorate of Weed Science Research Centre, M.A.U Parbhani (M.H.)
e-mail : plsontakke@gmail.com

A field experiment was conducted in a split plot design with three replication to study the effect of different tillage system on soil health and microbial population in soybean at DWSR Centre, MAU, Parbhani during *kharif* 2008. Different five tillage system were used (i.e. zero-zero, zero (ZT)–conventional (CT) , conventional-zero, minimum- minimum and conventional - conventional) as main plot treatment and sub-plot treatments (weed control treatment) were hand weeding, PE alachlor at 2.0 kg/ha and weedy check The soil sample were collected from rhizo-sphere for all the microbial and bio-chemical analysis of soil was collected at 3 stages of crop growth *viz*. Maximum vegetative growth stage (30 DAS), flowering stage (50 DAS) and at harvest. Result revealed that during *kharif* season among various weed control measures. There were no significant changes in soil pH. EC and organic carbon due to various tillage practices Regarding weed control treatment numerically maximum organic carbon was recorded in i.e. hand weeding treatment, Basal soil respiration and Microbial biomass carbon was recorded of highest value in CT-CT which was significantly highest over ZT-CT- Regarding weed control treatment it was found significant at 30 DAS where as significantly higher microbial biomass carbon was observed in unwedded control over herbicide application, Fungal and bacterial population was influenced by tillage system at 30 DAS. Highest microbial population was observed in CT-CT and Bed-Bed over ZT-ZT system. Bacterial population was influenced by weed control treatment at 30 DAS it was less in herbicide treatment where as it was more in case of hand weeding. Fungal population was not affected significantly due to weed control treatment.

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Herbicides residue studies in soil applied in rice under rice-wheat cropping system

S. S. Singh, A. K. Singh and R. K. Pathak
Department of Agronomy, N.D.U. A.T., Kumarganj, Faizabad (U.P.)
e-mail: aksnduat@gmail.com

Field trials were conducted at Agronomy Research Farm as well as in weed science laboratory, Faizabad during *kharif* 2008 and 2009 in a randomized block design with four replications. Application of almix 6 and 12 g/ha, pretilachlor 0.5 and 1.0 kg/ha and oxadiargyl 0.1 and 0.2 kg/ha, at pre-emergence in rice did not cause significant differences in germination, plant height and dry matter production of cucumber grown in sampled soil taken after the harvest of rice. Therefore, the results reveled that herbicides namely, almix 6 and 12 g/ha, pretilachlor 0.5 and 1.0 kg/ha and oxadiargyl 0.1 and 0.2 kg/ha at pre-emergence in rice did not cause significant differences in germination, plant height and dry matter production of cucumber grown in sampled soil taken after the harvest of rice. Therefore, the results revealed that herbicides namely, almix 6 and 12 g/ha, pretilachlor 0.5 & 1.0 kg/ha and oxadiargyl 0.1 and 0.2 kg /ha applied at pre-emergence to control the weeds in rice did not leave their harmful toxic level of residues in soil after the harvest of rice.

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Leaching behavior of atrazine in silty clay loam soil of mid hills of Himachal Pradesh

Neelam Sharma, N. N. Angiras and Suresh Kumar
Department of Agronomy, CSK HPKV, Palampur (H.P.)
e-mail : sharma_neelam29@rediffmail.com

A laboratory experiment was conducted to study the leaching behavior of atrazine in silty clay loam soil of mid hill zones of Himachal Pradesh in Department of Agronomy, Forages and Grassland Management, CSK Himachal Pradesh Krishi Vishvavidyalya, Palampur. Atrazine was applied at two doses i.e. 1.5 kg/ha and 3.0 kg/ha. The distribution of atrazine in 0-5 cm, 5-10 cm and 15-20 cm was 3.25, 0.86 µg/g and BDL at lower dose (1.5 kg/ha) and 6.27, 2.40 and 0.39 µg/g at higher dose (3.0 kg/ha) respectively. Atrazine concentration was highest in 0-5 cm soil depth at both the doses. Thus revealing that the maximum part of herbicide remained at the top of column. The movement of herbicides applied in soil under the influence of water is an important factor which governs the fate of herbicides in soil. Atrazine(2- chloro 4- (ethylamino)- 6 isopropyl amine s- triazine) belongs to triazine group is recommended as pre as well as post emergence herbicide to control the broad leaved weeds in maize. Increased use of this herbicide in maize is widely reported and it is essential to know the down ward movement (leaching) of soil applied atrazine, as it may lead to the contamination of soil and ultimately ground water pollution. Therefore, the present investigation was undertaken to evaluate the leaching potential of atrazine in silty clay loam soils of mid hills zone of Himachal Pradesh.

Surface soil samples (0-20 cm)from the surrounding area of the Agronomy Farm, CSK HPKV, Palampur that was never treated with any herbicide were collected, air-dried and passed through a 3 mm sieve. The collected soil was silty clay loam (clay 42 %, silt 20 % and 28 % sand) in texture with 1.27 % organic carbon and 5.16 pH. Commercial grade of atrazine (50 % WP) was used in leaching experiment. The experiment was conducted in residue laboratory of CSK HPKV, Palampur at room temperature (250C ± 2). Polyvinyl chloride columns (10 cm internal diameter and 60 cm long) were used in experiment and arranged in a completely randomized design with three replications. Columns were cut vertically into two parts and two cut halves were joined together using adhesive tape. The muslin cloth was tied to one end and from the open end processed untreated soil was added into columns. The known amount of soil (6 kg) was packed by gently tapping the columns. Water was added from the top to pre condition the soil. After attaining a constant percolation rate, the herbicide atrazine was sprayed 1.5 kg/ha and 3.0 kg/ha. The quantity of solution required for spraying was calculated on the basis of open surface area of the column. Water was added frequently to the top of the columns one day after the herbicide application. The sufficient amount of water was added to encourage the movement of herbicide. At the end of seven days adhesive tape was removed and columns were cut into two halves. The column soil was cut horizontally into twelve cores of 5 cm each. Soil from each core was mixed well. Representative soil sample (10 dry weight) from each core was taken in duplicate. The herbicide content in soil was determined by chemical assay using gas chromatographic technique by following the standard procedure.

The analysis of column soil showed that atrazine was mobile in soil columns. The distribution of herbicide was 3.25, 0.86 µg/g and BDL from lower dose 1.5 kg/ha and 6.27, 2.40 and 0.39 µg/g from higher dose i.e. 3.0 kg/ha in 0-5 cm, 5-10 cm and 10-15 cm layer of soil. It was observed that in spite of irrigation almost everyday, most of the residues remained up to 10 cm depth. Only small quantity of atrazine i.e. 0.39 µg/g at 3.0 kg/ha dose leached down to 10-15 cm layer. The concentration of atrazine remained highest at the top of column (0-5 cm) at both the doses. Atrazine at 1.5 kg/ha leached down up to 10 cm soil depth, whereas at 3.0 kg/ha up to 15 cm indicating that under normal conditions of average rainfall possibility of leaching of herbicide to ground water in silty clay loam soil is low. The distribution of atrazine at both doses i.e. 1.5 kg/ha and 3.0 kg/ha followed almost similar pattern at different soil depths.

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Germination and growth of weeds as influenced by waste water irrigation.

P. J. Khankhane and Jay G. Varshney
Directorate of Weed Science Research, Maharajpur, Jabalpur (M.P.)
e-mail : pjkhankhane@gmail.com

The waste water carrying drains provide an irrigation source to farmers during dry season in peri-urban areas of India. The farmers also prefer to use this water because waste water is extremely valuable source for them as pumping cost from sewage drains is cheaper than a borehole, which makes the practice more accessible to farmers with fewer financial resources. They intend to use waste water to their crop to sell the produce in the market and for the own consumption grow crop separately using good quality tube well water. However, the indiscriminate use of untreated water on the farm lands has created the problems of weed infestation and pest incidences. The waste waster is the means for carrying seeds of the weed species grown along the bank of drains. Farmers also attribute this to seeds that are carried in the waste water and then pumped onto the fields. Irrigation water was able to carry seeds over long distances without affecting viability. *Parthenium* hysterophorus is reported to be spread by seeds in waste water to agricultural fields. Besides this the high nitrate loading from waste water used for irrigating crops greatly increases the incidence of weeds. Therefore, an investigation was carried out to judge the effect of waste water on weed density in field crops irrigated with drain water at various contaminated sites of Jabalpur and adjoining areas. With regard to petridish culture, germination paper was applied and 10 ml waste water was applied. 50 seeds were kept in each petri dish and incubated at 25 for ^{0}C for 5 days. Five replicates of each waste water site were maintained. Tube well water as a control with 50 healthy seeds (five replicated) was also maintained. Observations were recorded after 5 days . Weed samples were also collected from various fields using the quadrants of 50 cm & cm under wheat and cauliflower cultivation irrigated with waste water at various drains sites of Gohalpur, Baldeobagh, Ukhari, Urdhana and Panagar and tube well irrigated area in Jabalpur and adjoining area during the winter season.

Higher germination of wild oat was observed under all waste waters in the range of 64-82.5% as compared to lower germination in Petri dishes filled with tube well water (53.6%). Except Ukhari water, higher shoot and root length of wild oat were recorded under the all waste waters which were at par as compared to tube well water**.** The lower germination of wild oat under Ukhari waste water can be due to higher content of salts resulting higher electrical conductivity values which is touching to the moderate degree of restriction on its use. The quality parameters of waste water such as nitrates indicated the impact on wild oat (*Avena ludoviciana*) germination, shoot and root length in all waste waters as compared to the tube well water. The highest weed density was observed under Urdhana water followed by Panagar water while least density was observed at Ukhari site. The effect of waste water irrigation found highly effective on the dry matter accumulation which were 25-67.6 percent higher than tube well water following decreasing order of weed density: Panagar > Urdhana > Ukhari > Gohalpur > Baldeobagh >Tube well water. Similarly as compared to tube well water, total weed density and dry weight under drain water irrigation were 26 and 53 per cent higher in cauliflower. The higher weed dry weight in both the crops recorded at Panagar site (80.2 g/m^2) is mainly due to the higher content of nitrates and phosphates as compared to tube well water. The weed dry accumulation was found higher in cauliflower fields than the wheat which may be due to the wider spacing is followed in case of cauliflower as compared to narrow spacing under wheat. Thus the waste water irrigation have the impact on weed infestation in terms of increased total weed density and total weed dry accumulation in wheat and cauliflower in general and on wild oat in particular in lab studies.

P-152 Effect of continuous use of herbicides on weed dynamics and soil health in soybean-wheat cropping system

V P Singh, C. Sarathambal and Jay G. Varshney
Directorate of Weed Science Research, Jabalpur (MP)
e-mail: vpsinghdwsr@yahoo.in

Due to the continuous use of herbicides, there is likelihood of development of resistant biotypes of weeds which may cause problem in the crop production system. The regular monitoring of weed flora due to the continuous use of herbicides in the system will enable to find out the change in weed flora succession and development of resistant biotypes, if any. Considering this, a long-term herbicide trial was initiated in 2006 in soybean-wheat cropping system with objectives to monitor weed dynamics, weed flora shift, soil health and productivity of crops when continuously same herbicides are applied in the same field. A field study conducted including treatments such as fenoxaprop 100 g/ha PO, imazethapyr 70 g/ha and 1 hand weeding at 30 DAS along with weedy check in soybean as a main plot treatments and superimposing isoproturon 1.0 kg/ha, sulfosulfuron 25 g/ha and clodinafop 60 g/ha followed by 2,4-D 0.5 kg/ha and 1 hand weeding at 30 days after sowing (DAS) along with weedy check in wheat as a subplot treatments in a split-plot design with 3 replications. In soybean, the experimental field was infested with *Echinochloa colona*, and *Dinebra* sp among grasses, *Commelina communis*, *Phyllanthus simplex*, *Euphorbia geniculata* among broadleaf weeds and *Cyperus* ir*i*a among sedges. Application of fenoxaprop 100 g/ha reduced the population of *E. colona* and *Dinebra* sp. whereas, lowest infestation of *P. simplex* and *C. iria* was recorded with imazathepyr 70 g/ha. Manual weeding 30 DAS was found most effective in reducing the population of *C. communis* and *E. geniculata*. Continuous use of fenoxaprop at 100 g/ha caused weed flora shift from grasses (*E. colona* and *Dinebra* sp) to broad leaf weeds, whereas problem of grasses were substantially increased in imazethapyr treated plots. Significantly lower weed density and weed biomass production was noticed with imazethapyr at 70 g/ha only as compared to weedy check. Yield attributes *viz*, pods and seed weight per plant and seed yield of soybean were significantly influenced with different weed control measures. Imazethapyr at 70 g/ha produced significantly higher pods per plant, seed weight per plant and seed yield over fenoxaprop at 100 g/ha and weedy check. However, highest yield attributes and seed yield of soybean were recorded with 1 hand weeding. Treatments applied in preceding crop did not influence weed dynamics and growth of succeeding soybean crop.

In wheat, *Avena ludoviciana, Medicago hispida, Cichorium intybus, Physalis minima* and *Euphorbia geniculata* were dominant weed flora in the experimental field. Preceding treatments applied in soybean significantly influenced the population of *A. ludoviciana*, *P. minima* and *E. geniculata.* Significantly low density of *A ludoviciana*, and *P minima* was recorded where imazethapyr at 70 g/ha was applied as preceding treatment. However, low population of *E. geniculata* was observed with preceded manual weeding. All herbicidal treatments significantly reduced the weeds excepting of *C. album*. Continuous use of clodinafop at 60 g/ha fb 2, 4-D at 0.5 kg/ha decreased the density of *A ludoviciana* and *C. intybus* significantly over rest of the treatments. However, application of isoproturon at 1.0 kg/ha being at par with sulfosulfuron at 25 g/ha reduced the density of *P. minima.* Application of clodinafop at 60 g/ha fb 2, 4-D at 0.5 kg/ha had lowest weed density and biomass and produced more tillers per metre row length, root volume (cc/plant), grains per spike and grain yield of wheat.

The results also revealed that the application of herbicides have adverse effect on the population of soil microflora. Continuous use of both fenoxaprop and imazethapyr in soybean caused reduction in the population of total bacteria, *Rhizobium* sp and Phospobacteria. Among these two herbicides, fenoxaprop was found to be more sensitive as compared to imazethapyr. Similar effect was also seen in respect to the population of actinomycetes. However, application of both the herbicides under study did not show any adverse effect on the population of total soil fungi.

P-153 Lead and manganese accumulation by *Vetiveria zizinoides* and *Arundo donax* grown in contaminated sites of Jabalpur

P. J. Khankhane and Jay G. Varshney
Directorate of Weed Science Research, Maharajpur, Jabalpur (M.P.)
e-mail : pjkhankhane@yahoo.com

The continuous vehicle pressure on road results in deposition of heavy metals on the road and nearby site. During precipitation, the metals along with dust are swept off the roadway which enter the soil and are channeled with runoff water into a storm drain. Lead can cause several unwanted effects such as disruption of biosynthesis of haemoglobin and anemia, rise in blood pressure, kidney damage etc. Very few plants respond to lead in a contaminated soil, however growing weedy plants in such soil have testimony to indicate their metal tolerance ability. Therefore, an investigation was carried out to study the ability of weedy plants for metal accumulation grown along the roadways. Weed and soil samples were collected from various sites in Jabalpur and adjoining areas including Nagpur bypass, Khamaria, Mandla and Mazoli and Ahartal. Soil samples were processed, passed through 2 mm sieve and analyzed for pH, electrical conductivity (1:2.5 soil water suspension), organic carbon (Walkley d Black). The heavy metals in soils were extracted using DTPA solution (Lindsay and Norvell, 1978) whereas plant samples were digested with diacid mixture (HNO3:HClO4 9:4) and their concentrations were measured using Atomic Absorption Spectrophotometer Thermo Solar S4.

The soil reaction (pH), electrical conductivity and organic content in the soil were in the range of 7.29 to 7.77, 0.39 to 0.76 dS/m and 0.39 -1.39 per cent respectively. The mean DTPA extractable concentrations of lead (3.92 mg/kg) and manganese (25.3 mg/kg) in soil were below the critical level of phyto-toxicity. Among the sites, the highest lead and manganese concentrations at Nagpur bypass were 7.37 and 40.4 mg/kg whereas lower concentrations observed at Mandla sites were 1.77 and 13.2 mg/kg respectively. The variations in the metal concentrations were due to heavy vehicle pressure on the Nagpur highway. The major weed species observed at the contaminated sites were *Calotropis procera, Argimone asteracantha, Sphaerantha indicus, Vetivera zizinoides, Ipomea carnia, Hyptis suaveolens, Chicorium intybus, Lantena camera, Parthenium hysterophorus, Xanthium strumonium* and *Arundo donax.* As far as metal accumulation by weedy plants is concerned, *Vetivera zizinoides* removed higher concentration of lead followed by *Arundo donax, Calotropis procera* and *Parthenium hysterophorus.* In case of manganese *Ipomea carnia,* followed by *Parthenium hysterophorus, Argimone asteracatha)*, and S*ida rhombifolia* extracted manganese in the decreasing order. To judge the hyperaccumulating ability of plants for the selection I phytoremediation, the ratio of metal concentration between soil and plant is an important criterion. The plant uptake >1 by plant can be considered as an accumulator plant. Among the weeds the highest accumulation ratio for lead was observed in *Vetiveria zizinoides* (17.6) followed by *Arundo donax* (12.5), *Calotropis procera* (5.4), *Sphaerantha indicus* (2.7) and *Argimone asteracantha* (2.4). As far as manganese is concerned, the highest metal accumulation ratio was observed in *Vetiveria zizinoides* (6.4) followed by *Arundo donax* (6.0), *Ipomea carnia* (5.4), *Sphaerantha indicus(4.7) Hyptis suaveolense* (3.7). The ability of *Vetiveria* lead without showing any toxicity symptoms is also been reported by (Chantachon *et al.,* 2004). Thus, depending on metal accumulation and biomass producing ability, weed species like *Vetivera zizinoides* and *Arundo donax* can be applied for the treatment of lead and manganese contaminated sites.

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Impact of long-term tillage practices and application of herbicides on bio-chemical and microbiological properties of rhizosphere soil

Tapas Chowdhury, A. P. Singh and S. B. Gupta
Department of Agricultural Microbiology, I.G.K.V., Raipur (C.G.)
e-mail: tapas_mb@rediffmail.com

Among different cereal based cropping systems, rice-wheat system is most common in India. In wheat cultivation, weeds are the major threat and considered as a major pest. Hence, it is essential to eradicate weeds which are the main competitor of plants for nutrients, sun light, moisture and space. Generally different tillage practices are adopted by the farmers to minimize the above problem. Herbicides are also applied to overcome this problem which is considered to be an efficient and economic method of weed control. The ultimate destination of herbicidal chemicals is the soil system where they come in contact with different microflora which are responsible for different biochemical transformations related to mineral nutrition to plants. The degradation of herbicides under different tillage systems was not adequately studied elsewhere. Four types of tillage system were evaluated and put in main plots *viz* (1) conventional-conventional (ii) conventional -zero (iii) zero-conventional and (iv) zero-zero tillage system. Among weed control measures performance of hand weeding & recommended herbicidal application was tested and compared with a weedy check and put in sub plots. As recommended herbicides for wheat pendimethalin was sprayed in pre emergence and Metsulfuron was sprayed in post emergence stage of the crop 1.0 kg and 2 gm/ha, respectively. The pre emergence and post emergence herbicides were applied at 3 and 20 days after sowing of the crop, respectively.

The treatments were replicated thrice under split plot design. Soil from rhizosphere was collected at a depth of 7.5-15.0 cm. The result of the study envisaged that different type of tillage systems exhibited their effect particularly on soil enzymes activities (acid, alkaline phosphatase and dehydrogenase), microbial biomass carbon and respiration rate of microbes existed in the rhizosphere of wheat . Maximum phosphatase and dehydrogenase activity was found under zero-conventional system followed by zero-zero system. The acid and alkaline phosphatase activity of soil increased significantly from conventional- conventional system to zero-conventional system at 30 DAS. However, dehydrogenase activity was recorded significantly higher in all the systems over conventional-conventional system at 30 DAS i.e. vegetative stage of crop growth. The acid phosphatase activity was found more than alkaline phosphatase activity. During the study of basal soil respiration and microbial biomass carbon estimation, it was visualized that maximum microbial biomass carbon was quantified under zero -conventional system which was duly supported by the data related to respiration rate of rhizosphere microflora. Results revealed that the soil enzyme activity, biomass carbon content (MBC) and respiration rate of microbes (BSR) influenced by weed management practices particularly at 30 and 50 DAS. The enzymatic activity, BSR and MBC significantly increased due to hand weeding and weedy check condition over recommended herbicide application but the effect was diluted with the advancement of crop growth and became insignificant at harvest of the crop. Hence it can be concluded from the study that zero- conventional tillage system is best to increase microbial activities and growth in comparison to other systems. However, in all the tillage systems, herbicide application reduce the above parameters but with the passage of time the effect of herbicides dilutes and at harvest of crop it becomes insignificant.

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Effect of FYM integration on persistence and bioefficacy of chloroacetanilide herbicides in rice

K. M. Durga Devi and C. T. Abraham
DWSR , Kerala Agricultural University, Thrissur (Kerala)
e-mail : durgadevikm@rediffmail.com

It is well known that farm yard manure application is the most effective method to enhance degradation of herbicides in soil. It has also been proved that increasing organic carbon content increased the rate of adsorption of organic herbicides and decreased leaching losses (Baskaran *et al.*, 1996). Adsorption is the major factor determining persistence and bioefficacy of applied herbicide. The present study was taken up to assess the persistence and bioefficacy of two chloroacetanilide herbicides *viz*., butachlor and pretilachlor in a sandy loam soil with and without FYM.

The treatments consisted of (i) hand weeded control,(ii) continuous application of butachlor (100% NPK), (iii) butachlor alternated with pretilachlor between seasons (100 % NPK), (iv) butachlor alternated with pretilachlor between seasons (FYM 25%+ NPK 75%), (v) butachlor alternated with pretilachlor between years (100 % NPK and (vi) butachlor alternated with pretilachlor between years (FYM25%+NPK75%). Rate of application of each herbicide was kept uniform in all the crop seasons (butachlor 1.25kg/ha and pretilachlor 0.75 kg/ha). The recommended rate of NPK 70: 35:35 kg/ha through fertilizers was taken as 100% NPK. In the two treatments *viz*., T4 and T6 , 25 % N (17.5 kg N) was replaced through FYM. Both butachlor and pretilachlor were applied as pre emergence spray (at 8 days after sowing).Residues of butachlor and pretilachlor in the soil were estimated at 15, 30 and 45 days after spraying and at harvest in the first crop season of 2003 to 2007. Gas chromatographic methods suggested by (Sankaran *et al*., 1993) were used for the analysis of the residues. Bioefficacy of the herbicides were evaluated from the observations on weed population at 60DAS and grain yield at the time of harvest. Population of *Echinochloa* spp., the major weed species in the experimental plots, and the grain yield in different treatments during first crop season were studied over the years (2001- 2009).

Analysis of herbicide residues in the field soil showed that at 15 DAS , the plots where FYM was applied for substituting 25 % fertilizer , had much higher levels of butachlor and pretilachlor than the plots where 100 % fertilizer was used, the residue levels being 0.03 and 0.018 ppm for butachlor and pretilachlor respectively in the treatments without FYM and 0.056 and 0.121ppm respectively for the treatments with FYM. The observations at 30 DAS showed that the residue levels were almost similar irrespective of whether organic matter was substituted or not, and by 45 DAS the residue levels reached below detectable level. This indicates that FYM tends to absorb the herbicides preventing them from easy leaching to lower layers, thereby maintaining sufficient quantity of herbicides in the top layers to control the weeds effectively. Because of the favorable effect of organic matter on soil microorganisms, a sudden decline in the levels of herbicides was noticed beyond 15 DAS and bringing down the concentration to levels to that of plots not treated with FYM.

The enhanced retention of herbicides in the FYM treated plots is reflected in the weed control and yield. The population of *Echinochloa* spp. in the FYM applied plots were significantly lower than that in the 100% fertilizer applied plots.

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Herbicide residue and heavy metal contamination in groundwater in different districts of Punjab

S. K. Randhawa and Puneet K. Randhawa
Department of Agronomy, P.A.U., Ludhiana (Punjab)
e-mail : aicrpwc_pau@rediffmail.com

Groundwater is a source of drinking water for as much as 95% of the population in agricultural areas. In India, the relatively more abundance of pests in agricultural crops and the indiscriminate use of herbicide in different crops create the problem of bioconcentration in the environment. Herbicides enter water bodies due to run-off and leaching. Monitoring studies at groundwater at 218 locations caused by central pollution control board (Bhardwaj, 2005) show that ionic conc. inn groundwater is generally higher than the surface water if not affected by waste water discharges. Arsenic problem has been reported in parts of West Bengal, especially in 24 paragnas of West Bengal. During health risk assessment studies, aluminum and heavy metals were monitored in groundwater of Russia (Momot & Synznys, 2005) where arsenic and aluminum were in the range of 0.03 mg/l and 0.21-0.65 mg/l respectively. Present investigation was conceptualized to determine the extent of herbicide contamination and heavy metal pollution of groundwater in five districts of Punjab.

Ground water samples were collected from tube-wells where farmers had applied anilophos, isoproturon, butachlor, sulfosulfuron, 2,4-D, clodinafop in rice-wheat cropping system during the in the districts of Ludhiana, Jalandhar, Ferozepur, Moga and Faridkot districts of Punjab.

Residue of isoproturon and 2,4-D in the water samples was determined spectrophotometrically. Butachlor, clodinafop, sulfosulfuron, anilophos were estimated by HPLC.

For heavy metal study, the water samples were filtered through whatman filter paper no. 4 and acidified by adding 2 ml HNO_3 Suprapur / litre of water and then determined for arsenic, lead, cadmium and nickel through atomic absorption spectrophotometer AAS -800 according to APHA 3113 B method (1998).

Results showed that tubewell water showed no detectable residue of isoproturon, 2, 4-D, butachlor, clodinafop and sulfosulfuron were below detectable limits 0.001 ppm and anilophos was below 0.05 ppm. This showed that these herbicides had not moved into the water table in five districts of Punjab.

Water samples were spiked at 0.025 ppm with arsenic, nickel and lead showed 92, 96 and 88% recovery. Similarly water sample spiked at 0.0015 ppm with cadmium showed 93.33% recovery. Water samples taken at different depths showed no contamination of heavy metals of lead arsenic, nickel and cadmium. All samples were below detectable limit of 0.10 ppm for arsenic, 0.01 ppm for cadmium, 0.20 for nickel and 5 ppm for nickel recommended for irrigation water.

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P-157 Bioefficacy and phytotoxicity of new herbicide Vesta (clodinafop propargyl 15% + metsulfuron 1% R.M.) for the control of complex weed flora in wheat and its residual effect on succeeding sorghum crop.

S. S. Punia, Dharambir Yadav, Samunder Singh and Yash Pal Malik
Department of Agronomy, CCS HAU, Hisar (Haryana)
e-mail : jagir@hau.ernet.in

Wheat crop is severely infested with both grassy and broadleaved weeds in Haryana. To tackle the resistance problem of isoproturon alternate herbicides and are being used by the farmers on large scale. Fenoxaprop and clodinafop are very specific to *P. minor* and *A. ludoviciana* control but are ineffective against broadleaf weeds of wheat. Continuous use of these herbicides for 2-3 seasons have resulted in tremendous increase in density of broadleaf weeds at farmers fields. Hence there is a need to evaluate more herbicides with different mode of action for the control of complex weed flora in wheat. To evaluate the efficacy of ready-mix formulation of clodinafop 15 %+ metsulfuron 1 %) registered with trade name vesta against weeds in wheat, field experiments were conducted during the *Rabi* (winter) 2005-06 and 2006-07 at Agronomy Research Area of CCS HAU Hisar. Different doses of vesta (clodinafop 15 %+ metsulfuron 1%) either alone or with surfactant and other treatments were applied at 35 DAS. The data on percent visual control (phytotoxicity) of weeds was recorded at 120 DAS on 0 - 100 scale. Residual effect of these herbicides applied in wheat was studied through bioassay studies by planting sorghum var. SSG-Hara chara in the same plots by giving slight disking. Ready mix formulation of clodinafop +metsulfuron (Vesta) at 60 + 4 and 75 + 5 g/ha with 0.2% surfactant was very much effective in controlling *P. minor* provided 97-98% control of grassy and $80^{-1}00$ % control of broadleaf weeds which was even higher than already recommended herbicides like clodinafop-propargyl and sulfosulfuron as shown by density, dry weight and per cent control of weeds. Singh *et. al* (2007) also reported excellent control of grassy as well as broadleaf weeds in wheat with the application of UPH 206 (Vesta) at 60+4 and 75+5 g/ha. However, the treatments of clodinafop + metsulfuron at 60 + 4 g/ha + surfactant at 0.2% and with out surfactant at 75+5 g/ha +surfactant at 0.2% were statistically at par and proved most effective. Excellent control of complex weed flora in wheat was observed with the tank mix application of clodinafop+ metsulfuron (15:1 ratio) at 60 g/ha (Punia *et al.*, 2004). Maximum grain yield (4890 & 4894 kg/ha) was obtained with the use of UPH-206+S at 75+5 g/ha which were at par with weed free check and ready mixture of sulfosulfuron+metsulfuron and UPH 206+S at 60+4 g/ha but significantly higher than clodinafop and sulfosulfuron. No carry over effect of this herbicide at any of doses tested was observed on succeeding sorghum crop.

P-158 Fish mortality due to depletion of oxygen during decay of water hyacinth not due to herbicide

R. C. Gowda, G. R. Hareesh, B. Shweta, R. Devendra and T. V. Ramachandra Prasad
Dept. of Crop Physiology, University of Agricultural Sciences, Bengaluru (Karnataka)
e-mail : dev.cuti@gmail.com

Fish mortality was observed when *Eichhornia crassipes* was sprayed with herbicides *viz*, glyphosate, 2,4-D and paraquat. In order to assess the effect of herbicide residue in pond water 14_C-glyphosate or 14_C-2,4-D was fed to fully expanded single leaf of *Eichhornia crassipes* and assessed the mobility to water by root exudates and half life of herbicide in water. Periodic radioactivity was assessed in water close to root assuming root exudates of herbicides. First order exponential function was fitted to assess the half life of herbicides added to water without *Eichhornia*. Results showed that, up to 6 days after 14_C-herbicide treatment, no root exudates observed in pond water but during 8^{th} and 10^{th} day after feeding, significant more radioactivity was observed in double the recommended dose in root exudates compared to recommended dose. However, the amount of herbicide as root exudates was below 1% compared to herbicide within the weed plant. The half life of herbicide present in pond or fresh water was 7 to 9 days for both the doses. Thus, the mortality of fish may be due to depletion of oxygen level due to decay of dead weed plants than due to the herbicide.

P-159 Persistence of herbicides in soil, crop, water and its residues on non-targeted organisms

Shobha Sondhia and Jay G. Varshney
Directorate of Weed Science Research, Jabalpur (M.P.)
e-mail : shobhasondia@yahoo.com

With the increasing use of herbicides for weed control, applied herbicides may find its way into streams and underground water sources by run off and leaching mechanism. Persistence of herbicides in the aquatic body is important as well as their ultimate fate. Continual use of herbicides near the aquatic area has prompted some concern of the effects of these chemicals on the life stages of fish. Many reports have been published on the ill effect of herbicides on fishes and other aquatic organisms. Thus work was initiated to evaluate herbicides persistence in soil, crop and bioaccumulation of residues on non-target organisms (fishes) in constructed artificial ponds under paddy based cropping system.

Butachlor and oxyfluorfen were applied at 1.50 and 0.300 kg/ha, respectively in rice crop in *kharif* 2009 as pre-emergence herbicides. Water, crop and soil samples were collected at 0, 10, 20, 30, 60, 90, 120 days after spray of herbicides. Fishes were also sampled at different growth stages to see bioaccumulation and persistence of herbicides which reached to the adjoining pond through runoff.

Herbicides persisted upto harvest of crop in soil sample. At harvest 0.0079 and 0.0077 µg/g residues of butachlor and oxyfluorfen was detected in soil samples collected at harvest. 0.051 to 0.011 and 0.074 to 0.026 µg/g residues of butachlor and oxyfluorfen were detected in fish samples collected after 10 day to 60 day after herbicide application which showed dissipation of herbicides in fishes. Butachlor and oxyfluorfen were dissipated slowly in water and fishes once they accumulated. Results revealed that care should be taken while applying herbicides near the aquatic system as they may affect non-targeted organism once they entered the aquatic system.

P-160 Dissipation and persistence of imazethapyr in soybean soil under application of long term fertilizers in Typic Haplustert

Rajesh Kumar Patel, Shobha Sondhia and A. K. Dwivedi
Department of Soil Science and Agricultural Chemistry JNKVV, Jabalpur (M.P.)
e-mail : rajesh_kumar@icarnet.ren.nic.in

The experiment was conducted to monitor the dissipation and persistence of imazethapyr applied to soybean crop grown under application of long-term fertilizers experiment. Imazethapyr has been established as a post-emergence herbicide applied to manage noxious weeds including broad-leaf annuals, perennials and sedges. Treatments included various combinations of N, P, K, Zn and FYM in continuous intensive cropping under various fertilizer and manurial level. Dissipation of imazethapyr was determined in soil, where imazethapyr was applied as post emergence after sowing on soybean at 100g/ha in all treatments except in T_4 (100%NPK+Hand Weeding).

Imazethapyr dissipation and persistence in soil was studied during crop growth period at an intervals of 0, 5, 10, 30, 60 days after spraying and finally at harvest. Soil samples were analyzed by HPLC. Result revealed that dissipation of imazethapyr varied with the treatments. In this connection, rate of dissipation was found to be increased with growth period. Amongst the treatments the highest persistence was observed in 100%N, as soon as P is included in fertilizer schedule (100%NP) it decline to a greater extent further inclusion of K (100%NPK) the corresponding declined was noted. However, residues were high in those treatments where 50, 100 and 150% NPK was applied. On the other hand lowest value of imazethapyr residues was found when 100%NPK was applied with organic manures.

P-161 Persistence of herbicide residue in soil, food chain and ground water in winter rice under medium lowland ecosystem

Nilay Borah, N. C. Deka, J. Deka, I. C. Barua, A. Sarma and D. J. Nath
Department of Agronomy, Assam Agricultural University, Jorhat (Assam)
e-mail : nilayborah@rediffmail.com

Winter (Sali) rice, grown mostly under rainfed transplanted situation, occupies about two third of the total rice growing area (2.53 m ha) of the state. Weed infestation strongly influences crop yield owing to alternate wetting and drying cycles resulting from erratic distribution of monsoon rain. Most of the farmers do not follow any weed management practice, but chemical control of weed, of late, has gained acceptance and popularity as a part of the integrated weed management in this crop. However, the potential hazard of herbicide residue in food, soil and water resources is a great concern to all quarters. Accordingly, the present experiment was carried out to evaluate the residue status of applied herbicides in soil, groundwater and food stuff under transplanted winter rice.

The treatments comprised of two doses (recommended and twice the recommended dose) of butachlor (1.5 kg/ha and 3.0 kg/ha) and pretilachlor (0.75 kg/ha and 1.5 kg/ha), mechanical weeding at 30 days after transplanting (DAT) and hand weeding at 30 DAT. Application of herbicides significantly lowered the weed population and dry weight in rice. The grain yield of rice was significantly lower in hand weeding compared to other treatments, while the same in rest of the treatments was statistically at par. The highest concentration of 0.25 ppm butachlor residue was detected in soil with application of butachlor 3.0 kg/ha (double recommended dose), and the lowest (0.16 ppm) in case of pretilachlor 0.75 kg/ha (recommended dose) on the day of spray. The highest residue concentration in soil at 15 days after spray was detected as 0.022 ppm of butachlor (3.0 kg/ha) and the lowest as 0.014 ppm pretilachlor residue (0.75 kg/ha). Irrespective of herbicides and doses of spray, residue level was below detectable level (BDL = 0.1 ppm) beyond 30 days after spray. The soil microbial population after harvest of the crop was affected by application of herbicides. In general, both Azospirillum and PSB population decreased in herbicide treated plots, the magnitude being higher in case of butachlor application. Residues of butachlor and pretilachlor in rice grain and straw and in groundwater after harvest of the crop were below detectable level (0.1 ppm).

P-162 Anilofos persistence in soil and its residue analysis in rice crop at harvest

Shishir Tandon
Dept. of Chemistry, DWSRPC, GBPUAT, Pantnagar (Uttarakhand)
e-mail : shishir_tandon2000@yahoo.co.in

Study was undertaken for persistence of anilofos in soil (clay loam) of Tarai region of Uttarakhand. Anilofos was applied on soil of soybean crop at two different doses i.e. 400 and 800 g/ha under field condition. Soil of 0-15 cm depth was taken and anilophos residues were analysed by RP-HPLC at 229 nm using mobile phase acetonitrile: water (85: 15 % v/v). Anilophos persisted in soil for more than 45th day at lower dose while at higher application dose it persisted beyond 60th day (93.33 % dissipation) after which it was below detectable. No residues were detected on 75th day of application in both recommended and double recommended doses. Dissipation of anilofos followed first order kinetics. At harvest, anilophos residues were below detectable limit in soil, rice grain and rice plant/straw. The limit of detection was 0.002µg/g of soil.

P-163 Leaf senescence on enhanced herbicide translocation and potency in *Cyperus rotundus*

R. Devendra , T. V. Ramachandra Prasad , B. Swetha, Dhanraj and S. B. Manjunath
Department of Crop Physiology, UAS, Hebbal, Bangalore (Karnataka)
e-mail : dev.cuti@gmail.com

Glyphosate, a nonselective, broad-spectrum weed control, eco-friendly (soil microbes degrades within 24 h), translocative herbicide has two formulations *viz*. glyphosate (41 %EC)- Roundup Monsanto 8-20ml/l (1640- 4100 g ai/ha) and glyphosate ammonium salt (71% SG) with surfactant polyoxyethyleneamine- Excel Crop care Ltd. Company people asks farmer to spray Meera 71, 5 - 10 gm/l (1597- 3194 g /ha) with "Sure Shot 240" a silicane based agri adjuvant consisting of polyethertrisiloxane (0.03%) reduce surface tension, enhance sprayed on leaf and stem fast uptake which reduce rain free period drastically. Spraying of glyphosate with narrow orifice flood jet nozzle helps in droplet deposition even on difficult to control weed foliage and surfactant helps to spread, entry into and mobilize the 14_C- glyphosate molecule across epi-cuticular wax. Ammonium form of glyphosate helps in mobility across plasma membrane. Still much of the applied herbicide remains in applied leaves (70-90%) depending on glyphosate dosage in the spray solution. To enhance translocation from fed leaves to other plant parts, experiments were done using the nutrients scavenge from senescence leaf to developing tissues approach. Leaf senescence was induced by ethephon (5000ppm) or paraquat (500 g/ha) or glyphosate (1640 g/ha) and total chlorophyll, membrane leakage and relative water content of Cyperus rotundus leaf, after 24, 48 and 72 h, were assessed. Using total biomass reduction bioassay senescence induced for 48 h with 1640g/ha of glyphosate followed by varied concentration of glyphosate showed significant reduction of biomass and tuber viability. Decrease in total chlorophyll, and increased membrane damage was much faster and to a greater extent in herbicide treatments than ethephon and control. RWC of control leaves remains same but decreased against time in ethephon and paraquat whereas drastically reduced at 24 h, later on increased during 48 and 72 h in case of glyphosate. Repair mechanism of glyphosate might helped to mobilize 14_C glyphosate mobility to other plant parts.

P-164 Monitoring of bispyribac-sodium (PIH 2023) residues in soil, rice grain and straw

S. K. Randhawa, Mandeep Kaur and U. S. Walia
Department of Agronomy, PAU, Ludhiana (Punjab)
e-mail : aicrpwc_pau@rediffmail.com

A new herbicide bispyribac-sodium 10% SC (sodium 2,6-bis[(4, 6 dimethoxy pyrimidin-2-yl) oxy] benzoate under the trade name Nominee Gold 10SC (PIH 2023) is recommended as post-emergence (25-30 days) for transplanted rice against weeds i.e. *Cyperus iria, Echinochloa crusgalli* and *Panicum colonum* under Punjab conditions. The use of PIH 2023 on rice crop can cause its accumulation in food commodities but the residue remaining at the time of harvest should not pose any health hazard. Present investigation was undertaken to evaluate the residues of bispyribac-sodium (PIH 2023) in rice grain, soil and straw.

HPLC method was standardized for the analysis of PIH 2023 using C_{18} column and Acetonitrile : 0.05 % acetic acid (1:1 v/v)mobile phase at 246 nm wave length. The standard curve was obtained in concentration 0.01, 0.05, 0.1, 0.5, 1.0, 5.0 and 10ppm of PIH 2023. The peak was obtained at 11.63 min. (retention time). Different doses of PIH 2023 at 25 g, 60 g/ha in flat puddled rice and in bed transplanted at 30 g/ha is applied for checking the rice weeds. At the time of harvest, samples of soil rice grain and straw were collected, extracted with water acetonitrile (20 : 80 v/v) cleaned up and analysed for herbicide residue by HPLC.

The recovery for soil and grain straw was found to be 80 %. Residues in the rice grains, straw and soil were below the detection limit of 0.05ppm.

P-165 Determination of terminal residues of pendimethalin in soil and garlic

Neelam Sharma, Sweta Sehgal, Suresh Kumar and N. N. Angiras
Department of Agronomy, FGM, CSKHPKV., Palampur (H.P.)
e-mail : sharma_neelam29@rediffmail.com

A field experiment was conducted at the Experimental Farm Palampur during *rabi* to estimate the residues of pendimethalin in soil and garlic bulbs at harvest. Pendimethalin was applied as pre emergence treatment at three different doses *viz*. 0.75 kg/ha, 1.5 kg/ha and 3.0 kg/ha. The collected samples of soil and garlic bulbs were processed and analyzed in laboratory by GC equipped with ECD. The retention time for pendimethalin was found to be 7.6 minutes. In soil and garlic bulbs, the percent recovery ranged from 79.2 to 83.8 per cent and 79.1 to 88.2 per cent, respectively. Pendimethalin residues were non detectable in post harvest soil in all three treatments. Whereas, in garlic bulbs 0.004 µg/g herbicide residues were found in pendimethalin 3.0 kg/ha.

Pendimethalin [N-(1-ethylpropyl)-3, 4 dimethyl 2, 6 dinitrobenzenamine], a selective pre emergence herbicide has wide spread use for control of a wide variety of grasses and broadleaf weeds. It is basically used for selective control of weeds in crops such as peas (*Pisum sativum L.*), rice (*Oryza sativa L.*), wheat (*Triticum aestivum L.*), soybean (*Glycine max L. merr.*) and several other vegetable crops including garlic (*Allium sativum L.*). Herbicide residue estimation in soil and edible plant parts is very essential to determine the duration of herbicide activity in soil and its effect on the crops. As such there is no information available on pendimethalin residues in garlic especially in Himachal Pradesh. Therefore, the present study was undertaken to study the herbicide residues of pendimethalin in soil and garlic crop.

Pendimethalin was sprayed as pre-emergence treatment at three different doses i.e. 0.75 kg/ha, 1.5 kg/ha and 3.0 kg/ha. These chemical treatments were compared with untreated control. All the treatments were triplicated. The soil (depth 0-15 cm), garlic bulbs from pendimethalin treated plots and control plots were collected at harvest and were used for residues studies. Collected samples were analyzed for pendimethalin residues by a GLC method.

The retention time for pendimethalin was found to be 7.6 minutes. The recoveries of pendimethalin in soil and garlic bulbs (fortified with 0.1 and 0.5 µg/g pendimethalin) ranged from 79.3 to 83.8 per cent and 79.1 to 88.2 per cent, respectively. The analysis of soil samples at all the three applied doses of pendimethalin revealed that the herbicide residues were below detectable levels. This might be due to the fact that pendimethalin 0.75 kg/ha, 1.5 kg/ha and 3.0 kg/ha in garlic crop dissipated completely by the time of the harvest. In garlic bulbs, for all the treatments except pendimethalin 3.0 kg/ha (0.004 µg/g) the residues were below detectable levels. Thus it clearly indicated that the use of pendimethalin in garlic could be considered safe from consumption point of view.

P-166 Leaching behaviour of alachlor and metolachlor in clay loam soil

P. Janaki, C. Chinnusamy and P. Murali Arthanari
Department of Agronomy, TNAU, Coimbatore (Tamil Nadu)
e-mail: janakibalamurugan@rediffmail.com

Leaching is one of the important transport mechanisms in soil and notably for herbicides which have high solubility's and are likely to be leached from the soil. Very little information is available with respect to movement and transport of alachlor and metolachlor in Indian soils. Hence a laboratory column experiment was conducted to study the leaching behaviour of alachlor and metolachlor in clay loam soil collected from the Tamil Nadu Agricultural University farm, Coimbatore using PVC pipes of 60 cm length and 60 mm internal diameter. Pipes were cut vertically into two and joined together using an adhesive tape. The lower end of the

tube was covered with a muslin cloth. Seven kg of soil was added to each column and were packed to a bulk density of 1.33 Mg/m3. One day before the herbicide application columns were pre treated with 500 ml distilled water. Water was allowed to drain naturally.

The treatments imposed *viz*., alachlor at 2.0 recommended (x) and 4.0 kg/ha double the recommended dose (2 x) and metolachlor at 0.75 recommended (x) and 1.50 kg/ha double the recommended dose (2 x). Sufficient quantity of water was added everyday to govern the movement of herbicides. Each column was replicated twice. At the end of experimental period (7 days) column was sectioned into different depths *viz*., 0-5, 5-15, 15-30, 30-45 and 45-60 cm depths. The leachates were collected from all the treatments on 3rd and 7th day. Soil samples and leachates were analyzed for alachlor and metolachlor residues using gas chromatograph equipped with ECD detector.

The residues of alachlor and metolachlor were decreased with an increase in soil depth and alachlor residue was detected upto 60 cm depth under both the levels of application while metalochlor was detected upto 60 cm depth in double the recommended dose (1.50 kg/ha) of application and upto 45 cm depth in the recommended dose (0.75 kg/ha) of application. Increased dose of application enrich the soil with the herbicide molecule besides transporting considerable quantity to lower depth also. After 7 DAA, only 49-55 and 35-62 per cent of the alachlor and metolachlor remained in the soil and the per cent retention is more in double the recommended dose received soil. The residue of alachlor and metolachlor were detected in the leachates collected at 60 cm depth. However, the quantity detected is very low and is below the maximum residue limit under the recommended quantity of application. The concentration of both the molecules was increased with increased quantity of application. The per cent of alachlor and metolachlor in leachates to total quantity applied is ranged from 0.016 to 0.25 and 0.23 to 2.75 ppm respectively.

P-167 Influence of solid surfaces on the phototransformation of 2, 4-D

Partha P. Choudhury and Jay G. Varshney
DWSR, Maharajpur, Adhartal, Jabalpur (M.P.)
e-mail : parthatinku@yahoo.com

Phototransformation is one of the important pathways for herbicide loss from the soil surface after their release into the environment. Plant surfaces and soil surfaces are the first reaction environment for the herbicide molecules after application. The heterogenous nature of soil surface makes the photoreaction of an organic molecule more complicated. In most of the cases reaction is sensitized by the inorganic and organic constituents present in the soil leading to the faster degradation of the herbicide. In some cases, these constituents exert quenching effect on the photo absorption by herbicide. For an instance, 2,4-dichlorophenoxyacetic acid (2,4-D), a member of the chlorophenoxy family of herbicides, one of the most widely used herbicides to control broad leaf weeds and grasses in crops throughout the world, is photochemically stable on soil. This is probably due the quenching effect of different fraction of humic substances. For the present study, ethyl ester of 2,4-D is chosen to investigate the role of different surfaces on the rate of photolysis of this compound. In the present experiment, different surfaces *viz*. glass surface, soil surfaces and semiconductor coated surface are selected. The phototransformation of 2,4-D-ethyl ester was carried out on those surfaces under germicidal lamp (254 nm). The degradation is faster on the semiconductor coated surface than that on the inert glass coated surface. This is probably due to the reduction of 2,4-D by the photoexcited valence band electron of the semiconductor. The rate of photolysis is slower on the surface of soil than that on glass. This is due to the presence of humic substances in the soil. Humic acid can act both as photosensitiser and as photquencher depending on the photo absorption nature of the organic compound. Here, it acted as photoquencher stabilizing 2,4-D on the soil surface.

P-168 Soil microbial activity as influenced by cropping system and weed management approaches in a Vertisols

C. R. Patil, Ramesh Babu and C. A. Agasimani
DWSR Centre, MARS, UAS Dharawad (Karnataka)
e-mail : rameshbabu.niws@gmail.com

Weed management through application of herbicides may become inevitable due to scarcity of labour and wherever other methods of weed management are difficult to practice. Newer molecules and formulations of herbicides effective on most hardy weeds are being introduced. Application of chemical inputs in agriculture has raised serious concerns about its impact on environment and human health. The effect of herbicides on soil microorganisms (SMOs) is assessed by tracking the changes in populations and soil enzyme activity due to herbicide application. These studies might help understand the impact of herbicide on soil health and environment and consequently help address the issues concerned with toxicity of herbicides in the environment than their effect on targeted weeds. Microbiological analysis of rhizosphere soils from different cropping systems as influenced by various weed control measures was carried out. This research work is part of All India Co-ordinated Research Project on Weed Control at Main Agricultural Research Station, University of Agricultural Sciences, Dharawad, Karnataka State. Rhizosphere soils were collected from the experimental plot under different weed management strategies by uprooting plants at 30, 60 days after sowing (DAS) and at harvest. The soil samples and uprooted plants were brought to laboratory for estimation of microbial activity such as soil respiration, dehydrogenase, phosphatase activity, per cent root colonized by arbuscular mycorrhizal fungi (AM), population of bacteria and fungi following standard microbiological procedures. In groundnut–wheat cropping system significantly higher soil respiration was recorded in treatment receiving pendamethalin at 30 DAS (50.9 mg CO_2 per 100 g soil/d). At 60 DAS, all treatments with herbicides recorded significantly lower soil respiration than those without herbicides. Similar trend was also observed at harvest. Application of herbicides also reduced soil dehydrogenase activity at 30 and 60 DAS. The phosphatase activity recorded in treatment receiving Alachlor was the least (0.514 µg pnp released g/soil/h) and at par with treatment receiving Butachlor. The phosphatise activity recorded in all other treatments was significantly higher. The population of bacteria and fungi in soils receiving different treatments also varied statistically. No significant differences were observed in fungal populations at harvest. The percent root colonization by AM fungi was significantly affected by chemical weed control methods. In the studies on the effect of long term tillage in maize–chickpea cropping system on the highest soil respiration at 30 DAS (49.6 mg CO_2 per 100 g/soil/d) and 60 DAS (50.1 mg CO_2 per 100 g/soil/d) was recorded in treatment receiving zero tillage + hand/day weeding. This was significantly higher than values recorded with most other treatment except for either Zero or conventional tillage with application of herbicide. Irrespective of the type of tillage, the weedy check treatment showed significantly less soil respiration. In contrast to this weedy check plots or those with recommended herbicide recorded significantly lesser soil respiration than most other treatments. Soil dehydrogenase activity at 30 DAS was significantly higher in treatment with hand weeding under zero tillage. These differences in dehydrogenase activity among various treatments narrowed with the crop growth and no significant differences were observed at harvest among various treatments.

Phosphatase activity at 30 DAS in treatment with zero tillage and weedy check was significantly lower than the rest of the treatments. This however improved drastically with crop growth period and did not differ significantly with any other treatments. Phosphatase activity was the highest in treatment with conventional tillage and hand weeding (65.29). In general treatments with herbicide applications showed significantly lower phosphatase activity at 60 DAS and at harvest. The population of bacteria at 30 DAS was significantly reduced due to herbicide application. These differences in bacterial populations reduced with crop growth. Treatment with zero tillage + weedy check had recorded the highest fungal populations (9.67×10^4 CFU/g soil) at 30 DAS while the treatment under conventional tillage + weedy check showed significantly higher population at 60 DAS (22.23×10^4 CFU/g soil) and at harvest (71×10^4 CFU/g soil) . The lowest mycorrhizal

colonization of roots was observed in treatment with zero tillage + recommended herbicide (32.63%). Significantly higher root colonization of mycorrhizal fungi was observed in rest of the treatments which however did not differ significantly within each other.

In the third field experiment on "Studies on long term effect of herbicides on weed seed bank and soil micro flora in maize-chickpea cropping systems" the soil respiration at 30 DAS was highest in weedy check (1.46 mg CO_2 per 100 g soil/d). Treatment with mechanical weeding showed significantly higher soil respiration than those receiving atrazine at 1.5 kg/ha and atrazine at 0.75 kg /ha plus 2, 4-D at 0.5 kg/ha. Similarly, the highest dehydrogenase activity was recorded in weedy check at all stages of plant growth. The highest phosphatase activity was observed in treatment with atrazine at 0.75 kg/ha at all stages of growth. This was significantly higher than the phosphatase activity recorded in all other treatments except mechanical weeding at 30 and 60 DAS. At harvest the trend was quite different. The highest phosphatase activity was recorded in weedy check (152 µg pnp released/g/soil/h) which was at par with treatment receiving atrazine at 0.75 kg/ha + pre. emer.+ 2, 4-D at 0.5 kg/ha. The bacterial population was the highest in treatment with weedy check at 30 DAS. No significant differences in bacterial populations were observed due to treatments at harvest. In contrast to this significantly higher population of fungi was observed in treatment with atrazine at 0.75 kg/ha + pre. emer.+ 2, 4-D at 0.5 kg/ha as compared to application of only atrazine at 1.50 kg/ha at 30 DAS. No significant differences in fungal populations were observed at 60 DAS and at harvest. The highest per cent root colonization by mycorrhizal fungi was recorded in the treatment weedy check (65.3 %), followed by treatment with mechanical weeding (45.71 %). The mycorrhizal colonization of roots in all other treatments was significantly lower than these two treatments. atrazine at 1.50 kg/ha showed significantly least mycorrhizal colonization (22.62 %). These initial studies were useful to understand that the effect of herbicide on soil biological properties measured as enzymes activities and microbial population varied with the type of herbicide applied, the cropping system and soil. However, application of herbicides in the early stages of crop growth severely affected soil microbial activity, population of microorganisms and mycorrhizal colonization.

P-169 Effect of some herbicides on nodulation in chickpea

K. K. Barman and Jay G. Varshney
Directorate of Weed Science Research, Adhartal, Jabalpur (M.P.)
e-mail : varshneyjg@gmail.com

Use of herbicides in crop production has become an integral part of modern weed management. But the greatest concern about the environmental impact of herbicides is their effect on non-target organisms. The primary means by which nitrogen is added to soil are biological nitrogen fixation and atmospheric deposition. Biological N_2 fixation is an important aspect of sustainable and environmentally friendly food production and long-term crop productivity. While herbicide use is recognized as a necessity for economically sustainable agriculture, the impact of herbicides on grain legume production and N_2 fixation is of increasing concern.

An experiment was conducted under net house condition to study the effect of clodinafop, quizalofop, pendimethalin and fluchloralin on nodulation in chickpea. Field soil was taken in a series of pots. Fluchloralin was incorporated in soil prior to sowing, pendimethalin was applied as PE, clodinafop and quizalofop were applied as post. All the herbicides were applied at their recommended doses. Observations about nodule growth and root volume were recorded at 50 days after sowing.

It was observed that the herbicides clodinafop and quizalofop were safe to chickpea nodulation. No adverse effect of these two herbicides was noticed in terms of nodule number. However, compared to control, decrease in nodule number was recorded in pendimethalin and fluchloralin treated pots. Compared to control, a relatively lower root volume was recorded in pendimethalin and fluchloralin treated pots. This indicated that the adverse impact of these two herbicides on chick pea root could have resulted in the relatively lower nodulation. It was concluded that the herbicides clodinafop and quizalofop could be used as the safe weed control measures in terms of biological nitrogen fixation.

P-170 Adsorption and desorption characteristics of alachlor in different soils of Tamil Nadu

P. Janaki, C. Chinnusamy and K. Nalini
Department of Agronomy, TNAU, Coimbatore (Tamil Nadu)
e-mail: janakibalamurugan@rediffmail.com

Adsorption-desorption behavior of herbicides is important processes that influence the amount retained by the soil and that which is susceptible to runoff or movement within the soil profile. Further the adsorption restricts the movement of herbicides and prevents the toxicant to reach the target weeds. The adsorbed compounds persist in soil for a longer time, creating pollution problems. With this background a laboratory experiment was carried out to study the adsorption and desorption behavior of alachlor in different types of soil.

The surface soil from a depth of 0-15 cm was collected from the TNAU farm, Coimbatore (clay loam), HRS, Kodaikkanal (peat soil) and farmers field from somayanur (silty clay loam), Coimbatore dt, air dried and processed. Two grams of processed soil samples were placed in a centrifuge to which different concentrations (0, 1, 2, 4, 6, 8, 10, 15, 20 ppm) of alachlor were added and the experiment was duplicated. The soil: solution ratio used for this study is 1:5 and were shaken for 12 hrs on an end over end shaker to attain equilibrium. After equilibration, the soil water suspension was centrifuged at 200 rpm for 15 minutes and the alachlor concentration was measured in the supernatant. The amount of alachlor sorbed was calculated from the difference between the initial and final solution concentrations. Desorption experiment was run immediately after adsorption experiments by dilution of the filtered equilibrium adsorption samples to 1:5 soil : deionised water ratio. The samples were shaken for 12 hrs and supernatant was obtained. Alachlor was determined using GC-ECD. Results showed that an increase in the concentration of alachlor increased the adsorption of alachlor and the adsorption is high in peat soil followed by black and red soils. The higher adsorption in peat soil may attribute to the higher amount of organic carbon content. The shape of the alachlor adsorption isotherm in all the soils were 'S' type and the isotherm expressed an increasing trend in the adsorbed content Cs (mg/kg) with respect to increase in the equilibrium concentration of alachlor Ce (mg/L) in solution. A linear fit (straight line) of Freundlich adsorption isotherm was obtained with experimental data in all soils and the coefficient values (Kf) indicate higher adsorption of alachlor on the peat soil followed by black and red soils which confirm the relevance of organic mater as the adsorbent for herbicides. Soil adsorption of herbicide has been reported to be inversely related to the herbicide mobility and such behavior has been observed in this study.

Amount of adsorbed alachlor desorbed from soil is in the range of 62 - 90, 62 - 91 and 6.0 - 54 per cent respectively for red, black and peat soils. In this study adsorption-desorption coefficient showed extensive hysteric behavior resulting from discrepancies between adsorption-desorption isotherms. Hysteric behavior is extensive for peat soil followed by black and red soils.

P-171 Effect of different tillage and weed control practices on physico-chemical properties and organic carbon status of soil

Tapas Chowdhury, A. P. Singh, S. B. Gupta and S. S. Porte
Department of Agricultural Microbiology, I.G.K.V., Raipur(C.G.)
e-mail: tapas_mb@rediffmail.com

The physical, chemical and biological properties of soil differs greatly by different tillage systems. Different type of tillage systems are generally adopted by the farmers to reduce the weed density which is one of the major constraints for increasing wheat production and considered as a major pest. Zero tillage system is also effective to reduce soil erosion. Weed control technology integrates preventive, cultural, mechanical, chemical and biological practices in which the use of chemical herbicides is probably the most important component of weed management system for most of the major crops. Long-term tillage practices and use of

different weed control measures have certainly some effect on physico-chemical properties and organic carbon pool of the soil. So a study was conducted to find out the effect of different tillage systems and weed control practices on physico-chemical properties and organic carbon content in experimental field soil because nutrient cycling in soil is governed by the above properties of soil. Rice-wheat cropping system was rotated for four continuous years (2005-08). Four types of tillage system were evaluated and put in main plots *viz* (1) conventional-conventional (ii) conventional -zero (iii) zero-conventional and (iv) zero-zero tillage system. Among weed control measures performance of hand weeding & recommended herbicidal application was tested and compared with a weedy check and put in sub plots. As recommended herbicides for wheat pendimethalin was sprayed in pre emergence and metsulfuron was sprayed in post emergence stage of the crop 1.0 kg and 2 g/ha, respectively. The pre-emergence and post-emergence herbicides were applied at 3 and 20 days after sowing of the crop, respectively. The treatments were replicated thrice under split plot design. Soil from rhizosphere was collected at a depth of 7.5-15.0 cm and tested for pH, EC and percent organic carbon content. The result of the study envisaged that the soil pH was less affected by tillage systems and herbicide application. Highest electrical conductivity (EC) was measured under conventional- conventional system, which found significantly higher over zero-zero tillage system at 0 and 50 DAS. Minimum EC was recorded under zero-zero tillage system. Significantly higher organic matter content was accumulated in rhizosphere soil under zero-zero tillage system in comparison to all other systems. The results of weed management revealed that the use of recommended herbicide application and hand weeding practice did not affect the physico-chemical properties and organic carbon content in rhizosphere soil during crop growth. However, a slight significant enhancement in organic carbon content was noticed under weedy check plot over herbicide treated plot at harvest of the crop.

P-172 Effect of crop and weed residues to control weeds in organically grown sun flower

Sunil A. Satyareddi, P. Devasenapathy, C. Chinnusamy and V. S. Mynavathi
Dept. of Agronomy, Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu)
e-mail : mynagri@yahoo.com

In view of the importance of organic weed management, a field experiment was conducted during *kharif*, 2006 to study the different non-chemical methods of weed management for the weed control efficiency and soil health in organically grown sunflower. The experiment with 12 treatments was laid out in randomized block design with three replications. The treatments consisted of hand weeding at 25 and 45 DAS, manually operated weeder at 25 and 45 DAS, manually operated weeder at 25 DAS + hand weeding at 45 DAS, two *in situ* green manuring at 45 DAS *viz*., cowpea and sunnhemp, intercropping with coriander, two mulches *viz*., crop residue (maize stalk) and weed residue at 5 t/ha, stale seedbed, eucalyptus oil spray at 0.4 per cent at 3 DAS, weed free and weedy check. Predominant weed flora were *Dactyloctenium aegyptium*, *Cynodon dactylon*, *Dinebra retroflexa, Echinochloa colonum* and *Chloris barbata among the grasses, the only sedge Cyperus rotundus and Trianthema portulacastrum*, *Digera arvensis* were dominant broad leaved weeds. Hand weeding twice, manually operated weeder at 25 DAS + hand weeding at 45 DAS reduced the weed biomass accumulation throughout the growth period. Intercropping with coriander, *in situ* green manuring with cowpea and sunnhemp although accounted favourable weed control reduced the yield of the sunflower may be due to the competition posed by the intercrops to the sunflower. From the results it could be concluded that initial weeding with manual weeder at 25 DAS + hand weeding at 45 DAS is recommended for effective and economic weed management practices in organically grown sunflower. Concisely, the treatments, mulching with maize stalk and weed residues, *in situ* green manuring with sunnhemp and cowpea shown the promotion of the microflora. This might be attributed to the addition of the biomass/organic matter to the soil and the process of decomposition. With organic production (low input system), the treatments of mulching and the *in situ* green manuring would be a beneficial over the years in system based approach, with evident improvement in the soil health.

P-173 Studies on harvest time residues of herbicides in soil, grain and straw of wheat

Asha Arora, Shobha Sondhia[1] and S. S. Tomar
R.V.S.K.V.V., College of Agriculture, Gwalior (M.P.)
[1]DWSR, Adhartal, Jabalpur (M.P.)
e-mail : ashaaroragwl@gmail.com

Wheat is the most important winter cereal crop of India. Isoproturon was recommended for weed control in wheat during 1980-81 and it became popular among the farmers. Now a days clodinafop, fenoxaprop-p-ethyl and sulfosulfuron are being recommended for efficient weed control in wheat. When the dose is more than the recommended rates due to indiscriminate use improper calibration and method of application, there is possibility of residual hazards in soil and crop produced and can be harmful for human and animals. Keeping these in view, an experiment was conducted during *rabi* 2006-07 at Research Farm, College of Agriculture, Gwalior to see the residues of these herbicides in post harvest soil, grain and straw of wheat.

The experimental soil was sandy clay loam with 55.2% sand, 19.4% silt, 25.4% clay and 0.54% organic carbon having 7.2 pH. Isoproturon, clodinafop, fenoxaprop and sulfosulfuron 2.0kg, 120 g, 240 g and 50 g/ha, respectively were sprayed as post emergence 30 days after sowing. Soil, grain and straw samples of wheat were collected at the time of harvest. The samples were extracted for herbicides along with control samples for each herbicide and after cleaning were analysed by HPLC.

Post-harvest soil samples contained 0.006 and 0.021 ug/g isoproturon and clodinafop respectively, where as no residue of fenoxaprop and sulfosulfuron was detected in soil. Similarly in wheat grain, isoproturon and clodinafop residues were present at the level of 0.041 and 0.096 µg/g. Sulfosulfuron residues were below detectable limit in wheat grain. Isoproturon residues could be detected in straw only to the level of 0.022µg/g.

P-174 Effect of organic matter on diuron adsorption by some benchmark soils of Punjab

Anubhuti Seth, S. S. Bhardwaj, S. K. Randhawa and B. D. Sharma
Dept. of Chemistry, Punjab Agricultural University, Ludhiana (Punjab)
e-mail : aicrpwc_pau@rediffmail.com

Increased use of pesticides for crop protection and pest control should be discouraged as their residue contaminates air, water, soil and food. The amount of organic matter in soil is fundamentally important for the adsorption and release process. Thus,the effect of organic matter on adsorption of diuron by seven bench-mark soil series belonging to different regions : arid (Gahri Bhagi, Jodhpur Ramana), semiarid (Gurdaspur, Fatehpur, Nabha) and subhumid (Dhar and Chamror) of north-western India was studied at 25°C .

Different concentrations of diuron ranging from 0 to 250 µg/ml were used for evaluating the effect of organic carbon extent on diuron adsorption . The organic matter from the soil samples was removed by oxidation using 30% H_2O_2. The adsorption data have been obtained for both type of soils i.e. with and without (removed) organic matter.

Results indicated that the adsorption of diuron decreases with the removal of organic matter in all the soils. Irrespective of the presence of organic matter, the adsorption isotherms are of L-shape. The results obtained for diuron adsorption conform to the Freundlich and the Langmuir equation at 25°C. Averaged values of partial molar free energy change DG and distribution coefficient (k_d) have been calculated to know the extent of adsorption process and adsorption capacity of soil, respectively.

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Effect of long term use of herbicides on soil microflora in rice under rice-wheat cropping system

C. Sarathambal, V. P. Singh and Jay G. Varshney
Directorate of Weed Science Research, Adhartal, Jabalpur (M.P)
e-mail: csaratha@yahoo.co.in

A field experiment was conducted during *kharif* season of 2009 at DWSR, Jabalpur to study the effect of herbicides on soil micro flora in rice eco system. The experiment was laid out as a split plot design with three replication. It comprised of 4 main plot treatments and 5 subplot treatments. Soil microbial populations were assessed at 15 days interval up to harvesting stage following serial dilution and plating method. In the present study it was observed that the application of herbicide under field condition initially (15 days after spraying) reduces soil micro flora. How ever the activity improved gradually. The population of total bacteria was 5.3 $x10^6$cfu/g and reduced drastically after the application of herbicide. The gradual increase in the population was noticed up to harvesting stage. At harvesting stage, maximum population was observed in the weedy check treatment ($18.8x10^6$ cfu /g) followed by 1 hand weeding ($17.3x10^6$ cfu /g) Similarly fungi and phosphobacteria population also were adversely affected by herbicides. Maximum fungi and phosphobacteria population were observed in weedy check($5.6x10^6$ cfu /g) ,this was followed by 1 hand weeding($5.1x10^6$ cfu /g), butachlor ($1.9x10^6$ cfu /g) anilophos ($1.7 x10^6$ cfu /g) respectively. Among the treatments no significant reductions were observed in actinomycetes population. Actinomycetes population maintained stable after the application of herbicide. In general treatments such as hand weeding and weedy check showed higher activity as compared with herbicide received treatments. Among the two herbicides sprayed, application of butachlor has less adverse effect when compared to anilophos on soil microorganisms.

P-176 Utilization of weeds as source of green leaf manures and their influence on weed flora, dynamics and growth in aerobic rice-rice cropping system

G. R. Denesh and T. V. Ramachandra Prasad
College of Agriculture, V.C. Farm, Mandya, UAS, Bangalore (Karnataka)
e-mail : grdenesh@rediffmail.com

The field experiment was conducted in aerobic rice- rice cropping system during *kharif* 2006 and summer 2007 at Agricultural Research Station, Kathalagere, coming under Bhadra command area of Karnataka. Weeds like *chromolaena, Parthenium and Cassia* as green leaf manure were compared at 75 and 100% recommended fertilizer dose (RDF, 100-50-50 kg/ha for *kharif* and 125-62.5-62.5 kg/ha for summer, respectively) with traditional green leaf manure-*Glyricidia,* FYM and paddy straw incorporation in order to know the effect of weed green leaf manures on weed flora, dynamics and growth. The experiment was laid out in a Randomized Complete Block Design with three replications. The soil type was sandy clay loam with slightly acidic pH of 5.83,normal electrical conductivity of 0.24 d/Sm, moderate organic carbon of 0.44 %, available nutrients- 168.0 kg N, 17.1 kg K_2O and 195.2 kg K_2O/ha.

Major weeds flora observed in the experimental plots were *Cyperus rotundus* (L.) Link, (from initial stage) (a sedge)*, Digitaria marginata* L.*, Dactyloctenium aegyptium* L.*, Echinochloa colona* L. and *Dinebra retroflexa* L. (from the beginning) (among grasses). Whereas among broad leaf weeds, major weeds were *Portulaca oleracea, Phyllanthus niruri* L.*, Parthenium hysterophorus* L.*, Mollugo cerviana* (L.) Ser., (from initial stage) and *Ageratum conyzoides* L. (at 60 DAS), *Spillanthus acmella* L. and *Oldenlandia corymbosa* L. and *Ocimum canum* L. (at harvest). Other weeds observed in lower densities were *Eragrostis pilosa* L.*, Chloris barbata* Sw*, Panicum* sp L. (among grasses), *Alternanthera sessilis* L.*, Mimosa invisia* L., *Cyanotis axillaris* L.*, Lagascea mollis* Cav. and *Euphorbia hirta* L. (among broad leaf weeds). The density of grasses was higher, followed by sedge and it was lower with broad leaf weeds. Initially, weed species – *C. rotundus* (sedge)*, D. marginata, D. aegyptium, D. retroflexa, E. colona* (among grasses), *P. oleracea, P. niruri* and *M. cerviana* (among broad leaf weeds) dominated in many of the treatments as compared to other weed species. The effect of green leaf manure of weeds or *glyricidia* or FYM on particular weed suppression or emergence was not observed at 30 DAS. The density of all categories of weeds did not differ significantly. With advance in crop growth at 60 DAS and harvest, the density of broad leaf weeds was higher, followed by grasses and it was lower with sedges. The weed types observed were similar to observed at 30 DAS and these weed types showed lower density in all treatments. In addition, *A. conyzoides* (at 60 DAS), *Spillanthus acmella* and *Oldenlandia corymbosa and Ocimum canum* (at harvest) showed emergence. The density of all categories of weeds were not influenced significantly by the use of green leaf manuring of weeds or glyricidia or FYM or paddy straw at 10 t/ha along with fertilizer levels in aerobic rice both at 60 and harvest. Among the weeds' category, the dry weight of grasses and broad leaf weeds was more, followed by sedge at 30 DAS, corresponding the density of these weeds' category, whereas, at 60 DAS and at harvest the dry weight of broad leaf weeds was more followed by grasses and sedge in *kharif* 2006. The dry weight of category of weeds did not differ significantly among treatments and there was no suppression or improvement in the growth of weed types due to the use of green leaf manure of weeds or *glyricidia* or FYM or paddy straw at all the growth stages of aerobic rice. Further, incorporation of green leaf manures of weeds-chromolaena or *Parthenium* or cassia at 10 t/ha along with 100 or 75% RDF in aerobic rice did not influence on suppression or improvement in density and dry weight of weed types. It is also noticed that *Parthenium* or chromolaena or cassia plants did not germinate and become dominant from their respective pre-flowered weed green leaf manures used for aerobic rice during the study, except with few germinated plants in *Parthenium* green leaf manures contaminated with post flowered plants during the *kharif* 2006. The use of 10 t/ha weed green leaf manures-chromolaena or *Parthenium* or cassia along with 100% RDF produced 30 to 37% (5241 to 5507 kg/ha) higher yield and along with 75% RDF 33 to 39% (4363 to 4555 kg/ha) higher paddy yield (pooled) than the corresponding fertilizer alone and compared similar to that of glyricidia green leaf manure and FYM.

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Utilization of weeds as source of compost and their influence on weed flora, dynamics and growth in maize-sunflower cropping system

G. R. Denesh, T. V. Ramachandra Prasad, H. V. Nanjappa and S. Bhaskar
College of Agriculture, V.C. Farm, Mandya, UAS, Bangalore (Karnataka)
e-mail : grdenesh@rediffmail.com

The field experiment was conducted in maize-sunflower cropping system during 2006 and 2007 at AICRP on weed control, main Research Station, Hebbal, University of Agricultural Sciences, Bangalore under eastern dry zone of Karnataka. *Parthenium, Chromolaena, and Cassia* weeds as compost were compared with traditional green leaf manure compost-*Glyricidia* and FYM along with two fertilizer doses – 75% and 100% recommended fertilizer dose (RDF). These combinations were compared with 75% and 100% of RDF alone and absolute control in maize and in succeeding crop of sunflower all the previous plots from treatment were divided in to two equal halves for raising sunflower crop under 75% and 100% RDF in order to know the direct and carry over effect of weed compost applied to previous *kharif* maize on weed flora, dynamics and growth.

Major weeds flora observed in the experimental plots were *Cyperus rotundus (*from initial stage) (among sedges)*, Digitaria marginata* L.*., Echinochloa colona* L.*., Cynodon dactylon* (L.) Pers.*., Dactyloctenium aegyptium* L. (from initial stages) (among grasses). Among broad leaf weeds, major weeds were *Commelina benghalensis* L.*., Ageratum conyzoides* L.*., Spilanthus acmella* L.*., Oldenlandia corymbosa* (from initial stage). Other weeds observed in lower densities were *Brachiaria mutica* L.*., Eleusine indica* L.*., Chloris barbata* Sw. *(*among grasses), *Lagascea mollis* Cav.*., Acanthospermum hispidum* DC.*., Euphorbia hirta* L.*., Cleome monophylla* L., *Borreria articularis* L. and *Phyllanthus niruri* L. The density of broad leaf weeds was higher, followed by grasses and it was lower in case of sedge. Initially, weed species – *C. rotundus, D. aegyptium*, *D. marginata*, *C. dactylon, C. benghalensis, S. acmella, O. corymbosa* and *A. conyzoides* dominated in many of the treatments as compared to other weed species.

The density of all categories of weed did not differ significantly in the experiment. With advance in crop growth at 60 DAS and at harvest, the density of all weed types was similar and lower than observed at 30 DAS. At this stage, *C. rotundus, D. marginata, D. aegyptium, S. acmella* and *A. conyzoides* were observed in higher density than other weed species during *kharif* 2006. The trend of weed density was similar in the years, 2006 and 2007. The compost of weeds along with fertilizer doses did not cause significant variation in densities of weed types-sedge, grasses and broad leaf weeds. There was no influence of the composts on any particular weed dominance or other wise similar at all stages. Similarly, the dry weight of weeds was similar in the years, 2006 and 2007. Among the weeds' category, the dry weight of broad leaf weeds was more, followed by grasses and it was lower with sedge at 30 DAS, corresponding to density of these weeds' category. The dry weight of category of weeds did not differ significantly due to variation in weeds' composts, glyricidia, FYM and fertilizer levels. Similar trend was observed at 60 DAS and harvest, except for lower dry weight of weeds. At this stage, weight of all weed types was similar, corresponding to weeds' density during both the year. Use of weed composts at 10 t/ha along with 75% and 100% RDF produced the 34 to 42% and 36 to 39%, respectively higher kernel yield maize than the corresponding 75% (3.77 t/ha) or 100% (4.55 t/ha) fertilizer alone. The residual effect of weed composts applied at 10 t ha^{-1} along with 75% RDF gave 32 to 35% and with 100% RDF level 33 to 34% higher sunflower seed yield than the use of 75 or 100% RDF alone in preceding maize.

P-178 Biocomposting of *Parthenium* for higher nutrient supply and productivity of crops

C. Nithya, C. Chinnusamy and P. Muthukrishnan
Department of Agronomy, TNAU, Coimbatore (Karnataka)
e-mail : nithiyachinnu@yahoo.co.in

Parthenium (Parthenium hysterophorus) popularly known as congress grass or carrot grass has taken the most dreaded position among the various weeds of the world. It is considered as an exotic poisonous, allergic and aggressive weed creating threat to environment and biodiversity. *Parthenium* as a weed has tremendous potential for biomass production both under crop fallow and non-cropped situations. The residues of weed biomass into value added compost may have the potential to improve soil fertility and crop productivity. Accordingly, field experiment was conducted at Coimbatore during *kharif* and *rabi* seasons of 2007–08 to evaluate the nutrient addition due to composting of *Parthenium* and the effect of compost on productivity of crops. The composting methods for *Parthenium hysterophorus* materials with semi solid cow dung and duration of decomposition to make good quality compost for use as nutrients. Different composting methods like pit aerobic, pit anaerobic, heap anaerobic and vermicompost methods were tried for composting *Parthenium hysterophorus* biomass.

Nutrient supply potenetial of these compost were compared with farmyard manure. Among the organic manures, *Parthenium* vermicompost at 5t/ha found most favourable and followed by pit anaerobic *Parthenium* compost at 5 t/ha. The nutrient content like Nitrogen, Phosphorus and Potassium were higher in composted *Parthenium* produced by different methods when compared to Farm Yard Manure. Enrichment in soil available N, P and K at the end each crops were observed with combined use of organics and inorganic N. Conjoint application of organics and inorganics (100 per cent NPK) sustained soil fertility and improved the crop productivity. *Parthenium* vermicompost especially increased the soil available N, P and K. The use of organics particularly with *Parthenium* vermicompost and pit anaerobic *Parthenium* compost along with 100 per cent of the recommended NPK supplied for individual crops in the cropping system will improve the growth, yield attributes and yield.

P-179 Screening of some weeds for antimicrobial activity

P. Swathi and M. Madhavi
Directorate of Weed Science Research Centre, ANGRAU, Hyderabad (A.P.)
e-mail: molluru_m@yahoo.com

Plant extracts have played significant role in inhibiting of the seed-borne pathogens and in the improvement of seed quality and field emergence of plant seeds. Present investigation is therefore, undertaken to test the efficacy of some of the common weed extracts against the bacterial pathogens like *E. coli, Staphylococcus aureus, Klebsiella pneumoniae, Bacillus subtilis* responsible for diseases like urinary tract infections, pneumonia, food poisoning, etc. *Lantana camera*, *Parthenium hysterophorus*, *Solanum xanthocarpum, Acalypha indica* and *Dathura stromonium* on four different bacteria *E.coli, Staphylococcus aureus, Klebsiella pneumoniae, Bacillus subtilis* and major seed-borne fungi *Aspergillus nige. Lantana camera* leaves are used in the treatment of tumors, tetanus, rheumatism, malaria and reported to possesses diaphoretic, carminative, antiseptic properties, and are main source of phosphorous and potassium when used as green mulch. In Africa, an infusion of the leaves is used against rheumatism, asthma, coughs and colds. It is used in asthma, bronchitis and dermatitis. It is also used in hay fever in humans and livestock. *Solanum xanthocarpum* is very spiny diffused herb commonly know as kantkari. is useful in treating worms, cold, hoarseness of voice, fever, dysuria, enlargement of the liver, muscular pain, spleen and stone in the urinary bladder. Nasal administration of kantkari is beneficial in migraine, asthma and headache. *Acalypha indica* is a common annual shrub in Indian gardens, backyards of houses and waste place throughout the plains of India. Leaves possess laxative properties (a substitute for senega) used in the form of powder or decoction. *Dattura stromonium* is commonly known as throne apple. It is very effective in asthma, when the smoke from the burning leaves is inhaled. Fruit of Datura is a specific remedy for phlegmatic and bilious types of malarial fever. Datura leaves are useful in the treatment of earache. Datura is very useful in checking secretion of breast milk.

P-180 Utilization of weed for panel products

D. P. Khali
CWD, FPD, FRI, Dehradun (Jharkhand)
e-mail : khalidp@icfre.org

Introduction of exotic species reflected positive and negative impact. But if we take in term of local biodiversity it actually played a negative role by slowly replacing the native species. They thus pose a serious challenge to sustainable management of forest ecosystems, and to the conservation of biodiversity. Certain plants, which were introduced as ornamental plants, have now become a weed. For example *Lantana camara*, *Ulex europaeus*, *Acacia mearnsii*, *Eupatorium glandulosum* and *Cytisus scoparius* have become a menace in western ghats and have replaced the valued flora at places. *Lantana camara* L. (Verbenaceae) is a variable shrub native to tropical America introduced to most of the tropical and sub-tropical regions. It is a weed in waste-areas and roadsides. It grows under varying conditions of climate and soil. It is drought resistant and regenerate quickly after cutting. Due to its prolific growth and wide adaptability, lantana has overrun large areas in India and developed into a serious weed. Similarly, *Parthenium hysterophorus* L., (Heliantheae: Asteraceae), has achieved the status of "worst weed" in India as it not only affects crop production, animal husbandry, and biodiversity but also poses serious health risks. Ever since the weeds became a menace in India and other countries, efforts are being made to manage the weed by a number of methods such as mechanical, legal, and biological etc. But so far no single method has been proved satisfactory. These considerations demand to develop an effective method for management of this weed. Utilization of lantana, *parthenium* and other weeds can also be an effective method for managing the weed. Owing to the presence of fibers, *Lantana camara* and *Parthenium hysterophorus* have exploitable potential to make value added products such as panel products. Panel products are good substitutes of solid wood depending upon the end use. Panel products have become popular for various purposes such as interior decoration, furnishing and as building materials. With the emergence of concern for the conservation of forest resources, the utilization of waste lignocellulosic material in the panel products have assumed greater importance as an alternative of valuable wood material.

The present paper gives overview of the work carried out at Forest Research Institute, Dehradun for development of panel products (composites) from invasive weeds such as *Lantana camara* and. *Parthenium hysterophorus*.

P-181 Utilization of weeds compost as source of nutrient in maize

G. Pramod, T. V. Ramachandra Prasad and M. T. Sanjay
University of Agricultural Sciences, Hebbal, Bangalore (Karnataka)
e-mail: pramod.agron@gmail.com

Field experiment was conducted during 2009 in red sandy loam soil of University of Agricultural Sciences, Bangalore to assess the utility of weeds as compost in maize during 2009 under irrigated conditions. The weeds namely *Chromolaena odorata*, *Parthenium hysteriophrous, Cassia uniflora* and *Eichhornia crassipes* were used as nutrient source and were compared with FYM along with the fertilizers doses 75% and 100% recommended dose (150 kg N, 75 kg P_2O_5, and 40 kg K_2O/ha) and absolute control. Weeds compost had 1.32-1.64 % N, 0.28-0.76% P and 0.93-1.86% K as against nutrient content of 0.78% N, 0.34% P and 0.69% K in farm yard manure. The results revealed that application of 100% RDF+ *Chromolaena odorata* compost 2.6 t/ha (25% N through compost) (7197 kg/ha), *Parthenium* compost (7162 kg/ha), *Cassia* compost (7088 kg/ha) and water hyacinth compost (7065 kg/ha) recorded yield similar to 100% RDF + 10 ton of FYM/ha (7083 kg/ha) and 100% RDF+ 4.8 ton FYM/ha (6759 kg/ha). All these treatments were significantly superior to mere application 100% RDF alone (6111 kg/ha). Further application of *chromolaena, parthenium, cassia* and water hyacinth and FYM with 100% RDF recorded higher kernel yield than corresponding application of weeds compost (25% N of RDF) with 75% RDF. Usage of none of these weed compost did not aid in germinating the corresponding weeds in the trial site.

P-182 Weed management in silvi-medicinal system

N. Berry and N. Singh
TFRI, P.O. RFRC, Mandla Road, Jabalpur (M.P.)
e-mail : nanita_agro@yahoo.co.in

Agroforestry is a farming system that integrates crops with trees which provides multiple benefits including diversified income sources, increased biological production and improved habitat for both human and wildlife. The integration of medicinal herbs with commercially important fast growing nitrogen fixing tree species on the same farmland ensures diversified products with high profitability to the farmers. medicinal herbs are the essential component of natural vegetation in India. The world trade figures suggest that India is second only to China with export of 32,600 tons of medicinal raw materials worth US $ 46 million annually. Traditional Indian system of medicines continues to be widely practiced which utilize 80 per cent of the material derived from locally available herbs. According to WHO survey about 25 per cent of prescribed human medicines are derived from the plants and 80 per cent people still depend on traditional systems of medicines. The demand for medicinal herbs is fast increasing all over the world due to its wider acceptance in the pharmaceutical industries. The Haridwar based Patanjali yogpeeth is one of the pioneer in this segment which succeeded in establishing the faith of millions of people worldwide towards traditional auervedic system. The current trend toward increased commercialization has resulted in over-harvesting of some economically important medicinal herbs, many of which have become endangered. Potential cause of rarity of plant species include unscientific extraction, deforestation, illegal export and drastic spread of weeds in the cultivated land. To reverse this situation, inclusion of medicinal herbs in agroforestry system (Silvi-medicinal) is one of the viable option available before us. Well managed and scientifically proven system are required for conservation of high value medicinal herbs *viz*. *Gloriosa superba, Ravolfia serpentine, Andrographis paniculata, Urgenia indica* etc with its natural habitat.

An experiment was conducted to develop silvi-medicinal system consisting of three medicinal herbs *viz*. *G.superba* L., *Costus speciosus* and *Curcuma longa* were intercropped in interspaces of 12 year old existing teak plantations at the 2m x2m spacing during 2007-2009 at the experimental area of Topical Forest Research Institute, Jabalpur (M.P.). Soil of the experimental area was sandy loam in texture with medium level of nitrogen (250- 300 kg/ha), phosphorus deficient (5-12 kg/ha) and rich in potassium content (300-425 kg/ha). Tree-crop interactions are an important component in agroforetsry which effect either positive (complementary) or negative (competitive) impact of trees with the companion crops. The competition for the resources like nutrient, water and light sharing by the components may result in complementary or competitive effect depending upon the nature of crops involved in the system. In an intercropping system involving a legume and non-legume, part of the nitrogen fixed by the legume crop become available to the non-legume component indicates complementary relationship. Under this silvi-medicinal system important weed species like *Cynodon dactylon* Pers. and *Cyperus rotundu*s were noticed. Data indicateed that infestation of the *C. dactylon* was 35- 40 % in sole crop (without trees) as compared to intercropped (with trees i.e. 15-18 %) followed by the *C. rotundus* 30-35% in sole crop and less than 15% as intercropped under the system. The growth of these noxious weed were inhibited under the canopy of teak. This proved the fact that leaf canopy of teak suppress the growth of weed thereby resulting into overall reduction in weed management as well as cost of cultivation. To prominent weed associated with medicinal herbs can be effectively controlled through this silvi-medicinal system.

P-183 Utilization of *Parthenium hysterophorus* as Vermicompost

Dharminder, D. K. Roy, D. Singh, N. K. Sinha and D. N. Pandey
Dept. of Agronomy, Rajendra Agricultural University, Pusa Samastipur (Bihar)
e-mail: devendrasingh_aicrpweed@yahoo.co.in

A field experiment was conducted at Crop Research Centre of Rajendra Agricultural University, Bihar, Pusa from 2007-09 to find out the vermicompost potentiality of *Parthenium hysterophorus* by using local and exotic strains of earthworm. The results revealed that vermicompost prepared by sole *Parthenium* showed the lower N-P-K content 1.78, 1.63 and 0.75 percent, respectively in presence of *Eisenia foetida* (Exotic earthworm) as compared to *Pheretima asiatica* (Local earthworm) showed the value of N-P-K Content 1.82, 1.65 and 0.78 percent, respectively.

P-184 Weed dynamics and productivity of yellow sarson as influenced by integrated use of vermicompost and inorganic fertilizer under different weed management practices

B. Duary, J. Fulmali and G. K. Ghosh
Institute of Agriculture Visva-Bharati, Sriniketan (West Bengal)
e-mail : bduary@yahoo.co.in

Field experiment was conducted during *rabi* season of 2006-07 and 2007-08 in a sandy loam soil in the farmers' field of village Bahadurpur of Birbhum, West Bengal to study the influence of integrated use of vermicompost and inorganic fertilizer under different weed management practices on growth of weed and productivity of yellow sarson. The experiment comprising of four main plot treatments *viz*. weedy, weed free, pendimethalin at 1.0 kg/ha as pre-emergence + one hand weeding at 35 DAS and one hand weeding at 30 DAS and five sub-plot treatments *viz*. no fertilizer, 100% recommended dose of NPK i.e 80:40:40 kg/ha through inorganic fertilizer, 75% recommended dose of N from fertilizer + 25% N from vermicompost, 50% recommended dose of N from fertilizer + 50% N from vermicompost and 25% recommended dose of N from fertilizer + 75% N from vermicompost was laid out in a split-plot design with three replications. Results revealed that pendimethalin along with hand weeding was as effective as weed free situation. About 22% yield reduction was recorded due to weed infestation in yellow sarson. Substitution of chemical fertilizer to the tune of 25% with vermicompost along with pendimethalin + hand weeding produced significantly higher number of siliquae per plant, number of seeds per siliqua, test weight and seed yield of yellow sarson which were at par with those of 100% recommended dose of fertilizer with pendimethalin + hand weeding. It was interesting to note that the species of weeds as well as their population varied significantly with higher proportion of nutrients from organic source. The population of *Cynodon dactylon*, *Croton bonplandianum*, *Polygonum plebeium* and *Chenopodium album* at 45 and 60 DAS was significantly more in the plots having higher proportion of vermicompost whereas the population of *Digitaria sanguinalis* and *Gnaphalium indicum* was reverse. This indicated the differential preference of weed species towards organic and inorganic source of nutrients. Pendimethalin at 1.0 kg/ha + one hand weeding along with substitutuion of chemical fertilizer to the tune of 25% with vermicompost may be recommended for managing weeds and obtaining higher productivity of yellow sarson in the lateritic soil of West Bengal.

P-185 Utilization of weed plants for medicinal purposes

K. L. Nandeha, T. D. Pandey, R. B. Tiwari and D. J. Sharma
IGKV, TCB College of Agriculture & Research Station, Bilaspur(C.G.)
e-mail : klnandeha@yahoo.co.in

Weeds not only adversely affect the crop productivity but many of them also cause health hazards in human beings and animals. They also affect the biodiversity to a greater extent. It is, therefore, weeds are generally considered as the unwanted, useless and noxious for the crops. Apart from all these, they may have numerous properties in one way or another and have immense potential as food & fodder, medicines, aromatic, phyto-remediation, industrial, soil & water conservation resources etc. Weeds may also be used for several other purposes like, for absorbing different types of pollutants from water, making compost and vermin-compost, essential oils, gums and dye production, furniture and hand-made paper, bio-pesticides, many home using materials etc. Medicinal plants have been the source of medicines since 4000-5000 BC. China was the first to use the plants as medicine. In Indian system, about 2000 plant species are of medicinal importance. Medicinal plants enlisted in the Indian system also include the weeds. Weeds are generally considered as the unwanted, useless and noxious for the crops. However, the weeds do also possess the medicinal properties. The common habitat of weeds is either cultivated lands, waste lands or other lands. Indian priority list of medicines includes 32 plants which also include some of the weeds. A very little information is available on the use of weed plants for such useful purposes *i.e.* including medicinal purposes. Therefore, an attempt has been made with the help of various sources to enlist the weeds which are important for medicinal uses. However, it is further required to investigate the plant parts used as medicines and their mode of preparation.

P-186 Bioefficacy of formulations developed from different polarity allelofractions of sesame (*Sesamum indicum*) root exudates against *Cyperus rotundus* L.

Lalit Kumar, Jay G. Varshney and A. Bhattacharya
Indian Institute of Pulses Research, Kanpur (U.P.)
Email - lalit1997@ymail.com

Impact of different polarity of allelofractions *viz*., F, E, D, C, B and A extracted from the root exudates of intact live plants of sesame (*Sesamum indicum* L.) revealed on the vegetative growth and root and tuber development of *Cyperus rotundus* L. Emulsifiable Concentrate (EC) and Emulsive water (EW) formulations developed from the extracted allelofractions not only revealed a grave impact on the vegetative growth of treated plants but also caused severe reduction in root biomass and their tuber forming tendencies. EC formulations developed from completely non-polar fractions *viz*., F and E caused nearly 90% reductions, as compare to control in both of the parameters i.e. the total biomass as well as the shoot biomass at 90 µg/g concentrations. At the same concentration, compare to control both the ECs were also observed quite effective in reducing up to 80-90% and 95-97% in the root biomass and their tuber forming tendencies, respectively. EC (fraction D) and EW (fraction B and C) formulations exhibited nearly 60-70% reduction in total biomass and about 70-75% reduction in root biomass and tuber forming tendencies of treated purple nut sedge plants at 180µg/g concentrations. However, the EW formulation developed from the completely polar fraction (A) caused around 50 -60% reduction in the entire observed root and shoot parameters that too at very high concentrations i.e. 270 µg/g. Apart from inhibitory effect on vegetative and root growth concern parameters the EC formulation exclusively developed from the highly non-polar fraction (F) also exhibited severe impact on the morphology of the plants. At higher concentrations i.e. 60 µg/g and above, though, it severally prohibited the plants to induce new shoots but instigated them to elongate their main shoots abruptly which ultimately forced the treated plants to fluorescence in very short period of time

P-187 Effect of root exuded allelochemicals of sorghum (*Sorghum bicolor*) on growth and developments of purple nutsedge (*Cyperus rotundus* L.) and other winter weeds of pulses

Lalit Kumar, Jay G. Varshney, A. P. Khare and G. K. Srivastava
Indian Institute of Pulses Research, Kanpur (U.P.)
Email - lalit1997@ymail.com

Since the allelopathic approaches has emerged as an effective tools to manage weeds infestation therefore, laboratory experiments were conducted during 2005-07 at Kanpur to find out the effect of non-polar fraction, released as root exudates by intact live plants of sorghum, against purple nutsedge and other winter weeds of pulse crops. Emulsifiable concentrate (EC) formulation developed from ethyl acetate fraction, found to constitute only three compounds in the ratio of 55, 30 and 15%, not only revealed a considerable impact on the vegetative growth of purple nutsedge (*Cyperus rotundus* L.) but also caused severe reduction in root biomass and their tuber forming tendencies. Developed formulation at 400 µg/g concentration in pot experiments, compare to control, caused approximately 70-75% reduction in both of the vegetative growth parameters i.e. shoot biomass as well as the total biomass of purple nutsedge. At the same concentration, compare to control, it also caused approximately 80% reduction in average biomass of roots and their tuber development tendency of the test weed. Developed EC at its highest concentration i.e. 400 µg/g was also observed quiet effective in retarding the vegetative growth of five other winter weeds *viz*., lambsquarters (*Chenopodium album,* L.), scarlet pimpernel (*Anagalis arvensis,* L.), corn flurry (*Spergula arvensis,* L.), common vetch (*Vicia sativa,* L.) and white sweet clover (*Melilotus alba,* L. *Medik.*). Based on total biomass inhibition, as compared to control, it was observed more toxic to V. sativa by inhibiting total biomass by 67.26 % followed by *C. album* (62.59%), *M. alba* (51.52%), *S. arvensis* (50.82%) and *A. arvensis* (26.21%).

P-188 Traditional medicines from weeds of Kerala

P. G. Shiju, C. T. Abraham, P. O. Bijoy and S. T. Rathish
DWSRC, Kerala Agricultural University, Thrissur (Kerala)
e-mail : ctabraham@yahoo.com

Weeds cause much more damage to agriculture production than other pests like insects, diseases etc. But they have economic values in other fields like medicine, gardening, food production etc. Amongst of the important use is preparation of ayurvedic medicines.

During survey conducted under the National Invasive Weed Surveillance Programme in different parts of Kerala, it was noticed that people collect and utilize many of the weeds for ayurvedic treatment. Informal interview with local people was conduct to understand the medicinal utility of common weeds. Following seven weeds were found to be widely used for ayurvedic purpose. Leaf juice of *Calycopteris floribund* is used to treatment of Malaria in early stage. *Calycopteris floribunda* and latex of *Tabernaemontana divaricata* are used against all kinds of wounds in grandma's medicine. *Calycopteris floribunda* and *Ipomoea pes-tigridis* have antivenin activity, *Ipomoea pes-tigridis* is used against reptile poison. Flowers of *Tabernaemontana divaricata* is keep over night and used to treat eye disorders. Leaves of *Gymnema sylvestre* are used for urine purification and chewing of leaves is found to be effective against diabeties. Large numbers of plants are used in traditional ayurvedic medicines and among them most of them are weeds. Eradication of such plants from our fields may adversely affect the diversity of flora and reduce the availability of valuable plants for medicinal uses.

P-189 Production of low-cost compost from weed biomass

Vineeta Parmar and Shobha Sondhia
Directorate of Weed Science Research, Jabalpur, (M.P.)
e-mail - parmar_vineeta@yahoo.co.in

There is estimated 37% average annual loss of crop production due to weeds apart from suppression of other local biodiversity. Herbicides and manual weeding are the most common approach of weed management. Weed biomass is one of the easily available sources of organic matter and plant nutrients. Weed composting is one of the recycling technologies, which will improve the quality of the products. The aim of the present study was to find out the possibility of utilization of agricultural wastes for composting. Open pit technique was chosen for composting. Treatment consisted of *Parthenium* weed +cow dung, mixed weed +cow dung, Echinochloa weed +cow dung. After 5.5 months, nutrient values were determined from the compost and compared. It was found that NPK values were maximum in compost obtained from mixed weed other than *Parthenium hysterophorus* and *Echinocloa colona* weed compost.

P-190 Weeds: a potential source of eco-friendly, biodegradable polymers

Neelu Singh and Nanita Berry
Tropical Forest Research Institute, Jabalpur (M.P.)
E.mail : singhnaticfre.org

Environmental concerns associated with the adverse effects in handling of synthetic petro-chemical based products that are non renewable and non–degradable hazardous chemicals, emphasized the importance of developing biodegradable products for variable utility *viz*., composites, pesticides, plastics and adhesives *etc* as "Green Products". Polysaccharides that is starch and cellulose are potential renewable raw materials which can be converted into biodegradable products by some chemical modification or processing directly or modified chemical reactions to significantly reduce the environmental impact in terms of energy consumption and green-house effect in specific applications.

There are several alien weeds *viz., Parthenium hysterophorus ,Cyperus rotundus , Hyptis suoveolens, Eichhornia crassipes, Ipomoea carnea, Cassia tora , Amorphophyllus spp, Ricinus communis etc.*, which creates an inhospitable environment to native plants, causing an inception of biodiversity losses and posing several health hazards are the potential source of allelochemicals like triterpenes, phenols, steroids, flavonoids and polysaccharides that can be converted into value added biodegradable products that are cost effective, efficient and biocompatible. In the present paper, the potential of weed species in development of different eco-friendly products have been discussed.

P-191 Studies on adoption pattern of various herbicides in wheat

O. P. Lathwal, S. P. Goyal, Hari Om and S. S. Punia[1]
KVK, Kurukshetra, [1]Department of Agronomy, CCS HAU Hisar (Haryana)
e-mail : jagirathau.ernet.in

Earlier, the lone herbicide isoproturon was extensively used for control of *Phalaris minor* and 2,4-D for broad leaved weeds. The scenario altogether changed after the failure of isoproturon (resistance development) and shift in weed flora during the previous decade. The alternate herbicides *viz*. sulfosulfuron, clodinafop and fenoxaprop for the control of *Phalaris minor* and metsulfuron for broad leaved weeds have been recommended by the respective states in the region. Now the farmers have started putting question mark on effectiveness of these alternate herbicides in the potential wheat growing region. Thus, the present study was carried out to see the adoption pattern of different herbicides to combat the herbicide resistance problem in future. A survey was conducted to assess the use of different herbicides in wheat. An appreciable number (269) of farmers were approached across the district Kurukshetra (Haryana) during 2008-09 to collect the information on use of herbicide brands for the control of grassy as well as broad leaved weeds in wheat. The data was analyzed for each herbicide using simple mathematical tools. This way the data on wheat cultivated in 871 ha area was collected. The findings revealed that the majority of farmers (47.6%) were found using clodinafop in maximum area (45.2%) under wheat crop and they harvested the highest grain yield (47.9 q/ha) when compared to users of sulfosulfuron and other categories of herbicides available in the market. Sulfosulfuron was used by 20% farmers covering 21.6% wheat area reported to be poor in control of weeds and registered about 13% less yield of wheat dissatisfying the farmers. About 28% farmers in about 30% area applied metsulfuron to control the broad leaved weeds but they applied this along with clodinafop (mixing) in a single shot. Mixed application of clodinafop and metsulfuron decreased the bio-efficacy of both the herbicides but proved better than sulfosulfuron alone. None of the farmers found using fenoxaprop in wheat. Exceptional farmers (1.1%) followed crop rotation in small area (0.5%) and got maximum grain yield in comparison to chemical control of weeds in wheat. The fear of cross resistance against alternate herbicides may be seen due to continuous use of these herbicides depending upon the situation varying from farmer to farmer.

P-192 Microbial induction of systemic resistance in the management of *Cuscuta* in chickpea

C. Kanan and Samvedna Shukala
Directorate of weed Science Research, Adhartal, Jabalpur (M.P.)
e-mail : agrikannanatgmail.com

Cuscuta spp (dodder,Convulaceae), are parasitic plants which severely impact host growth and reproduction. They have yellow to orange vines that lack chlorophyll, roots or expanded leaves, and thus are completely dependent on aboveground attachment to other plants (hosts) for their subival and reproduction. They generally depend on the host plant volatiles, secreted from the roots, to locate the hosts. Once a host is located the vines twine around the host stem and produce haustoria which grow into the host to extract nutrients from both xylem and phloem. *Cuscuta* spp. cause extensive damage to numerous agricultural crops including tomato, alfalfa, potato, soybean, onion and chickpea. Since they have intimate physiological connection to the hosts, they are difficult to be managed without also impacting the crop plants. In this context, making the host plants themselves defend against *Cuscuta* invasion would be a better and successful strategy in the management of this dreaded pest. Plants have the ability to perceive attack and respond specifically to the invasion by activating their resistance genes to produce the defense reaction. The host plant are induced either by the invading organism (a virulent pathogen) or by certain group of microbial agents called plant growth promoting rhozobacteria (PGPR), to produce a specific defense reaction depending upon the attacker. In the management of *Cuscuta* spp. There are two approaches (a) the composition of the root leachates of the host may be changes so that the parasite cannot find the host and starve for food (b) the host may be induced to synthesize defense compounds to repel the haustoria of the parasite. In the present case, pot culture studies conducted in the containment chambers in DWSR, Jabalpur, showed that the number of haustorial attachments of the parasite (*Cuscuta* sp) on the host (chickpea) was found to decrease when treated with PGPR microbes *viz.*, *Pseudomonas fluorescence* (17 t0 33%) and *Trichoderma viride* (16 to 3%) when compared with the control. Microbial treatment led to initial late establishment of *Cuscuta*, however as days progressed *Cuscuta* was able to parasitize the whole chickpea plant and the plants were wilted in the end. The treatment in which microbial seed treatment and application of the microbes on the 15 DAS led to the maximum decrease in the number of haustorial attachments. However detailed studies are required to be done before arriving at a conclusion. Further studies in understanding the mechanisms behind the haustorial suppression, the actives of the defense enzymes in the host and frequency of application of the microbes are under progress.

P-193 Performance of Maxican beetle on *Parthenium hysterophorus*

O. L. Sharma
Agricultural Research Station, SKRAU, Bikaner (Rajasthan)
Email: sharma_olatrediffmail.com

A study was conducted for two years 2008 and 2009 at Agricultural Research Station SKRAU, Bikaner to see the performance of maxican beetle (*Zygogramma bicolorata*) a bio-agent against gajar ghas (*Parthenium hysterophorus*) . The beetles were released on *Parthenium,* infested area as per the protocol during 2008 and 2009. Monthly observations were recorded on population of eggs, larvae and adult during September, October and November. An increasing trend was noticed after one month of releasing the insects with regard to the all three parameters up to the month of November. It was also noted that activity of insect was practically stopped in the month of December. On an average, beetles were found effective against *Parthenium*.

P-194 Biology and herbicidal management of water hyacinth in stagnant water bodies

R. Sathya Priya, P. Manickasundaram, C. Chinnusamy and P. Muthukrishnan
DWSRC, Department of Agronomy, TNAU, Coimbatore (Karnataka)
e-mail : sathyaagro.priyaatgmail.com.

Water hyacinth native to Brazil, was introduced in India in 1886 in Bengal as an ornament and then it has become a major pest of rivers and dams, introduced to throughout the country. Chemicals such as paraquat, glyphosate, metsulfuron methyl and the amine and acid formulations of 2, 4-D are the most effective and commonly used chemicals against water hyacinth. The experiment was conducted under controlled condition using cement containers/tanks. The *Eichhornia crassipes* plants were collected from stagnant water bodies and 15 number of water hyacinth plants have been inoculated in each water filled cement tanks on *kharif*-2009. Initial biomass of 15 plants was recorded. Fish fingerlings were released on the same day to estimate the herbicide influence over fish. Wet weight and dry weight of the water hyacinth plants has been recorded at weekly intervals. Application needs to be undertaken by trained individuals using correct dosages and applied at appropriate stages of growth. In view of this, to study the efficiency of different herbicides on water hyacinth management and the influence of herbicides on water hyacinth regeneration. The results showed that paraquat has quick knock down effect and it control water hyacinth up to 7 DAHS later which it has no affect on water hyacinth regeneration. 2, 4-D Na salt controlled the water hyacinth from 14 DAHS to 60 DAHS but comparatively lesser than glyphosate application. Spraying of glyphosate at 10 ml/lit + carfentrazone at 4mg/lit and glyphosate at 10ml/lit of water resulted in complete control of water hyacinth and there was no regeneration of water unlike other chemicals. There was no mortality of fishes were observed with all the tested herhicides.

P-195 Weed species diversity for forage enrichment in dryland ecosystems of western zone of Tamil Nadu

V. S. Mynavathi, C. Jayanthi, D. Ravisankar and P. Muthukrishnan
Department of Agronomy, T.N.A.U., Coimbatore (Tamil Nadu)
e-mail : mynagriatyahoo.com

A survey was made in dryland ecosystem of western zone of Tamil Nadu was carried out in Tirupur district, Tamil Nadu during 2009. About 43% of the farmer's own less than 5 ha land area and 30% and 27% of the farmer's are big and marginal farmer's respectively. Of these, 73% of the farmer's owned pasture lands for grazing the livestocks. The main farming system of the zone is silvipasture system locally called "Korangadu", typically consists of a mixture of Cenchrus grass and tree *Acacia leucophloea*. Thirty sites were surveyed in the district to identify the composition and diversity of natural weed species in dryland agro ecosystem of western zone of Tamil Nadu. There were about forty natural weed species were found in fields. The weeds observed were *Cynodon dactylon, Borreria hispida, Crotalaria globosa, Setaria verticulata, Aerva tomentosa, Chloris barbata, Phaseolus trilobus, Celosia argentea, Trachys muricata, Cenchrus ciliaris, Chrysopogon species, Merremia species, Phyllanthus maderapatensis, Abutilon indicum, Aerva lanata, Alysicarpus rogosus, Boerhaavia diffusa, Cardiospermum halicacabum, Corchorus olitorius, Leucas aspera, Parthenium hysterophorus, Tridax procumbens, Vigna trilobata, Achyranthus aspera, Phyllanthus amarus.* Among these *Celosia argentea, Parthenium hysterophorus, Leucas aspera* are invasive weeds of concern to the farmers. Some of the weeds *viz., Cenchrus ciliaris, wild naripayaru* and *Cardiospermum halicacabum* are grazed by the livestock. Livestock cause weed invasion by grazing and trampling native plants, clearing vegetation and destroying the soil crust. Livestock transport weed seeds into uninfested sites on their coats and feet, preferentially graze native plant species over weed species, create patches of bare, disturbed soils that act as weed seedbeds and destroy micro biotic crusts that stabilize soils and inhibit weed seed germination. Grazing also creates patches of nitrogen-rich soils, which favor nitrogen-loving weed species, reduces concentrations of soil mycorrhizae required by most western native species and accelerates soil erosion that buries weed seeds and facilitates their germination.

P-196 Major aquatic weeds of north malabar region of Kerala

P. G. Shiju, C. T. Abraham, T. P. Ramya and S. T. Rathish
DWSRC, Kerala Agricultural University, Thrissur (Kerala)
e-mail : ctabrahamatyahoo.com

Kasaragod, Kannur and Wayanad districts are known as North Malabar region of Kerala. This region have large aquatic area other than sea coast and these areas are well known for inland water transport and fishing. Vast variety of aquatic flora and fauna are found in this region. A study was conducted to identify distribution of major aquatic plants in north Malabar of Kerala. The study was conducted as a part of National Invasive Weed Surveillance Programme during 2008 – 09 in various parts of Kerala. Survey spots were selected randomly in every 10 km. by using 1 sq m. quadrates .The major aquatic plants of inland water bodies like lakes, canals, streams, rivers and adjacent marshy areas were observed. The inland aquatic ecosystem of Thalassery, Kannur, and Cheruvathur are now widely infested with *Eichhornia crassipes and Salivinia molesta.* Initially one or two plants were found, but now the number is found to be high. Major inland aquatic plants found in North Malabar. The vegetative mode of reproduction is the major cause of fast spread of these specieses. *Lemna gibba* is found in almost all waste water bodies of Kannur District. *Nymphaea nouchalli* and *Nymphaea rubra* are found in abandoned fields of Cheruvathur and Nileswaram. *Hygrophila schulli* is found in banks of streams in Cheruvathur, Thrikkarippur, and Pazhayangadi. *Eriocaulon brownianum, Hydrilla verticillata, Vallisneria spiralis, Najas indica, Cabomba caroliniana* are found in the rocky ponds and in laetrite plains of Cheemeni, and Peringome. In addition to this, a number of other aquatic plants are also found in the water bodies of north Malabar. *Eichhornia crassipes* and *Salivinia molesta* create problems in inland water transport and fishing, while others are not so problematic. Some of these plants have ornamental value like *Nymphaea nouchalli*. Major aquatic plants in north Malabar are *Eichhornia crassipes, Salivinia molesta, Nymphaea nouchalli*, *Nymphaea stellata and Lemna gibba.* These plants affect the activities of human beings by hindering fishing and transport. *Alternanthera philoxeroides* is an emerging aquatic weed of water bodies.

P-197 Evaluation of herbicides for management of *Eichhornia crassipes*

N. C. Deka, Nilay Borah, J. Deka, I. C. Barua, and B. Chetia Borah
Department of Agronomy, Assam Agricultural University, Jorhat (Assam)
e-mail : nilayborahatrediffmail.com

Aquatic weeds are major problem both in cropped and non-cropped situations. Colonization of these weeds not only affects the crop productivity but also cause hindrance in other crop management activities, natural flow of water resulting in flash flood *etc*. Out of several aquatic weeds *Eichhornia crassipes* is most common in wet rice culture and water bodies of the state. The chemical control of *Eichhornia crassipes* with glyphosate has been found effective. However, there is no information available on the efficacy of alternate herbicide. The present investigation was conducted to study the efficacy of different herbicides against *Eichhornia crassipes*. Concrete tanks of size 3 m in length, 2 m in width and 1 m in depth were filled up with tape water up to 0.7 m and water hyacinth plants (*Eichhornia crassipes*) were kept at 10 plants/m for one week before spraying of herbicides. Herbicides at two doses each of paraquat 24SL (4 ml/L and 8 ml/L), glyphosate 40 SL (5 ml/L and 10 ml/L), 2,4-D sodium salt 80% WP (1.25 g/L and 2.5 g/ha), glufosinate of ammonia 15 SL (6.5 g/ha and 13.0 g/ha), metsulfuron methyl 20WP (0.05 g/L and 0.075 g/L) were applied with a spray volume of 1000 litre/ha on 10-04-2009 and the relevant observations were recorded. Irrespective of herbicides, weed plants showed complete drying by the second week of the spray. Among the herbicides, paraquat applied tanks showed faster drying of the weeds. The lowest weed dry weight at 7 days after spray was recorded with paraquat 8 ml/L and highest in untreated control. Weed plants were completely killed by 15 days after spray in all the herbicide treated tanks while the dry weight in control tank was increased to 71.2 g/m^2. Regrowth of weeds up to 120 days of spray was not observed in treated tanks irrespective of herbicides.

P-198 Biology and herbicidal management of water hyacinth in stagnant water bodies

R. Sathya Priya, P. Manickasundaram, C. Chinnusamy and P. Muthukrishnan
Department of Agronomy, T.N. A.U., Coimbatore (Tamil Nadu)
e-mail: sathyaagro.priyaatgmail.com.

Water hyacinth is a native to Brazil. In India, it was introduced in 1886 in Bengal as an ornament and then it has become a major pest of rivers and dams, introduced to throughout the country. *Eichhornia crassipes* is a perennial fastest growing leaved grass weed persists in water bodies in abundantly large number. It is a good of invasive and naturalized weeds, which has established itself firmly wherever it has invaded and became naturalized over space and time. The high reproductive capacity and rapid growth of *Eichhornia crassipes* endow it with high vegetative development and productivity rates. A single inflorescence has 20 flowers and each flower produces 3000-4000 seeds. The seeds sink down to the bottom and remain viable at least for 20 years. A pair of plants can multiply up to about four thousand times in one season. Chemical control is one of the world wide, most commonly used methods of macrophyte repression. Chemicals can be applied from the air, water or land and some degree of accuracy as to where the herbicide lands can be achieved. Chemicals such as paraquat, glyphosate, metsulfuron methysl and amine and acid formulations of 2, 4-D are the most effective and commonly used chemicals against water hyacinth. The experiment was conducted at controlled condition using cement containers / tanks. The *Eichhornia crassipes* plants were collected from stagnant water bodies and 15 number of water hyacinth plants have been inoculated in each water filled cement tanks on *kharif*-2009. Initial biomass of 15 plants was recorded. Fish fingerlings were released on the same day to estimate the herbicide influence over fish. Wet weight and dry weight of the water hyacinth plants has been recorded at weekly intervals. Application needs to be undertaken by trained individuals using correct dosages and applied at appropriate stages of growth. In view of this, to study the efficiency of different herbicides on water hyacinth management and the influence of herbicides on water hyacinth regeneration.

The results showed that paraquat has quick knock down effect and it control water hyacinth up to 7 DAHS later which it has no affect on water hyacinth regeneration. 2, 4-D Na salt controlled the water hyacinth from 14 DAHS to 60 DAHS but comparatively lesser than glyphosate application. Spraying of glyphosate at 10 ml/lit + carfentrazone at 4mg/lit and glyphosate at 10ml/lit of water resulted in complete control of water hyacinth and there was no regeneration of water unlike other chemicals. There was no mortality of fishes were observed with all the tested herhicides.

P-199 Yield and yield attributes of irrigated maize as influenced by manually operated weeders

V. S. Mynavathi, N. K. Prabhakaran and C. Chinnusamy
Department of Agronomy, T.N.A.U., Coimbatore (Tamil Nadu)
e-mail : mynagriatyahoo.com

Field experiment was conducted during *kharif* 2006-07 at Tamil Nadu Agricultural University, Coimbatore. The experiment was laid out in randomized block design with treatments *viz*., crescent hoe, multi tyne weeder, wheel hoe and rotary peg weeder weeding twice on 25 and 45 days after sowing. The above treatments were compared with hand weeding twice on 25 and 45 DAS, pre-emergence application of atrazine 0.5 kg/ha on 3 DAS with one hand weeding on 45 DAS and unweeded control. The treatments were replicated three times. The weeders were used at 25 and 45 DAS. Results of the study revealed that, among the mechanical weeders wheel hoe proved better in terms of reducing total weed density (52.7 No./m2), total dry weight of weeds (113.3 kg/ha) resulting in higher number of grains /cob (484) and grain yield(4814 kg/ha). Application of pre-emergence atrazine 0.5 kg/ha on 3 DAS with hand weeding on 45 DAS registered significantly lower weed density (34.7 No./ m2), total dry weight of weeds (104.7 kg/ha). Compared to other treatments which led significantly higher number of grains/cob (513) and grain yield (5429 kg/ha).

P-200 Influence of manually operated weeders on weed dry weight and nutrient removal by weeds in irrigated maize

V. S. Mynavathi, N. K. Prabhakaran and C. Chinnusamy
Department of Agronomy, T.N.A.U., Coimbatore (Tamil Nadu)
e-mail : mynagriatyahoo.com

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The experimental field was mainly infested with *Dactyloctenium aegyptium, Cyperus rotundus, Parthenium hysterophorus*, *Trianthema portulacastrum* and *Digera arvensis.* Among the treatments, hand weeding twice recorded the least weed dry weight at 45 DAS. The next best treatment was pre-emergence application of atrazine 0.5 kg/ha on 3 DAS with one hand weeding on 45 DAS and it was comparable with wheel hoe weeding on 25 & 45 DAS. Weed removal only after its germination and establishment up to either 25 or 45 DAS in maize might have facilitated higher total weed density in manual or mechanical weeding and enhanced the weed dry weight. Pre-emergence application of atrazine 0.5 kgha on 3 DAS with one hand weeding on 45 DAS recorded lower nutrient removal by weeds followed by hand weeding twice, which were comparable with each other. Pre-emergence application of atrazine 0.5 kg/ha on 3 DAS with one hand weeding on 45 DAS recorded remarkably higher grain yield of 5429 kg/ha and comparable yield of 5227 kg/ha was recorded with hand weeding twice. Among the mechanical weeders, wheel hoe weeding twice recorded significantly higher grain yield of 4814 kg/ha. Lower depletion of nutrients by weeds promoted the higher yield of maize in these treatments. The study revealed that pre-emergence application of atrazine 0.5 kg/ha on 3 DAS with hand weeding on 45 DAS in maize recorded the least weed dry weight, nutrient removal by weeds and higher grain yield.

P-201 Major aquatic weeds of Kole lands

P. O. Bijoy, C. T. Abraham, P. G. Shiju and S. T. Rathish
Kerala Agricultural University, Thrissur (Kerala)
e-mail : ctabrahamatyahoo.com

Kole lands of Kerala are one of the important Ramsar site, because of its biodiversity. It lies between Bharathapuzha and Chalakudi rivers in the districts of Thrissur and Malapuram below MSL. The ecosystem of kole lands is mainly divided into two - canal ecosystem and 'Padam' (rice fields) ecosystem. The canal ecosystem is entirely a wetland ecosystem where as padam ecosystem remains submerged in water for 6-8 months in an year. Once the South west Monsoon is over, the field will be drained and used for rice cultivation known as "Kole cultivation". The study was conducted as a part of National Invasive Weeds Surveillance Programme, during summer 2008.

The floristic composition was noted by making visual observation, taking photographs and collecting specimen samples. The plants were identified by the help of floras and subject experts. Among the major ten weeds, six were alien weeds, namely *Cabomba caroliniana,* Gray., *Eichhornia crassipes,* (Mart.) Solms., *Salvinia molesta,* D.S. Mitchell, *Alternanthera philoxeroides,*(Mart.), *Ipomoea carnea,* Jack. and *Limnocharis flava,* (L.) Buch. Other four weeds, which are of Asian origin were *Ipomoea aquatica,* Forssk., *Nymphoides cristata,* (Roxb.) O. ktze, *Nymphaea nouchali,* Burm.f. and *Utricularia aurea,* Lour. Among these weeds, the most serious problem weeds are *Eichhornia, Salvinia* and *Ipomoea aquatica* creating problems for agriculture operations (in paddy fields) and destructions for water movement in irrigation canals and hindrances to the water transport and fishing in water bodies. *A. philoxeroides, I. carnea* and *L. flava* are comparatively new introduction spreading fast in the Kole lands.

P-202 Performance of manually operated weeders in irrigated maize

V. S. Mynavathi, N. K. Prabhakaran and C. Chinnusamy
Dept. of Agronomy, Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu)
e-mail : mynagriatyahoo.com

Yield losses as high as 50% caused by weeds have been reported in irrigated maize. Undependable labour availability and escalating wages in many cases has given impetus to the development and use of herbicides and mechanical weeders for weeding would be the advantageous as they require lesser labour. Keeping this in mind, the field experiment has been conducted in irrigated maize with the following objectives to evaluate the weed control efficiency of mechanical weeders. Crescent hoe , multi tyne, wheel hoe and rotary peg weeders, pre-emergence application of atrazine on 3 DAS followed by hand weeding on 45 DAS , hand weeding twice on 25 and 45 DAS were compared with unweeded control in randomized block design with three replications in irrigated maize during *kharif* 2006 and 2007. Predominant weed flora were *Echinochloa colonum, Dactyloctenium aegyptium* and *Digitaria longiflora* among the grasses, the only sedge *Cyperus rotundus* and *Parthenium hysterophorus, Trianthema portulacastrum and Digera arvensis* were dominant broad leaved weeds. Wheel hoe utilized lower time (i.e) 71.43 and 35.71 hr/ha, respectively at 25 and 45 DAS probably due to rotational movement of the front wheel, which helps in ease of operation causing less fatigue to the operator and also recorded a yield of 4814 kg/ha which was 154 per cent increase over control. Further this hoe reported maximum area coverage with minimum cost of operation (Rs.714.30/ha) as such seems to be the most promising weeding tool for those areas where labour is costly and not easily available.

P-203 Evaluation of manually operated weeders for time saving and weed control efficiency in irrigated maize

V. S. Mynavathi, N. K. Prabhakaran, C. Chinnusamy and P. Muthukrishnan
Dept. of Agronomy, Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu)
e-mail : mynagriatyahoo.com

Weeds constitute a major component among the bottlenecks for successful crop production. Maize (*Zea mays* L.) is the third most important cereal crops, and no cereal crop on the earth that has so much yield potential as that of maize. As the crop is heavily fertilized and sparsely grown, severe weed infestation is experienced, resulting in to a drastic reduction of grain yield. The traditional weeding operation is arduous, time consuming, back breaking and may not be undertaken at appropriate time due to non-availability of labours during peak period. So, it is not possible to control the weeds timely with the traditional methods like hand weeding. Mechanical weed control is an alternative practice. In view of the importance of mechanical weed control, a field experiment was conducted during *kharif*, 2006 to evaluate the efficiency of manually operated weeders in irrigated maize. The treatments consisted of four manually operated weeders *viz.,* crescent hoe , multi tyne, wheel hoe and rotary peg weeders weeding on 25 and 45 DAS and were compared with hand weeding on 25 and 45 DAS, PE atrazine 0.5 kg/ha on 3 DAS + HW on 45 DAS and unweeded control in randomized block design with three replications.

Among the mechanical weeders, wheel hoe required less number of man days to complete the weeding operation (5.46 man days/ha). Wheel hoe utilized lower time probably due to rotational movement of the front wheel, which helps in ease of operation causing less fatigue to the operator. Further this hoe reported maximum area coverage. Pre emergence application of atrazine 0.5 kg/ha on 3 DAS followed by one hand weeding on 45 DAS required more number of man days (18 man days/ha). Results revealed that pre emergence application of atrazine 0.5 kg/ha on 3 DAS followed by one hand weeding on 45 DAS reduced the weed dry weight and enhanced the weed control efficiency. Among the mechanical weeders, wheel hoe weeding twice efficiently suppressed the weed growth and recorded a grain yield of 4814 kg/ha and thus, wheel hoe is a promising weeding tool for maize.

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Evaluation of diclosulam and haloxyfop for weed control in soybean

R. C. Nainwal, S. C. Saxena and V. Pratap Singh
Dept. of Agronomy, G. B. Pant Univ. of Agril. & Tech., Pantnagar (Uttarakhand)
e-mail : nainwal.rakeshatgmail.com

Weed population during *kharif* is most critical and deciding the soybean productivity, resulted about 54-65 per cent reduction in soybean yield (Chandel, 1989). Weeds not only compete with soybean for moisture, light, nutrients and space but also hamper operation of equipment, harbor crop pests such as insects and diseases, and contaminate harvested grain with foreign matter and weed seeds (Lembi and Ross 1999). Application of herbicides as pre emergence for effective weed control in soybean, are required to be used with in very short period (2-3 DAS) of time after planting. In monsoon season, if rain capture this critical period of application then pre emergence herbicide cannot be used. This may necessitate the search of some post emergence herbicides for effective and economic control of weeds in soybean crop. In view of above facts, an experiment is being conducted to evaluate the bio-efficacy of pre-and post-emergence herbicides on weed growth and yield of soybean. The experiment was laid out during the rainy season of 2008 and 2009 at crop research centre of G.B.P.U.A.&T.,Pantnagar, in a randomized block design with three replications of 6 treatments consisting diclosulam 26 g/ha, pendimethalin and fluchloralin each at 1000 g/ha, haloxyfop 100 g/ha, two hand weeding (30 and 45 DAS) and weedy (control). All the pre emergence herbicide were applied the day after sowing, whereas, fluchloralin was applied as pre plant incorporated treatment one day before sowing and haloxyfop was applied as post emergence (21 DAS) by using a knap sack sprayer fitted with flat fan nozzle with volume of water 750 litres per/ha.

The experimental plot was mainly infested with *Echinochloa colona, Eleusine indica, Brachiaria ramosa, Digitaria sanguinalis, Eragrostis japonica,* among the grassy weeds while *Celosia argentia, Lindernia ciliata, Eclipta alba* and *Trianthema monogyna* were among the broad leaf weeds (BLWs). Diclosulam (84 WDG) 26 g/ha was found most effective to suppress broad spectrum (grassy and non grassy) of weeds at all the stages as it resulted the lowest density and dry weight of different weed species among all herbicidal treatments while, haloxyfop (10 EC) was found much effective to control the grassy weeds. Among the herbicides, the highest weed control efficiency (WCE) (75.6 %) was obtained with application of diclosulam at 26 g/ha, followed by pendimethalin used as standard check in the experimental plot, which might be due to the lower weed index (WI) in that treatment.

During the course of study, Diclosulam (84 WDG) at 26 g/ha as pre emergence was found as promising herbicide which suppressing all weed spp. in soybean field while haloxyfop was only effective to control the grasses.

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P-205 Distribution of dominant weeds species in Pudukkottai and Tirunelveli districts of Tamilnadu

P. Balamurugan and R. Balasubramanian
Dept. of Agronomy, ACRI, Madurai, TNAU (Tamil Nadu)
e-mail : kpbalamuruganatyahoo.co.in

A survey work was conducted in southern districts of Tamilnadu with the objectives of early detection of regulated weeds along with the weeds distribution in different categories. The work was carried out in Pudukkottai and Tirunelveli districts. The survey was performed in each and every village of all blocks in each district. Grid map of the districts were prepared and the survey villages were delineated based on the main road, secondary and access roads. The villages are covered with cropped, non cropped and garbage areas. Each category is placed with 10 quadrates ($0.25m^2$) and the observation was recorded in the categories of grasses, sedges and broad leaved weeds. The Relative density of various weeds is furnished. In cropped area, *Croton sparsiflorus* recorded higher RD followed by *Dactyloctenium agyptium* and the lower RD was recorded with *Aerva lanata*. *Parthenium hysterophorus* and *Perotis indica* were the dominant weeds in non-cropped area. In garbage area, *Parthenium hysterophorus* registered higher value followed by *Abutilon indicum* and the lower value was registered with *Heteropogen contortus* and *Tribulus terrestris*. This district was registered higher RD with *Parthenium hysterophorus* followed by *Cyprus rotundus* and lower RD was recorded with Sida acuta. In non cropped area, higher RD value was registered with *Parthenium hysterophorus* followed by *Perotis indica*. In garbage area, *Parthenium hysterophorus* registered higher value of RD followed by *Abutilon indicum* and lower value of RD was registered with *Heteropogen contortus*. Irrespective of catogories, Tirunelveli districts was registered with higher value in *Parthenium hysterophorus*.

P-206 Awareness and adoption levels of weed management technology in transplanted rice in Jind district of Haryana

Yash Pal Malik, S. S. Punia and Dharam Bir Yadav
Krishi Vigyan Kendra, Jind (Haryana)
e-mail : jagirathau.ermet.in

There are specific recommendations of different herbicides and their application techniques. Though there is extension web for disseminating the recommended and latest technologies, yet the adoption pattern of recommended package of practices including usage of herbicides in rice crop is not worth satisfying and full efficacy of herbicides has not been obtained in wheat at farmers' fields. Therefore, it has become important to find out the reasons of partial efficiency of applied herbicides to realize the maximum control of weeds in transplanted rice. In order to assess the adoption pattern of different herbicides recommended in rice, a comprehensive survey was undertaken in district Jind (Haryana) where rice-wheat cropping sequence is prevalent for the last three decades. During survey in *kharif* 2009, the 50 farmers were interviewed across the district to collect the information on time of application, dose, and method of application and other aspects of herbicide use in rice crop. In district Jind, 96 % farmers applied pre-emergence herbicides to control weeds in transplanted rice. Fifty per cent farmers also practiced hand weeding in addition to herbicide use. Ten per cent farmers also applied post emergence herbicide bispyribac- sodium in addition to pre-emergence herbicide because of poor control given by pre-emergence herbicides owing to poor water level maintained at the time of herbicide application. Only 38 % farmers applied herbicide at recommended time (3 DAT) where as 58 % farmers applied late up to 7 DAT because of late emergence due to heavy puddling and to avoid stress to crop due to early application. Fourty two per cent applied various herbicides by mixing in sand where as 34 % farmers applied herbicides by mixing in DAP and only 20 % farmers applied by splash method by making holes in the lid of bottle or bottle supplied by pesticide dealers exclusively made for this purpose. Various brands of pretilachlor (44 %), butachlor (28 %) and anilofos (24%) were more popular among farmers. None of farmer used oxadiargyl although recommended by CCS HAU Hisar for effective weed control.

P-207 Resistence of *Echinochloa colona* against post-emergence application of azimsulfuron

C. Sangeetha, C. Chinnusamy, K. Kalaichelvi and P. Muthukrishnan
Department of Agronomy, T.N.A.U., Coimbatore (Tamil Nadu)
e-mail: chandrusan2007atgmail.com

Rice is one of the major crops in Tamil Nadu and also cultivated in large area. One of the major constraints in rice cultivation is weed infestation.The two important species *Echninochloa colonum* and *E. crusgalli* are predominant weeds in our state. Due to labour scarscity at the peak period of rice cultivation, application of herbicide is an alternative way to reduce the crop-weed competetion. But repeated application of the same herbicide would develop resistance to the specific weed. In this view, an experiment was conducted in completly randomised block design with three replication under controlled condition to study the resistance development of *Echinochloa* sp. and mortality percentage against azimsulfuron at various concentrations 30,35,40 GAH in predominant rice based cropping system. *Echinochloa* seeds were collected form 10 different locations of paddy field where azimsulfuron was applied for five seasons,It was applied on 3 to 4 leaf stage of *Echinochloa* plants as early post emergence (EPOE).

Phytotoxicity or drying symptoms were observed at weekly intervals. Reddening of stems and leaves, chlorosis and drying intensity was higher with increased dose (35 and 40 g/ha) of azimsulfuron than lower dose of 30 g/ha under pot culture condition. 100 % control of *Echinochloa* was observed at 21 DAT at 35 and 40 g/ha and there was no regeneration of dried seedling with azimsulfuron at all the tested doses. Based on weed density 35 and 40 g/ha had better control than lower dose of 30 g/ha. At 40 and 60 DAT, control was maximum to 93.6 and 100 per cent with post emergence application of azimsulfuron at 40 g/ha, which was followed by 35 g/ha. Based on the experiments conducted, it has revealed that there was no resistantance developed by *Echinochloa* plants against post-emergence application of azimsulfuron at 30, 35 and 40 g/ha. There was no regeneration of *Echinochloa* seeds observed at all the doses upto 60 DAT. The control and drying was higher with 35 and 40 g/ha than 30 g/ha and the drying percentage was higher at 14 and 21 DAT. This showed that *Echinochloa* has not developed any resistance to the post-emergence herbicide (azimsulfuron) under controlled condition.

P-208 Influence of weather environment on the biological control of *Parthenium* in non-cropped situation

C. Babu, C. Chinnusamy, N. K. Prabhakaran and P. Muthukrishnan
Department of Agronomy, T.N.A.U., Coimbatore (Tamil Nadu)
e-mail : agribabuatyahoo.com

Parthenium hysterophorus is an exotic weed accidently introduced in to India in 1955 through the imported food grains. It can be found abundantly on waste lands along the railway tracks, near bus stops and gradually creeps into crop lands. An area of 2 sq. km comprising non-cropped area was selected and bench mark survey was done. *Parthenium* infestations were assessed in terms of its density by sampling technique in one sq m area using quadrats. Ten spots each non-cropped areas were assessed for *Parthenium* infestation at pre-flowering stage and mean was worked out. Permanent peg marks were made to continuously monitor the population dynamics of *Parthenium* over a period of time. *Zygogramma biocolorata* is a potential natural enemy capable of suppressing *Parthenium*. The release of *Zygogramma* beetle was done 2 times in a year for easy multiplication and spread. *Zygogramma biocolorata* beetles were released three heavily *Parthenium* infested areas of Arasur, Vadavalli and Mathampalayam blocks of Coimbatore districts of western zone of Tamil Nadu. Adult beetles were released at 450, 400 and 500/m^2 per site in about 120m^2 areas in Arasur, Vadavalli and Mathampalayam blocks under non-crop situation.

Observations on number of eggs, larvae and adult beetles per plant were made at monthly intervals. Beetles were released during end of *kharif* season and there was better multiplication of beetles during September, October and November months (*rabi* season) during which period there was fair distribution of rainfall and relative humidity. From mid-November the beetles started evading from the infested blocks and sites. After a month of release, there were 20.2 to 34.5 eggs/ plant with 14.6 to 30.7 larvae and 16.4 to 28.1 adults/ plant in the three sites. *Parthenium* damage was in the range of 38.5 to 65.6 per cent during first month of observation with an average damage of 47.2 per cent. There was quite lot of variation in the beetle population in the bombarded sites. However, with higher *Parthenium* damage ranging from 49.8 to 79.4 per cent with an average of 67.9 per cent at second month after beetle release. Enhanced *Parthenium* damage was observed at 3rd month of observation with a damage range of 72.5 to 88.6 per cent with an average damage of 80.8 per cent based on biomass reduction in comparison with *Parthenium* from beetle free areas.

P-209 Phyto ecological survey of weeds in central dry zone of southern Karnataka

Ramulu, N. Ananda, K. S. Somashekar, K. P. Praveen, S. N. Anilkumar, T. C. Yogesh, H. A. Shanmukhappa and T. V. Ramachandra Prasad
University of Agricultural Sciences, MRS, Hebbal, Bengaluru (Karnataka)
e-mail : ram3415atgmail.com

Intensive survey of weeds was undertaken in Central day zone covering districts of Tumkur, Chitradurga and Davanagere during 2008-09 in the cropped, non cropped and garbage areas. Central dry zone receives an annual rainfall of 453 to 718 mm with sandy loam to clay loam soils. The major crops of the zone are paddy, maize, pigeon pea, banana and coconut.

The predominant weed species observed in major crops were *Parthenium hysterophorus, Echinochloa colona, Cynodon dactylon, Chloris barbata, Digitaria marginata, Oxalis corniculata, and Celosia argentia.* Major weeds in non-cropped areas were *Abutilon indicum*, *Ageratum conyzoides, Calotropis gigantea*, *Lagasca mollis* and *Parthenium hysterophorous. Whereas* in garbage area the dominant weeds were *Amaranthus spinosus*, *Cassia uniflora, Mimosa pudica, Parthenium hysterophorus* and *Solanum carolinense.* Among these weeds, the invasive naturalized weed *viz, Parthenium hysterophorous* was observed in cropped, non- cropped and garbage areas. Initially the weed was confined to roadside, railway tracks, wastelands, non- cropped and garbage areas, but now the weed is started colonizing in the cropped fields also. Whereas *Solanum carolinense* L., an invasive alien weed, was observed in garbage areas. This new alien weed is colonizing near garbage, road sides, village settlements with laborers' colony and around schools premises. The weed grows to a height of 30 to 75 cm with 8 to 10 branches and 3 to 20 fruits /plant .The flower are pink in colour. The weed is perennial and has deep root system. Another invasive weed *Cenchrus* sp. is observed in pigeonpea fields in Hiriyur taluk, Chitradurga district .

The weed grows to a height of 25 to 75 cm with 8 to 34 tillers/plant, 1 to 2 panicles/shoot, 4 to 9 cm panicle length and 17 to 45 seeds/panicle At densely populated weed infested places, number of plants/m^2 ranged from 1 to 11 plants. The weed resembles either *Cenchrus tribuloides* or *Cenchrus biflorus.* The weed appears to be seasonal and matures during November – December months after cessation of rains. The spines possessed on the seed unit caryopsis facilitate easy dispersal through human beings, animals and other materials. It is an opportune time to create awareness among villagers and public to locate further spread of the weed and necessary ways to contain the same in due course of time.

P-210 Weed flora of major crops in selected blocks of Burdwan district of West Bengal

P. Ankure and B. Duary
Institute of Agriculture, Visva-Bharati, Sriniketan (West Bengal)
e-mail : palashankureatgmail.com

An investigation was carried out on survey of weed flora of five major crops (rice, wheat, potato, rapeseed-mustard, and sesame) at two Community Development Blocks *viz.* Ausgram- I and Ausgram- II of Burdwan district of West Bengal of during pre-*kharif*, 2008, *kharif* 2008 and *rabi* 2008-09 using GPS. It revealed that there were in total 43 weed species belonging to 23 families of which 7 grasses, 5 sedges and 31 broadleaved. In the sesame field, 16 weed species were recorded out of which 4 were grasses, 2 sedges and 10 broadleaved. The most pre-dominant weed in sesame was *Digitaria sanguinalis* followed by *Cyperus rotundus, Euphorbia hirta* and *Cynodon dactylon*, *Echinochloa colona* and *Dactyloctenium aegyptium* both in Ausgram -I and Ausgram-II Block. In transplanted *kharif* rice 24 weed species were found out of which 6 were grasses, 4 sedges and 14 broadleaved. As per the value of importance value index (IVI) the most pre-dominant weed species in transplanted *Kharif* rice of Ausgram – I Blolck was *Commelina benghalensis,* followed by *Marsilea quadrifolia, Cyperus digitatus, Ludwigia parviflora* and *Fimbristylis miliacea* and in Ausgram – II, *Ludwigia parviflora* was the most pre-dominant followed by *C. digitatus, F. miliacea, C. benghalensis* and *E. colona*. Nineteen weed species were found in the wheat field of two blocks out of which 4 were grasses, 1 sedge and 14 broadleaved. In wheat field *Chenopodium album* was found to be the most predominant in Ausgram -I Block followed by *C. rotundus, Spilanthes acmella, C. dactylon* and *D. aegyptium*. In Ausgram- II, *Polygonum plebeium* was found to be the most predominant weed followed by *C. rotundus* and *C. album.* In potato of Ausgram - I and II Blocks 20 weed species were recorded out of which 4 were grasses, 1 sedge and 15 broadleaved. As per the value of IVI, *C. album* was the most pre-dominant weed in potato field of both the Blocks. The other major weeds were *P. plebeium, C. rotundus, D. aegyptium* and *S. acmella*. Rapeseed-mustard was infested with 20 weed species out of which 4 were grasses, 1 sedge and 15 broadleaved. In rapeseed-mustard, *C. album* and *C. rotundus* was the most predominant weed in Ausgram - I and Ausgram - II respectively. As per the value of IVI, the other major weeds were *P. plebeium, S. acmella* and *D. aegyptium* in both the Blocks under study. *Parthenium hysterophorus*, mainly an alien invasive weed of non-cropped area of West Bengal, was also found to appear in wheat, potato, rapeseed-mustard and sesame field of the Ausgram-I and Ausgram - II Block of Burdwan district.

P-211 Prioritization of weed management research in last three decade: a documentation based review

Madhav Pandey, A. P. Singh and U. K. Watti
Indira Gandhi Krishi Vishwavidyalya, Raipur (C.G.)
e-mail : mpandey_ig632002atyahoo.co.in

In agriculture, the review of documentation related with agronomy is an important way to understand its past and accordingly decide the future to increase the crop productivity for ever increasing animal and human population on sustainable basis. Research prioritization in different weed management studies is also an important issue in the current agronomical scenario in the field of agriculture, which can only be achieved through critical review of ratio of documentation between various we P-124 weed survey in Raigarh district of Chhattisgarh.

P-212 Survey of adoption level of chemical weed control technology in wheat crop at farmers' field

P. K. Singh and Jay G. Varshney
Directorate of Weed Science Research, Adhartal, Jabalpur (M.P.)
e-mail : drsinghpkatgmail.com

With the introduction of higher yielding varieties of wheat responsive to intensive irrigation and fertilizers application, wheat production increased from 12.5 MT during 1963-64 to 75 MT in 2007. However, there is wide gap between potential yield of wheat and yield obtained at farmer's field. Among the problem weeds, *Phalaris minor* and wild oat are serious weeds of wheat crop especially where wheat follows rice. Control of these weed through herbicide is more efficient than mechanical weeding and helps in improving the efficiency of applied nutrients and production of quality produce. Adoption of rice-wheat cropping system favoured. *P. minor* and *wild oat* growth and thus became a troublesome weed. At present large area of wheat is treated with herbicides to control these weeds in wheat crop. Keeping in view the above facts, the study was conducted to find out the present status of adoption of chemical weed control technologies, stages of non- adoption of this practice, constraints and suggestions of farmers for bringing further improvements in it. On the basis of the interview with 147 farmers, it was recorded that 87% had not fully adopted this practice in wheat crop. Half of the respondents had not adopted it at the knowledge stage. The reasons for non-adoption of this practice were lack of knowledge (42%) and lack of guidance (24%). About 65% of farmers suggested that extension system should publicise the method of chemical use and highlight its instructions through mass media in advance. It was also found that major factor responsible for non-adoption of this practice was due to ignorance (50%), followed by inappropriateness (32%), inability (9%) and unwillingness (9%). The lack of knowledge of details of recommendation was probably the cause of using lower dose, improper spray and choice of wrong herbicides.

P-213 Major weed flora in Gadag district of Karnataka–a case study

R. Nayak, R. Babu, B. N. Arvind Kumar, R. N. Bhat, M. B. Puradal and G. Sajjanar
NIWS, DWSR Centre, MARS, UAS, Dharwad (Karanataka)
e-mail : rameshbabu.niwsatgmail.com

An extensive survey work was carried out during *kharif* season (June – September 2009) under National Invasive Weed Surveillance Programme, DWSR Centre, UAS, Dharwad in order to assess the dominant weed flora of Gadag district of Karnataka. Weed flora was studied in a quadrat of 1 sq m. Ten random spots each in cropped, non-cropped and garbage areas of different villages/blocks in Gadag district. The data was analyzed for relative weed density, relative frequency and relative dominance and Importance Value Index (IVI) was obtained. The IVI values revealed that *Cynodon dactylon* was the dominant weed in cropped (36.95), non-cropped (29.44) and garbage (64.97) areas. The other dominant weeds in cropped area were *Digera muricata* (26.49), *Commelina benghalensis* (25.96), *Euphorbia hirta* (20.08) and *Parthenium hysterophorus* (18.11); In non-cropped area, *Cassia ceresea* (27.78), *Parthenium hysterophorus* (19.76), *Commelina benghalensis* (18.76) and *Croton sparsiflorus* (14.78) were the dominat weeds. In garbage area, *Parthenium hysterophorus* (63.22), *Amaranthus viridis* (44.53), *Datura metal* (27.43) and *Tribulus terrestris* (13.5) were the other dominant weeds. The occurance of *Cynodon dactylon* is rampant in Gadag district which results in the decline of yields in different crops of the district. Therefore timely control of this weed through integrated weed control measures can increase crop productivity.

P-214 Weed survey in Raigarh district of Chhattisgarh

Vivek Tripathi, S. Malaiya, Shweta Gupta, Nirmodh Prabha and A. P. Singh
Department of Agronom, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.)
e-mail : apalsinghatyahoo.com

In Raigarh district, a total 41 villages of 2 blocks were surveyed during *kharif*, 2009. A total number of weed species were identified during the survey in rice fields of Raigarh district. The main crop in the area during *kharif* was rice, vegetables and Black gram. *Commelina benghalensis* registered with highest density, dominance, frequency, relative density, relative frequency, relative dominance and IVI among the 41 weed species. *Commelina benghalensis* registered with highest density (5.35), dominance (6.37), frequency (31.72), relative density (11.09), relative frequency (6.64), relative dominance (0.24) and IVI (17.97) among the 41 weed species. The order of IVI of other weed species was followed by *Cyperus iria* (12.94), *Amaranthus viridis* (9.75), *Cyanodon dactylon* (8.54) and *Chloris barbata* (8.51) in descending order but with differed order of other ecological parameters. A total number of 44 weed species were identified during the survey in non-cropped area of Raigarh district. *Cynodon dactylon* registered highest density/ m2 (7.7) frequency (54.48), relative density (11.36), relative frequency (9.56) and IVI (21.31) among the 44 weed species. Other weed species with higher IVI were *Commelina benghalensis* (13.25), *Achyranhes aspera* (12.48), *Digitaria sanguinalis* (11.76) and *Chloris barbata* (9.20), in descending order, but with differed order of other ecological parameters. A total number of 36 weed species were identified during the survey in garbage area of Raigarh district. *Cassia tora* registered with maximum density (4.97), frequency (37.93), relative density (8.82), relative frequency (6.28) and IVI (15.30). This trend of IVI was closely followed by *Xanthium strumarium* (12.05), *Cynodon dactylon* (11.78), *Chloris barbata* (10.27) and *Sesbania bispinosa* (8.98), in descending order, but with differed order for other ecological parameters.

P-215 Effect of different tillage and weed control practices on physico-chemical properties and organic carbon status of soil

Tapas Chowdhury, A. P. Singh, S. B. Gupta and S. S. Porte
Department of Agricultural Microbiology, IGKV, Raipur (C.G.)
e-mail: tapas_mbatrediffmail.com

Long term tillage practices and use of different weed control measures have certainly some effect on physico-chemical properties and organic carbon pool of the soil. So a study was conducted to find out the effect of different tillage systems and weed control practices on physico-chemical properties and organic carbon content in experimental field soil because nutrient cycling in soil is governed by the above properties of soil. Rice-wheat cropping system was rotated for four continuous years (2005-08) in research-cum-instructional farm of Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh and in the end of fourth year (*rabi*-2008-09) the present study was conducted. The experiment was conducted on wheat (*Triticum aestivum L.*) with test variety GW-273. The soil was inceptisol. Four types of tillage system were evaluated and put in main plots *viz* (1) conventional-conventional (ii) conventional -zero (iii) zero-conventional and (iv) zero-zero tillage system. Among weed control measures performance of hand weeding and recommended herbicidal application was tested and compared with a weedy check and put in sub plots. As recommended herbicides for wheat pendimethalin was sprayed in pre emergence and metsulfuron was sprayed in post emergence stage of the crop 1.0 kg and 2 gm/ha, respectively. The pre emergence and post emergence herbicides were applied at 3 and 20 days after sowing of the crop, respectively. The treatments were replicated thrice under split plot design. Soil from rhizosphere was collected at a depth of 7.5-15.0 cm and tested for pH, EC and percent organic carbon content. The result of the study envisaged that the soil pH was less affected by tillage systems and herbicide application. Highest electrical conductivity (EC) was measured under conventional- conventional system, which found significantly higher over zero-zero tillage system at 0 and 50DAS. Minimum EC was recorded under zero-zero tillage system. Significantly higher organic matter content was accumulated in rhizosphere soil under zero-zero tillage system in comparison to all other systems. s

P-216 Micro-metorological modification for the weed management in horticultural fields

Somnath Choudhury, R.S. Sidar, Amit Dixit and Sanjeev Malaiya
RMD College of Agriculture and Research Station, Ambikapur (C.G.)
e-mail : somu4ap@yahoo.com

Modification of the meteorological conditions of the pest microenvironment offers a real challenge. Agricultural meteorologists have made notable contributions to reduce weed population for some crops. Further joint research along this line can give significant increases to agricultural efficiency and public safety by reducing the need for chemical pesticides. Cultural control includes any practice that prevents the introduction of weeds or makes the environment less favorable for weed development and more favorable for desirable plants. Controlling weeds before they mature their seed will help prevent future weeds. Black plastic mulches are excellent for preventing weed germination. White plastic also works well as a mulch, but it does not have as much effect on weed control as black plastic because only crop will get the direct sunlight through the small hole in which the plant was transplanted and the weed doesn't germinate. White plastic allows light to penetrate, resulting in germination of weed seeds. Another option is the use of wavelength selective mulches. The wavelength selective mulches try to combine the benefits of both black and clear plastic mulch. The idea is that the wavelengths that warm the soil pass through the mulch but the wavelengths that allow plant growth are blocked by the mulch. These products fall in-between clear and black plastic in their soil warming properties. They will stop most weeds from growing but there a few weed species that will grow under them. These products are often green or brown in color.

P-217 Efficacy of pendimethalin and oxyflourfen in controlling weeds of onion (*Allium cepa* l.) nursery

Amit Dixit, D. K. Gupta, Somnath Choudhury and R. S. Sidar
RMD College of Agriculture and Research Station, Ambikapur (C.G.)
e-mail : somu4ap@yahoo.com

Onion (*Allium cepa* L.) occupies an important place as a commercial crop in India as well as world. Onion nursery production is handicapped by several factors and one of the most limiting is problem of weeds. The practice of application of farm yard manure (FYM) and frequent irrigation in nursery plots encourages the early establishment and luxuriant growth of weed, sometimes even before the germination of onion seed. Onion is a poor competitor of the weeds due to its inherent characters like spars foliage, non-branching habitat, shallow root system and slow initial growth. Uncontrolled weed growth reduces the bulb yield upto 40-80% depending upon the nature, intensity and duration of weed competition in field onion. Hand weeding, no doubt, is effective, but it is time consuming and uneconomical due to closer spacing and shallow root system of the crop. Moreover, due to non-availability of timely labour, weeds are not controlled at the proper stage of the crop results in production of unhealthy seedlings. Hence, the use of herbicides is one of the options left with the farmers to eliminate the crop weed competition at early growing stage of the crop. A field study was conducted at RMD College of Agriculture and Research Station, Ambikapur during 2008-09 and 2009-10 to evaluate the effect of different weed control treatments on germination, growth of onion seedlings and weed spectrum in onion nursery. All the treatments reduced weed growth significantly over the unweeded control except oxyfluorfen at 0.05 kg/ha. Pendimethalin at all the three levels significantly reduced weed population but adversely affected the germination of onion seedlings. The most adverse effect of pendimethalin was observed at 1.0 kg/ha. However, partial control of weed was observed in case of oxyflourfen. There was significant reduction in weight of 100 seedlings at all the oxyflourfen levels. So, pendimethalin at 0.5 kg/ha and oxyflourfen at 0.125 kg/ha can be used for better weed control and higher seedling production in onion nursery.

P-218 Bioefficacy and phytotoxicity of new herbicide Vesta (clodinafop propargyl 15 % + metsulfuron 1 % R.M.) for the control of complex weed flora in wheat and its residual effect on succeeding sorghum crop.

S. S. Punia, Dharambir Yadav, Samunder Singh and Yash Pal Malik
Department of Agronomy, CCS HAU, Hisar (Haryana)
e-mail : jagir@hau.ernet.in

Ready mix formulation of clodinafop +metsulfuron (Vesta) at 60 + 4 and 75 + 5 g/ha with 0.2% surfactant was very much effective in controlling *P.minor* provided 97-98% control of grassy and 80-100 % control of broadleaf weeds which was even higher than already recommended herbicides like clodinafop-propargyl and sulfosulfuron as shown by density, dry weight and per cent control of weeds. Singh *et. al* (2007) also reported excellent control of grassy as well as broadleaf weeds in wheat with the application of UPH 206 (Vesta) at 60+4 and 75+5 g/ha. However, the treatments of clodinafop+ metsulfuron at 60 +4 g/ha + surfactant at 0.2% and with out surfactant at 75+5 g/ha +surfactant at 0.2% were statistically at par and proved most effective. Excellent control of complex weed flora in wheat was observed with the tank mix application of clodinafop+ metsulfuron (15:1 ratio) at 60 g/ha (Punia *et al*., 2004). Maximum grain yield (4890 & 4894 kg/ha) was obtained with the use of UPH-206+S at 75+5 g/ha which were at par with weed free check and ready mixture of sulfosulfuron+metsulfuron and UPH 206 +S at 60+ 4 g/ha but significantly higher than clodinafop and sulfosulfuron. No carry over effect of this herbicide at any of doses tested was observed on succeeding sorghum crop.

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P-219 Management of *Orobanche aegyptiaca* in Indian mustard

S. S. Punia, Ashok Yadav, Dharambir Yadav and Samunder Singh
Department of agronomy, CCS HAU Hisar (Haryana)
e-mail - jagir@hau.ernet.in

In South Haryana, mustard crop grown in light texture loamy sand soils is heavily infested with root parasitic weed *Orobanche aegyptiaca* locally known as margoja or rukhri. Pre-emergence application of different herbicides along with hoeing tested earlier proved ineffective in minimizing the density of this weed. Keeping it in view, experiments were planned to study the effectiveness of neem cake, herbicidal seed treatment, varietal tolerance, sources of nutrient supply for the control of *Orobanche aegyptiaca* in mustard.

To study the bioefficacy of various chemical and cultural methods for the control of *Orobanche aegyptiaca* in mustard, different experiments were conducted in *rabi* 2004, 2005, 2006, 2007 and 2008 at the farm of Sh. Sat Pal Shoeran of village Obera Distt. Bhiwani situated at latitude of N 28 ^{o} 41' 07.1" and E 075 ^{o}45' 18.9''. 21 genotypes of mustard recommended for cultivation by HAU Hisar, PAU Ludhiana, RAU Bikaner and Pusa were tested for their tolerance against *Orobanche.* Experiments were conducted in fields heavily

infested with *Orobanche aegyptiaca* during previous years. Data on no. of Orobanche panicles emerged and percent control of this weed was collected after 70 and 120 days of sowing.

Pendimethalin alone or in combination with neem cake up to 400 kg/ha did not prove useful in minimizing population of *Orobanche aegyptiaca*. Seed coating of mustard seeds with sulfosulfuron/triasulfuron or meso+iodosulfuron at 1.0 ppm although provided good control of *Orobanche* up to 120 days after sowing but crop suppression was observed from the very initial stage resulting in poor yield. Although application of glyphosate 25 g/ha at 25 DAS, glyphosate 25 g/ha at 25 and 55 DAS along with 1% $(NH_4)_2So_4$ gave 85-90% control of this weed with out any crop suppression resulting in higher yield over other treatments. Glyphosate 50 g/ha at 25 DAS also provided effective control but with 30% crop suppression resulting in poor yield equal to untreated check. Response of neem cake was erratic. None of genotype including Durgamani as reported by NRCR&M, Bharatpur showed tolerance against this weed. Even Durgamani showed more infestation than other genotypes. Poultry manure, press mud of sugarcane, FYM, potassic fertilizers, soybean oil, CAN and Calcium Nitrate did not prove effective in inhibiting germination of *Orobanche aegyptiaca* in mustard. Post emergence application kerosene oil and paraquat caused toxicity to mustard crop. As infestation of this weed starts 15-20 days after sowing, so to inhibit its infestation, we should apply any control measure in the early stages of crop growth. Application of any treatment after its emergence at panicle initation (around 75 DAS) is of no use as damage starts from 30 days after planting in soil.

P-220 Survey of *kharif* weed flora in South Saurashtra zone of Gujarat

M. I. Meisuriya, R. B. Patel and B. D. Patel
DWSR-Anand Centre, B. A. College of Agriculture, AAU, Anand (Gujarat)
e-mail: mimeisuriya@yahoo.com

Weed survey work was carried out in South Saurashtra zone of Gujarat state during *kharif* 2008. This zone includes the districts namely Junagadh, Porbandar, Amreli and Bhavnagar. Major crops grown in this zone are groundnut, cotton, pearl millet, sesamum, onion and sugarcane. Survey revealed that groundnut crop was infested with 24 weed species in which dominant weed species having higher IVI values consisted of *Commelina benghalensis* (13.24), *Phyllanthus niruri* (11.03) and *Cyperus rotundus* (18.65). Total 27 weed species were associated with the cotton crop. The most dominant weed species in cotton having higher IVI values consisted of *Echinochloa crusgalli* (13.13), *Phyllanthus niruri* (13.57) and *Cyperus rotundus* (18.67). Twenty three weed species were found infesting the pearl millet crop in which *Eragrostis major, Digera arvensis* and *Cyperus rotundus* were found dominant having higher IVI values consisted of 15.58, 12.62 and 22.32, respectively. Among 24 species recorded in sesamum, Eragrostis *major, Commelina benghalensis* and *Digera arvensis* were found dominant having higher IVI values consisted of 15.49, 15.29 and 12.75. Onion crop was infested with 24 weed species and dominated by *Eragrostis major, Euphorbia hirta* and *Cyperus rotundus* with higher IVI values consisted of 18.54, 12.68 and 19.58, respectively. Total 25 weed species were associated with the sugarcane crop. The most dominant weed species having higher IVI values consisted of *Echinochloa crusgalli* (20.21), *Abutilon indicum* (12.83) and *Cyperus rotundus* (20.91) in sugarcane. Banana crop was infested with 25 weed species and dominated by *Eragrostis major, Physalis minima* and *Cyperus rotundus* with higher IVI values consisted of 21.66, 8.98 and 21.12, respectively.

P-221

Effect of pre-emergence weedicides on woil enzyme.

A. D. Kadlag, M. V. Nagmote and A. N. Deshpande
Department of Soil Science and Agril. Chemistry, MPKV, Rahuri (M.H.)
e-mail - ad_kadlag@rediffmail.com

The field experiment was carried out on groundnut in two successive years during summer on Sawargaon soil series of inceptisol in randomized block design with three replications. The fourteen treatment consist of graded levels of oxyflurofen at 0.5, 1.0 and 1.5 kg/ha, alachlor at 1.0, 2.0 and 4.0 kg/ha, pendimethalin at 0.75, 1.5 and 3.0 kg/ha, weedy check and control. The soil enzyme urease, acid phosphatase and dehydrogenase were assessed periodically at 20, 30, 60 DAS and at harvest. The application of oxyflurofen at 0.5 kg/ha and pendimethalin at 1.5 kg/ha did not adversely affected soil urease, acid phosphatase and dehydrogenase enzyme activity in summer groundnut. In recent years the use of agricultural chemicals such as insecticides, herbicides and fertilizers with the introduction of high yielding varieties are increased considerably. Weeds are means all around, they are successful competitors with crops for nutrient, water and solar energy. Weed problems varies with irrigated and rainfed situation and weed management technology is to be provided (Bhan, 1992). The nutrient supplying capacity of soil depends on bio chemical reactions which are catalyzed by enzymes. The enzyme activity in soil has been found to be affected by herbicide, in general three important enzymes *viz*. urease, acid phosphatase and dehydrogenase associated with the recycling of nitrogen and phosphorus. The field experiment was conducted on groundnut in two successive years during summer on Sawargaon soil series of inceptisol in randomized block design with three replications. The fourteen treatment consist of graded levels of oxyflurofen at 0.5, 1.0 and 2.0 kg/ha, alachlor at 1.0, 2.0 and 4.0 kg/ha, Fluchloralin at 0.75, 1.50 and 3.0 kg/ha, Pendimethalin at 0.75, 1.5 and 1.50 kg/ha), weedy cheek and control (weed free checks). The standard methods were used to asses the soil anzyme urease, acid phosphatase (Tabatabai and Bremner, 1972) and dehydrogenase (Casida *et al.* 1964).

The periodical soil urease, acid phosphatase and dehydrogenase enzyme activity were influenced by the different graded levels of pre emergence weedicides. It was reduced at 60 days after sowing over 20 and 30 DAS. The fluchloralin preemergence weedicide recorded the less enzyme activity at 20, 30 and 60 DAS. However, it was more in alachlor (Ramesh *et al.* 2000 & Nagaraja *et al.* 1998). Whereas, acid phosphatase acivity was found less in fluchloralin and more in pendimethalin (Frank and Malkomes, 1990 and Nagaraja *et al.* 1998). These results indicated that fluchloralin pre emergence weedicide has adverse effect on urease and acid phosphatase enzyme. The alachlor pre emergence weedicides did not should adverse effect on urease and pendimethalin on acid phosphatase soil enzyme than the other pre emergence weedicide. The soil dehydrogenase activity at 20, 30 and 60 DAS and at harvest were adversely affected by oxyflurofen at all the levels of application. It was followed by alachlor. The application of fluchloralin and pendimethalin recorded higher values of dehydrogenase activity. In general higher levels of oxyflurofen, alachlor, fluchloralin and pendimethalin decreased the soil enzyme activity.

The application oxyflurofen at 0.5 kg/ha, alachlor at 2.0 kg/ha, fluchloralin at 0.75 kg/ha and pendimethalin at 1.5 kg/ha did not adversely affected soil urease, acid phosphatase and dehydrogenase enzyme activity insummer groundnut grown on inceptisol.

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P-222 Integrated weed management in wheat (*Triticum aestivum* L.)

M. Hague, B. Kumar and S.Tyagi
Dept. of Agronomy, Rajendra Agricultural University, Sabour, Bhagalpur (Bihar)
e-mail : rpsharmaonline@yahoo.co.in

A field experiment was carried out at Bihar Agricultural College, farm, Sabour, Bhagalpur during winter season of 2007 and 2008 to find out the effect of integrated weed-management practices on weeds and yield of wheat. The treatments consisted of weedy check , hand weeding twice at 20 & 40 DAS, two inter cultivation at 20 & 40 DAS, One hand weeding at 20 DAS + 2,4D at 0.5 kg/ha at 35 DAS, One hand weeding at 20 DAS + Isoproturon at 1.0 kg/ha at 35 DAS, One hand weeding at 20 DAS + tank mixture of Isoproturon at 0.6 kg/ha + 2,4D at 0.4 kg/ha at 35 DAS, Sulfosulfuron at 25 g/ha at 35 DAS, Pendimethalin at 1.0 kg/ha, pre-emergence + Metasulfuron at 4 g/ha at 35 DAS and criss-cross sowing (20 cm x 20 cm). The major weed flora observed in the experimental plots included *Chenopodium album* L., *Convolvulus arvensis* L., *Anagallis arvensis* L., *Fumeria parviflora* Lam and *melilotus indica* L., among broad-leaf weeds; and *Phalaris minor* (L.) Retz., *Avena fatua* L., *Cynodon dactylon* (L.) Pers. and *Cyperus rotundus* L. among the narrow-leaf weeds. The composition of broad-leaved,grasses and sedges in weedy check plots was 48%, 30% and 22%, respectively.

All the weed control treatments proved effective in reducing the weed population and their dry weight significantly compared with weedy check. Higher number of weeds (35 no./m^2) and weed dry weight (140.86 g/m^2) were recorded in weedy check which was significantly more than all other weed control treatments, whereas the minimum weed population (53 no./m^2) and weed dry biomass (35 g/ m^2) were noted with hand weeding twice at 20 and 40 DAS followed by one hand weeding at 20 DAS along with the application of tank mixture of Isoproturon at 0.6 kg/ha and 2,4D at 0.4 kg/ha at 35 DAS. Weed control efficiency of different treatments varied from 38 to 75%. The highest weed control efficiency was found under hand weeding twice at 20 and 40 DAS followed by one hand weeding at 20 DAS + tank mixture of Isoproturon at 0.6 kg/ha + 2,4D at 0.4 kg/ha at 35 DAS.

Weed control treatments had significant effect on the yield attributes and grain yield of wheat. All the weed control treatments resulted in significantly higher number of effective tillers/m^2, number of grains/spike and 1000 grain weight and hence significantly higher grain and straw yields over the un-weeded control. Maximum grain and straw yields were recorded in hand weeded plots (two hand weeding at 20 & 40 DAS).

One hand weeding at 20 DAS in combination with tank mixture of Isoproturon at 0.6 kg/ha and 2,4D at 0.4 kg/ha 35 DAS was equally effective and exhibited the grain and straw yield at par with two hand weeding at 20 and 40 DAS.

P-223 Influence of organic farming packages on weed density and population

A. Y. Hugar, H. Chandrappa, H. M. Jayadeva, A. Sathish, T. H. Gowda and O. Kumara
Agricultural Research Station, Kathalagere,U.A.S.,Bangalore (Karnataka)
e-mail : ayhugar@yahoo.com

A field experiment was conducted on clay loam soil of ARS, Kathalagere (Karnataka) during 2005-06 to study the influence of different organic farming packages on weed density and population in maize-groundnut cropping sequence. The results revealed that among the different weed flora observed, the density of broad leaved weeds was highest (2 to 7 /0.25m^2).It was followed by grasses (3 to 5 /0.25m^2) and least was noticed in case of sedges (0 to 0.5/0.25m^2). Among the different organic farming packages tried least number of total weeds (7/0.25m^2) was recorded in the treatment where different sources of organics each equivalent to 1/3 of recommended N (FYM+vermi compost + neem cake) with bio fertilizers.

P-224

Effect of tillage and sowing management on weed dynamics, grain yield and conservation of resources in rice (*Oryza sativa*) wheat (*Triticum aestivum*) system

R. P. Sharma, K.R. Raman, S.K. Pathak and B. Kumar

Bihar Agricultural College, Rajendra Agricultural University, Sabour (Bihar)

e-mail : rpsharmaonline@yahoo.co.in

A field experiment was conducted for three consecutive years from 2006-07 to 08-09 at Bihar Agricultural College, Sabour, Bhagalpur to compare the performance of the conventional method, zero till drilling, strip till drilling and bed planting under varying rice sowing/ transplanting *viz*., direct sowing by zero till drill, direct seeding of sprouted seeds in puddled soil by drum seeder, manual transplanting and mechanical transplanting by transplanter in strip plot design with thee replications. The experimental soil was clay loam in texture, low in organic carbon 0.47%, available N 168 kg/ha, P 10.4 kg/ha and K 95.5kg/ha. The rice variety 'PHB-71' and wheat variety 'HD 2733' were fertilized with uniform dose of 100 kg N+ 40 kg P_2O_5 + 20 kg K_2O/ha and 120 kg N + 60 kg P_2O_5 + 40kg K_2O, respectively.

The weed flora in experimental plot of rice consisted of *Echinochloa crusigalli*, *Dactyloctanium aegyptium*, *Cynodon dactylon* and *Setaria glauca* among grassy weeds, *Cyperus rotundus* among sedges and *Phyllanthus niruri, Amaranthus viridis* and *Ipomoea reptans* among broad leaved weeds whereas, *Cyperus rotundus, Chenopodium album, Phalaris minor, Anagallis arvensis* and *Melilotus spp.* were predominant weeds during rabi season. The intensities of grasses, sedges and broad leaved weeds were found to be 37.5, 38.2 and 22.3 per cent, respectively in rice fields. Whereas corresponding figures during rabi season were 28.3, 24.4 and 50.6 per cent. Among all planting methods, weed population and dry weight were maximum (132.7/m^2 and 45.5 g/m^2) in direct sowing of rice by zero till drill. While in case of wheat, weed flora did not differ significantly, but weed population and dry weight were minimum in when wheat was sown by strip till drill (101.8/m^2 and 34.0 g/m^2).

Mechanical transplanting by transplanter provided significantly higher grain yield (6.34 t/ha), rice-equivalent yield (12.47 t/ha), net monetary return (Rs.55,652/ha) and benefit: cost ratio (1.57) than those obtained under zero till drill and drum seeder but remained at par with manual transplanting. In comparison to manual transplanting, zero till drill, drum seeder and use of transplanter saved 77.2%, 62.3% and 37.4% cost of sowing/transplanting and 79.1, 53.1and 32.8% energy, respectively. Direct seeding of rice by zero till drill required minimum specific energy (316 MJ/ha) and higher specific productivity (316.9 g/MJ). Sowing methods of wheat under different tillage practices revealed that the highest grain yield (4.34 t/ha), rice- equivalent yield (12.70 t/ha), net return (Rs.54, 102/ha) and B: C ratio (1.63) was realized by strip till drill, which was significantly superior to other methods except grain yield which remained at par with conventional method of wheat sowing. In comparison to conventional method, zero till drill, strip till drill and bed planter covered 0.42, 0.50 and 0.35 ha/ h area, saved about 91.1, 89.7 and 86.3% time, 75.0%, 40.6% and 23.0% cost of sowing, 71.8, 54.1 and 26.1 % energy, 11.0, 16.0 and 32 % water, 69.0, 74.0 and 58 % diesel. Sowing of wheat by strip till drill resulted in minimum specific energy (309MJ/q) and higher energy productivity (324 g/MJ).

P-225 Management of pulse residues in rice (*Oryza sativa*) wheat (*Triticum aestivum*) cropping system

R. P. Sharma, S. Tyagi, Sambhu Roy and S.S. Kumar
Department of Agronomy, RAU, Sabour, Bhagalpur (Bihar)
e-mail : rpsharmaonline@yahoo.co.in

A field experiment was conducted during 2006-07 and 2008-09 at Bihar Agricultural College Farm, Sabour, Bhagalpur to find out the effect of incorporation of legumes during summer season in continuous rice- whet cropping system. The soil of experimental plot was sandy loam having pH 8.1 and organic carbon 0.47%, available N 155 kg/ha, available P 11.6 kg/ha and available K101.3 kg/ha. The treatment comprised of six cropping systems *viz*; rice-wheat fallow, rice-wheat- dhaincha (*Sesbania aculeata*) as green manure (G.M.), rice–wheat–moong, rice-wheat- cowpea, rice-wheat- black gram and rice-wheat- cluster bean. The experiment was laid out in randomized block design with four replications. Rice cv. 'Sita', was harvested in last week of October, wheat cv. 'HD2733' was sown in 3rd week of November and harvested in 1st week of April and mungbean cv. 'SML 668', cowpea cv. 'Pusa Komal', blackgram cv. 'Naveen' and clusterbean cv. 'B.G. 1'were sown in 2nd fortnight of April under irrigated condition with recommended package of practices. After picking of mature pods of legumes during summer season, the whole plants were incorporated into the soil to serve as green manure crop. *Sesbania* cv. 'Local' was sown on 1st week of May and incorporated in soil after 50 days of growth at the same time as residues of legumes.

Growth and yield of rice following legumes improved compared with that after fallow, and were maximum after *Sesbania,* followed by mungbean and cowpea. Incorporation of *Sesbania* as well as whole biomass of mungbean and cowpea after picking of mature pods into the soil resulted in increase in rice yield to the tune of 0.48, 0.39 and 0.31 t/ha over rice crop grown without incorporation of legumes biomass in rice-wheat systems. Despite of higher rice yields, *Sesbania* green manuring resulted in lower rice-equivalent yield and net returns on par with fallow, while mungbean or cowpea, followed by rice and wheat were found to be the most profitable cropping systems. The highest rice-equivalent yield (15.10 t/ha) and net return (Rs. 58,871/ha) was obtained from rice-wheat mungbean, followed by rice-wheat-cowpea having corresponding figures 13.86 t/ha and Rs. 53,451/ha. Rice –wheat fallow had the lowest productivity (10.8 t/ha) and profitability (Rs.42,707/ha). Inclusion of legumes in rice-wheat system improved physical and biological properties of soil which also need to be accounted for greater adoption ensuring sustainable productivity.

It may be concluded that mungbean and cowpea in rice- wheat system and its incorporation after picking of mature pods proved most beneficial in terms of productivity as well as net returns in sustainability of rice- wheat production system.

P-226 Weed flora as influenced by different light irrigated cropping sequences

A. Y. Hugar, A. Sathish, H. Chandrappa, H. M. Jayadeva, C. Malleshappa and O. Kumara
Agricultural Research Station, Kathalagere,U.A.S.,Bangalore (Karnataka)
e-mail : ayhugar@yahoo.com

A field experiment was conducted on clay loam soils of ARS, Kathalagere (Karnataka) during 2005-06 under light irrigated conditions to study the weed density and population in different light irrigated crop sequences under Bhadra command area. In all the sequences tried, the density of sedges was found to be highest ranging from 3.38 to 15.38 per 0.25 m^2. It was followed by broad leaved weeds (4.13 to 10.27/0.25 m^2) and density of grasses was least (1.63 to 2.76/0.25 m^2). Overall observations in different sequences tried clearly indicated that the hybrid cotton- sunflower sequence recorded the maximum number of total weeds (26.65/ 0.25m^2) followed by sorghum-groundnut sequence (20.16/0.25m^2). Least number (15.28/0.25m^2) was noticed in maize-groundnut sequence.

P-227 Effect of selective post-emergence herbicides on yield and economics of soybean *Glycine max* (L.)

B. D. Patel, H. P. Khedkar, R. B. Patel, V. J. Patel and M. I. Meisuriya
DWSR-Anand Center, BACA, Anand Agricultural University, Anand (Gujarat)
e-mail:bdpatel62@yahoo.com

A field experiment was conducted during *kharif* 2008 at College Agronomy Farm, Agricultural University, Anand to test the bio-efficacy of selective post emergence herbicides on yield and economics of *kharif* soybean in a Randomized Block Design with four replications. Herbicides *viz*., imazethapyar (75 g/ha), imazethapyar (75 g/ha) + chlorimuron ethyl (8 g/ha), fenoxaprop-p-ethyl (75 g/ha), fenoxaprop-p-ethyl (75 g/ha) + chlorimuron ethyl (8 g/ha), quizalofop ethyl (75 g/ha) and quizalofop ethyl (75 g/ha) + chlorimuron ethyl (8 g/ha) were tested as post emergence. The soil of the experimental field was loamy sand in texture, low in available nitrogen (465kg/ha) high in available phosphorus (89.58 kg/ha) and medium in potassium (230.48 kg/ha) with slightly alkaline in reaction. Herbicides were sprayed with Knapsack sprayer using 500 liter of water/ha as post emergence.

Among the weed control treatments, significantly lower weed dry weight was recorded under interculturing *fb* hand weeding at 20 and 40 DAS which was at par with post emergence application of quizalofop ethyl 75 g/ ha *fb* hand weeding at 30 DAS, fenoxaprop-p-ethyl 75 g/ha *fb* hand weeding at 30 DAS, imazethapyar 75 g/ha *fb* hand weeding at 30 DAS and hand weeding at 20 and 40 DAS, respectively. More than 90 per cent Weed control efficiency was also recorded in these treatments. Interculturing *fb* hand weeding carried out at 20 and 40 DAS registered higher yield of seed (2251 kg/ha) and straw (3756 kg/ha) and harvest index (34.72 %) followed by hand weeding at 20 and 40 DAS, imazethapyar 75 g/ha *fb* hand weeding at 30 DAS and post emergence application of quizalofop ethyl 75 g/ ha *fb* hand weeding at 30 DAS. Weedy check recorded significantly the lowest yield of seed (856 kg/ha) and straw (1682 kg/ha). Moreover, cost benefit ratio was also recorded higher (1:3.67) under the interculturing + hand weeding carried out at 20 and 40 DAS. Post emergence application of imazethapyar or quizalofop ethyl or fenoxaprop-p-ethyl at 75 g/ha *fb* hand weeding at 30 DAS is equally effective to control weeds as compared to non chemical weed management practices.

P-228 Weed dynamics under zero tillage in wheat crop

B. R. Kamboj, S. S. Punia, Rajbir Garg and N.K. Goyal
Department of Agronomy, CCS HAU, Hisar (Haryana)
e-mail : jagir@hau.ernet.in

Rice-wheat cropping system is practiced over 11 million ha in the Indo- Gangetic Plains. The sustainability of this system is being questioned. Various resource conserving technologies have been identified to sustain the system. Zero tillage in wheat is a worthwhile technology. In order to study the feasibility and weed dynamics under zero tillage, an experiment was carried out from 2005-06 to 2008-09 at farmers field in district Yamunanagar of Haryana. Zero tillage was compared with convention tillage practiced by the farmers. The yield advantage to the extent of 5.6% was observed under zero tillage. The *Phalaris minor* is the most serious weed in wheat crop. Its population was significantly reduced under zero tillage. However, some shift towards broadleaf weeds was observed. But in the complex weed flora broad leaf weeds are easy to control.

The technology made significant impact in the district Yamunanagar. It has been successfully integrated by the farmers in their existing agro-ecological matrix. It has been adopted over 15000ha area in district Yamunanagar of Haryana.

P-229 Persistence of herbicides applied in mustard and okra on sandy loam soil

R. B. Patel, B. D. Patel and M. I. Meisuriya
DWSR Anand Centre, BACA, Anand Agricultural University, Anand (Gujarat)
e-mail : rbpatel33@yahoo.com

Herbicide differs in their persistence under different environmental conditions. Dinitroaniline herbicides applied with irrigation water can move in sub surface soil with irrigation water and showed residual effect on succeeding crops. Therefore, present investigation was carried out at DWSR Anand Centre, B. A. College of Agriculture, Anand Agricultural University, Anand to find out residual effect of dinitroaniline herbicides applied in mustard on succeeding summer pearl millet. The experiment consisted of six treatments of herbicides. Pendimethalin, trifluralin and fluchloralin herbicides were applied at 0.75 kg/ha as pre emergence alone and same herbicide applied again at 0.50 kg/ha at 45 DAS with irrigation water to control *orobanche* parasitic weed in mustard and compared with non - chemical weed management practices. After harvesting of mustard crop, summer pearl millet was sown by adopting recommended package of practices. In another study, herbicides *Viz*; alachlor, fluchloralin, trifluralin, pendimethalin, metolachlor and butachlor each applied at 1.0 kg/ha in okra as pre emergence and pre plant during *kharif*. After harvesting of okra crop, one row of each succeeding crops *viz*., sorghum, wheat, cucumber and mustard were sown in each plot in *Rabi* season at a spacing of 45 cm x 30 cm. All the recommended agronomic practices were adopted to raise succeeding *Rabi* crops. Results revealed that significantly the lowest germination, plant height and grain yield of succeeding pearl millet were recorded where pendimethalin applied at 0.75 kg/ha as pre-emergence and again applied at 0.50 kg/ha at 45 DAS with irrigation water for controlling *Orobanche* in mustard crop. Pendimethalin persisted upto 110 days in sandy loam soil in *Rabi* season and showed toxic effect on succeeding summer pearl millet crop. While, herbicides applied even at 1.00 kg/ha in okra did not persist.

P-230 Weed flora of cultivated fields of north Gujarat

R. B. Patel, J. G. Anjanapatel, R. H. Sodhaparmar, P. K. Patel and C. M. Patel
DWSR Anand Centre, BACA, Anand Agricultural University, Anand (Gujarat)
e-mail : rbpatel33@yahoo.com

A survey of weed flora of *kharif* crops in North Gujarat was conducted during 2008-09 in the districts of Gandhinagar, Ahmedabad, Sabarkantha, Mehsana, Patan and Banaskantha. Altogether 840 numbers of spots of Gandhinagar district each in cropped, non-cropped and garbage areas were surveyed covering 28 villages. Similarly, in the Ahmedabad district 900 numbers of spots were covered. In district of Sabarkantha 960 spots each in cropped, non-cropped and garbage areas were surveyed. Altogether 900 numbers of spots of Mehsana district each in cropped, non-cropped and garbage areas were surveyed covering 30 villages. In the Banaskantha district 930 numbers of spots were covered. In Patan district 870 spots each in cropped, non-cropped and garbage areas were surveyed.

Weed survey carried out in *kharif* revealed that a total of 26 species were found to infest *kharif* crop fields in North Gujarat, out of which eight were grassy, fifteen broad leaf weeds and three sedges. In Gandhinagar district, *Boerhavia repanda* and *Amaranthus viridis* were the most dominant weeds with a relative density of 33.2 and 32.8 no/m^2, respectively in *kharif* crops. In Sabarkantha district, *Amaranthus viridis* and *Cyperus rotundus* were the most dominant weeds. *Tridex procumbens* and *Spergula arvensis* were the dominant weeds in Ahmedabad district. *Eragrostis major* and *Digitaria sanguinalis* were the most dominant weeds with a relative density of 15.1 and 14.2 no/m^2, respectively in *kharif* crops in Mehsana district. In the Banaskantha district, *Amaranthus viridis* and *Cyperus rotundus* were the most dominant weeds. *Digitaria sanguinalis* and *Dactyloctenium aegyptium* were the most dominant weeds with a relative density of 4.2 and 3.6 no/m^2, respectively in *kharif* crops in Patan district. Weed intensity was more observed in the cropped area of Gandhinagar district due to more irrigated area as compared to other districts of North Gujarat.

P-231 Effect of herbicides applied with and without vermicompost on soil properties under chickpea

R. B. Patel, Bharat Meena, B. D. Patel and M. I. Meisuriya
DWSR Anand Centre, BACA, Anand Agricultural University, Anand (Gujarat)
e-mail : rbpatel33@yahoo.com

The field experiment was carried out at DWSR Anand Centre, B. A. College of Agriculture, Anand Agricultural University, Anand during *rabi* season of the year 2006-07 to find out effect of herbicides applied with and without vermicompost on physico-chemical properties of soil in chickpea. The experiment consisted of fifteen treatment combinations of weed management practices and vermicompost levels. Pendimethalin, trifluralin and fluchloralin herbicides were applied as pre-plant incorporation each at 1.0 kg/ha and compared with weed free (non-chemical) and weedy check. Vermicompost was applied at 0, 1.0 and 2.0 t/ha.

The findings of the present investigation indicated that Physico-chemical properties *viz*; bulk density, pH, available P_2O_5, available K_2O and micronutrients were not significantly influenced by application of herbicides and vermicompost, while NO_3-N content of soil was significantly influenced by herbicides at 30 and 60 DAS and at harvest. Nitrogen content of plant, seed and straw were significantly influenced by herbicidal treatments. Phosphorus uptake by seed and straw as well as total uptake by chickpea were significantly maximum recorded under application of vermicompost at 2.0 t/ha. Herbicidal treatment had no significant effect on potassium content but potassium uptake by seed, straw and total uptake by chickpea were significantly affected by weed management practices. Application of vermicompost at 2.0 t /ha recorded significantly the highest nitrogen content and phosphorus in chickpea plant at 30 DAS and in seed and straw at harvest. Application of vermicompost at 2.0 t/ha recorded significantly higher potassium content and uptake than control treatment and being at par with application of vermicompost at 1.0 t/ha. It can be concluded that application of pendimethalin at 1.0 kg/ha as pre plant incorporation or twice inter culturing and hand weeding at 20 and 40 days after sowing for weed management with application of vermicompost at 2.0 t/ha is recommended in chickpea for better yield and for improving soil physico-chemical properties.

P-232 Downward movement of pendimethalin and quizalofop in different soils using bioassay

B. T. Sheta and R. B. Patel
DWSR Anand Centre, BACA, Anand Agricultural University, Anand (Gujarat)
E-mail : btsheta@yahoo.co.in

Downward movement of pendimethalin and quizalofop were studied in laboratory at DWSR Centre, AAU, Anand during 2008-09 in *rabi* Season in laboratory. Clayey soil was collected from Vadodara district while Sandy loam soil was collected from the field of Weed Control Project. PVC columns (10cm internal diameter and 60cm long) were cut vertically into two pieces and joined together using adhesive tape. Muslin cloth was tide to one end of column to hold the soil. Ten columns were filled with different soils from bottom by gently taping the columns. Water was added from the top to pre condition the soil. Pendimethalin and quizalofop were applied at the recommended dose (0.5kg/ha and 50g/ha) and double the recommended dose (1.0 kg/ha and 100g/ha). A set of column was used without herbicide (control) for comparison. After 15 days of the treatments, columns were cut and open. Presence of herbicide in the soils at different depth was tested by bioassay technique. Oat (*Avena sativa*) seeds were sown in each column. Germination, root and shoot growth as well as dry matter of oat were recorded periodically. Movement of pendimethalin at both the doses restricted germination of oat up to 5cm in both the soils. In the case of quizalofop applied at 50g/ha influenced germination of oat up to 5 cm in both the soils and at higher level oat germination was restricted up to 10 cm in sandy loam soil and up to 5 cm in clayey soil. The clay content is an important factor that influenced downward movement of herbicides in soil.

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Weed management studies in spring sugarcane (*Saccharum officinarum* L.)

B. Kumar, S. Tyagi and M. Haque
Dept. of Agronomy, Bihar Agricultural College, Sabour, Bhagalpur (Bihar)
e-mail : rpsharmaonline@yahoo.co.in

A field experiment was conducted at new area Farm of Rajendra Agricultural University, Bihar, Pusa, Samastipur during 2000-01 and 2001-02 to study the effect of weed management practices on weed dynamics, cane yield, juice quality and profitability in spring sugarcane. Treatments included nine weed control practices *viz*., weedy check; three hoeing at monthly intervals at 35, 65 and 95 DAP; manual weeding twice at 35 and 55 DAP; Atrazine at 2.0 kg/ha (pre-em)+2,4-D at1.0 kg/ha (post-em) at 60 DAP; Metribuzin at 1.5 kg/ha (pre-em); Pendimethalin at 2.0 kg/ha (pre-em); Ametryn 80 WP at 2.0 kg/ha (pre-em); Metribuzin at 1.5 kg/ha (pre-em)+ 2,4-D at 1.0 kg/ha (post-em) and Glyphosate at 1.0 kg/ha as directed spray at 30 DAP. Soil of the experimental plot was sandy loam having pH 8.3, organic carbon 0.42%, available N, P and K 143.6, 20.5 and 119.5 kg/ha, respectively.

The experiment was laid out in randomized block design with three replications. Recommended fertilizer dose of 120:85:60 kg NPK /ha was applied. Total average rainfall received during the crop season was 1251.80 mm. Sugarcane variety COP 9206 was planted in furrows 75 cm spacing in third week of February during 2000-01 and harvested on third week of January during 2001-02, respectively. Results revealed that hand weeding and herbicides showed their effectiveness in controlling the weeds and increasing the cane yield of spring sugarcane. Weeds count and dry weight of weeds were found to be the lowest while weed control efficiency was recorded maximum in treatment getting hand weeding twice at 35 and 55 DAP. Among the herbicidal treatments, Metribuzin (pre-em) + 2, 4-D (post-em) and Atrazine (pre-em) +2, 4-D (post-em) also showed the similar trends as it was reported incase of hand weeding twice. Weedy check treatment (control) recorded significantly highest values of weeds count and weeds dry weight as well as lowest value of weed control efficiency. Cane yield was also recorded highest (68.43 t/ha) in treatment getting hand weeding twice at 35 and 55 DAP which was followed by metribuzin at 1.5 kg a.i./ha (Pre-em) + 2,4-D at 1 kg a.i./ha (Post-em) and atrazine at 2.0 kg/ha (Pre-em) + 2,4-D at 1.0 kg/ha (Post-em) at 60 DAP having the respective values of 64.79 and 66.93 t/ha. Among herbicides, Pendimethalin at 2.0 kg/ha (Pre-em) was least effective and produced cane yield (55.1 t/ha) and was not able to show its significant superiority over weedy check (46.73 t/ha). Weed control practices did not exert any significant effect on sucrose per cent in juice. The net return (Rs. 33,971/ha) was found to be maximum under hand weeding twice which was followed by chemical weeding systems with Atrazine (pre-em)+2,4-D (post-em) and Metribuzin (pre-em))+ 2,4-D (post-em) having their respective values of Rs. 33,927/ha and Rs. 32,764/ha.

Thus, it might be concluded that though hand weeding twice produced highest cane yield as well as net return, but the combination of herbicides had a definite dent which have proved to be more economical and suitable alternatives to manual weeding.

P-234 Crop-weed competition between direct seeded rice and *Echinochloa colona* as affected by nitrogen application

M. B. B. Prasad Babu
Directorate of Rice Research, Rajendranagar, Hyderabad (A.P.)
e-mail : mbbprasadbabu@gmail.com

Weed problems are critical in rainfed upland rice which is grown in an area of about 6 million hectares where rice is mostly direct seeded. The slow seedling establishment and growth of young rice seedlings are more susceptible to weed competition which could lead to yield losses of about 85%. Among different weeds, *Echinochloa* Sp. is the major one threatening the productivity of direct sown rice. Supply of nitrogen (N) can increase the ability of cereals to suppress weeds. Keeping this in view, field experiments were conducted during *kharif* season of 2006 and 2007 at Directorate of Weed Science Research (NRCWS), Jabalpur to study the effects of N supply on inter-specific competition between rice and *Echinochloa colona*. In microplots (1 m^2), six treatments comprising three species combinations (rice monoculture, weed monoculture, rice and weed mixture in equal proportions) and two levels of N supply (0 kg and 60 Kg N ha^{-1}) were replicated four times in a randomized block design. The soil of the experimental field was clay loam in texture, neutral (pH 7.5) in reaction with low organic carbon (0.65%) content and low available N (225 kg ha^{-1}). Observations on plant height, LAI, dry weight and N content were made at 20 day-interval till harvest of rice while chlorophyll measurements were made at 20 and 40 days after sowing. Observations on yield attributes were made at harvest. N supply significantly enhanced the plant height, LAI, dry weight, N uptake and chlorophyll content of both rice and weed at all the stages of crop growth. *E. colona* maintained a significantly higher plant height and LAI than rice, both with and without N supply. *E. colona* caused a higher biomass reduction of rice without N application (54%) as compared to 46% reduction with N supply. Chlorophyll content of rice (2.45 mg/g fresh wt.) was higher than that of *E. colona* (1.9 mg/g fresh wt.). Plant N content of both rice and the weed increased with the application of N, with the former maintaining a higher concentration at all growth stages. Crop biomass, grain yield and effective tillers m^{-2} increased with N application. The grain yield of rice increased by 90% with N application over control. The reduction in the grain yield due to competition by *E. colona* was lower at N60 (55%) than at N0 (60%). The relative grain yield of rice (0.41 at N0 and 0.45 at N60) was <1 indicating greater effect of inter-specific competition than intra-specific competition. The relative yields (grain yield and dry weight) of rice increased with N supply while the relative yield (dry weight) of *E. colona* (0.75 at N0 and 0.61 at N60) decreased which shows that rice becomes more competitive with N supply.

P-235 Evaluation of herbicides for weed control in direct seeded puddled rice

K. S. Mohan, K. N. Kalyana Murthy and Y. M. Ramesha
Dept. of Agronomy, College of Agriculture, UAS, GKVK, Bangalore (Karnataka)
e-mail : rameshaym@gmail.com

An investigation was carried out to evaluate the herbicides for weed control in direct seeded puddled rice at V.C. Farm, Zonal Agricultural Research Station, Mandya, Karnataka. Experiment consisted of 14 treatments and laid out in RCBD design replicated thrice. The treatments include four herbicides alone at different dosages and in combination *viz.,* anilophos- 20 % EC (0.4, 0.3 and 0.3+0.4 kg 2,4-D/ha), pendimethalin-30 % EC (1.0, 0.5 and 0.5+0.5 kg 2,4-D/ha), butachlor-50 % EC (1.5, 1.0 and 0.5+0.5 kg 2,4-D/ha) and pretilachlor-50 % EC (0.5, 0.4 and 0.3+0.4 kg 2,4-D/ha). The predominant weed flora observed in the experimental plots were *Echinochloa crusgalli, Leptochloa chinensi* and *Panicum repens* among the grasses and *Cyperus iria, Cyperus difformis and Fimbristillis miliace* among the sedges and *Eclipta alba, Marsilia quandrifolia, Centella asiatica and Manochoria vaginalis* among the dicot weeds. The results revealed that better weed control and higher grain yield of rice was obtained with pre-emergent application of butachlor at 1.0 kg/ha + safener (5334 kg/ha) followed by pretalachlor at 0.4 kg/ha + safener (5100 kg/ha) which were on par with hand weeding twice at 20+40 DAT (5562 kg/ha). The weed dry weights of these treatments were significantly low and registered very low phytotoxicity on rice plants as indicated by better plant stand. They also recorded higher plant height and low grain sterility. The weedy check plot has registered higher weed dry weight and lower grain yield (3452 kg/ha).

P-236 Effect of weed control methods on the performance of transplanted onion (*Alleum cepa* L.)

K.N. Kalyana Murthy, Y.M. Ramesha and K.S. Rajashekarappa
Department of Agronomy, College of Agriculture, UAS, GKVK, Bangalore (Karnataka)
e-mail : rameshaym@gmail.com

Onion is a very poor competitor with weeds on account of its inherent characteristic traits such as short stature, non-branching habit, sparse foliage, shallow root system and extremely slow growth in the initial stages, enabling quick and rapid growth of weeds. Therefore, an experiment was conducted to know the effect of weed control methods on the performance of the transplanted onion (*Alleum cepa* L.) at farmers field in Chikkaballapur Dist, Karnataka during *rabi* season for two years. The experiment consists of 16 treatments which include four herbicides alone (oxyfluorfen -23.57 EC, metolachlor-50% EC, Pendimethalin-30% EC and Butachlor-50%) and all herbicides in combination with hand weeding at 45 days after transplanting (DAT) and only physical methods (hand weeding) at different growth stages (15, 30 and 45 DAT) and composed with weed free and weedy check. The design used was RCBD replicated thrice. The variety of onion used in the experiment was Rose onion. The predominant weeds flora observation with the onion crop were *Ergrostis ciliensis, Dactyloctenium aegyptium, Dicantheium annulatum, Digitaria marginata, Galensoga parviflora, Cenebra didyma, Phyllantus niruri, Amaranthus viridis* and *Ageratum conyzoides*. Among the herbicidal treatments pre-emergent application of oxyfluorfen at 0.16 kg/ha recorded significantly higher bulbs yield (148.46 q/ha) which was on par with pendimethalin at 1.25 kg/ha (142.79 q/ha) and metolachlor at 1.25 kg/ha (140.93 q/ha). Further, pre-emergent application of oxyfluorfen at 0.09 kg/ha supplemented with one hand weeding at 45 DAT recorded significantly higher bulbs yield (159.73 q/ha) closely followed by pendimethalin at 0.75 kg ai/ha + one hand weeding at 45 DAT and metolachlor at 0.75 kg/ha + one hand weeding at 45 DAT. Manual weeding twice at 30 DAT+45 DAT recorded bulbs yield (145.83 q/ha) on par with herbicide treatments alone (oxyfluorfen, metolachlor and pendimethalin). Significantly lower bulbs yield was noticed with weedy check (40.81 q/ha).

P-237 Effect of weed competition on the performance of transplanted onion (*Alleum cepa* L.)

K.N. Kalyana Murthy, Y.M. Ramesha and K.S. Rajashekarappa
Department of Agronomy, College of Agriculture, UAS, GKVK, Bangalore (Karnataka)
e-mail : rameshaym@gmail.com

An experiment was conducted during *rabi* season at farmers field in Chikkaballapur Dist, Karnataka to know the effect of weed competition on the performance of transplanted onion (*Alleum cepa* L.). The experiment consisted of 12 treatments with different weed free and weedy periods. Experiment was laid out in RCBD with three replications. The variety of onion used in the experiment was Rose onion. The predominant weed flora noticed in the experimental plots were *Ergrostis ciliensis, Dactyloctenium aegyptium, Dicantheium annulatum, Digitaria marginata, Galensoga parviflora, Cenebra didyma, Phyllantus niruri, Amaranthus viridis* and *Ageratum conyzoides*. The bulb yield increased with increase in weed free periods. Higher bulb yield was obtained by incresing weed free situation upto 45 days after transplanting (DAT) (165.5 q ha^{-1}) and further, increase in weed free condition did not significantly increase the yield. Delay in weeding beyond 30 DAT resulted in reduced yield. Weedy condition for the first 15 DAT caused no significant reduction in yield. Thus, the critical period of crop weed competition works out to be between 20-45 DAT. The reduction in bulb yield due to crop weed completion was 75.5 per cent. Further, weed free period upto 45 DAT resulted in maximum bulb diameter (5.29 cm).

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Bio effectiveness of Anilofos 30% EC granules against grasses and non grasses in transplanted rice

Rohitashav Singh, Prem Kumar, Radhey Shyam and V.K. Singh
Dept. of Agronomy, GBPUA&T,Pantnagar, Udham Singh Nagar (Uttarakhand)
e-mail: rohitashsingh_agro@india.com

A field experiment was conducted during two consecutive season of *kharif* 2006 and 2007 at GBPUA&T, Udham Singh Nagar "to find out the weed control efficacy of anilofos 30% granules against grassy and non-grassy weeds in transplanted rice". The soil of the experimental plot was silty loam in texture having available N (260.2 kg/ha), available P (29.8 kg/ha) and available K (176 kg/ha) with pH 7.3. The treatment consisting of three application rates of (0.3, 0.45 and 0.6 kg/ha) of anilofos 30% granules with and without emulsifier, anilofos EC at 0.30 and 0.45 kg/ha, weed free and weedy check. The experiment with ten treatments was laid out in randomized block design with three replications. Anilofos 30% granules with and without emulsifiers were broadcasted in the field having 3-4 cm standing water after mixing with 25 kg dry sand per hactare. EC formulation of anilofos was applied as spray using 500 litres of water /ha. Different formulations of anilofos were applied 3 days after transplanting of rice seedlings. Rice variety "Narendra 359" were transplanted at a spacing of 20cm x 15cm on July15, 2006 and July 11, 2007.

Echinochloa colona, E. crus-galli, Ischaemum rugosum, Ammania baccifera, Cyperus iria, and *Caesulia axillaries* were the major weeds in the experimental field. Other weed species associated were *Commelina benghalensis, Eclipta alba, Fimbristylus miliaceae, leptochloa chinensis* and *Panicum spp.*

There was drastic reduction in the density and dry weight of weeds due to application of anilofos 30% granules with and without emulsifier and anilofos 30% EC formulation over unweeded control. Application of anilofos 30% granules with emulsifier was more effective than its formulation without emulsifier in reducing density and dry weight of weeds. Anilofos 30% granules with emulsifier and EC formulations at the same rates were almost equal from weed control point of view in transplanted rice. The density and dry weight of total weeds reduced significantly with the increase in the rates of application of anilofos 30% granules with and without emulsifier from 0.3 kg/ha to 0.45 kg/ha. Further increase in its dose had no significant effect on the reduction of weeds. Anilofos granules irrespective of emulsifier as well as EC formulation provided effective control of *E. colona, E. crus-galli, C. iria* and *I. rugosum.* Application of this herbicide also provided some relief from the infestation of *A. baccifera*.

All the weed control treatments produced grain yields of rice significantly more than weedy check. The highest grain yield of rice was obtained with weed free treatment thought it was at par with application of anilofos 30% granules with emulsifier at 0.45 or 0.6 kg/ha or anilofos 30% EC at 0.45 kg/ha .Anilofos granules with emulsifier being at par with anilofos EC formulations produced significantly more grain yield than anilofos granules without emulsifier at 0.3 and 0.45 kg/ha. Further increase in its rate had no positive effect on the grain yield of rice.

On the basis of two year experimentation it can be concluded that anilofos granules with emulsifier at 0.45 or 0.6 kg/ha was the best option for suppressing the weeds simultaneously increasing the grain yield of transplanted rice.

P-239 Bio-efficacy evaluation and dose standardization of Velpar K_4 60 WP for the control of weeds in sugarcane

Radhey Shyam and Rohitashav Singh
Dept. of Agronomy, GBPUA&T,Pantnagar Udham Singh Nagar (Uttarakhand)
e-mail: talk2radhey@india.com

A field experiment was conducted during 2006-07 and 2007-08 at Crop Research Center of G.B.P.U.A. &T., Pantnagar "to evaluate the bio-efficacy of Velpar K_4 60 WP for the control of sugarcane weeds". Experiment with nine treatments comprised three doses of velpar K_4 60 WP at 1000, 1200 and 1400 g/ha compared with hexazinone 75 DF, at 300 g /ha, diuron 80 WP at 1600 g /ha, atrazine at 2000 g/ha, along with three hoeings at 30, 60 and 90 days after planting of sugarcane crop (DAP), weed-free and weedy check and three replication was laid out in randomized block design. Velpar at different doses, hexazinone and diuron were applied at 2-4 leaf stage of weeds while, atrazine was applied just after first irrigation followed by hoeing. Herbicides were applied by using a Maruti Foot Sprayer fitted with flat fan nozzle as spray using 600 litres of water per hectare. The major weed flora in weedy-check were: *Cyperus rotundus*, *Echinochloa colona, Brachiaria mutica, Digitaria sanguinalis, Parthenium hysterophorus* and *Ipomoea spp.* during 2006-07; However, *Trianthema monogyna,* and *Caesulia axillaris* were emerged as major weeds instead of *D. sanguinali* and *P. hysterophorus* during 2007-08. The other weeds with very low density were *T. monogyna, Portulaca oleracea, Ellusine indica* and *Commelina benghalensis* during 2006-07, *C. benghalensis, Cleome viscose, Digera arvensis, D. sanguinalis, Eclipta alba* and *P. hysterophorus* during 2007-08.

All the weed control measures caused significant reduction in the density of total weeds over weedy check during both the years. The lowest density of total weeds was recorded with three hoeing executed at 30, 60 and 90 days after planting (DAP). Among the herbicidal treatments, atrazine at 2000 g/ha applied after first irrigation followed by hoeing proved most effective for the control of weeds in sugarcane crop during both the years which was followed by application of velpar at 1200 or 1400 g / ha at 2-4 leaf stage of weeds. Application of velpar at 1200 or 1400 g/ha at 2-4 leaf stage of weeds also effectively controlled the grassy weeds viz. *E. colona, B. mutica* and *D. sanguinalis* during 2006-07 and *E. colona* and *B. mutica* during 2007-08 as compared to other herbicides. This herbicide at these doses was found very effective for the control of broad leaved weeds viz. *Ipomoea spp*., *T. monogyna* and *C. axillaries*. Velpar at 1400 g/ha atrazine applied after first irrigation followed by hoeing and three hoeings caused complete control of *P. hyterophorus.* None of the herbicidal treatment was found effective for the control of *C. rotundus* except atrazine applied after first irrigation followed by hoeing. The lowest dry weight of all the categories of weeds viz. sedge, grasses and broad leaved weeds was recorded under three hoeings executed at 30, 60 and 90 DAP. Application of velpar at 1400 g/ha also recorded at par dry weight of grasses and broad leaved weeds with that of three hoeings. Among the herbicidal treatments, atrazine at 2000 g /ha applied after first irrigation followed by hoeing was found most effective for reducing the dry weight of sedge which was followed by application of velpar at 1400 or 1200 g/ha at 2-4 leaf stage of weeds. Velpar at 1400 g /ha applied at 2-4 leaf stage of weeds was found most effective for the reduction of dry weight of grasses and broad leaved weeds which was followed by velpar at 1200 g /ha and atrazine. Uncontrolled weeds in weedy plot caused 73.49 per cent reduction in cane yield when compared with weed free condition. The highest cane yield (94.3 t/ha) was recorded under weed free treatment which was closely followed by three hoeings at 30, 60 and 90 DAP. Among the herbicides, the highest cane yield was obtained with atrazine at 2000 g/ha applied after first irrigation fb hoeing. Application of velpar at 1200 g/ha recorded 59.7 t/ha cane yield, which was statistically at par with velpar at 1000 g/ha and Diuron but significantly higher than velpar at 1400 g/ha and Hexazinone.

On the basis of two years bio-efficacy study, it can be concluded that among the herbicides atrazine at 2000 g/ha applied after first irrigation followed by hoeing was found most effective for the control of weeds. Among different rates of velpar, velpar at 1200 g/ha could be the standard dose for post emergence application at 2-4 leaf stage of weeds in sugarcane crop to achieve effective control of both grassy as well as broad leaved weeds with higher cane yield.

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Efficacy of haloxyfop on grassy weeds and yield of soybean (*Glycine max* L.)

V. Pratap Singh, S. P. Singh, A. Kumar, Neeta Tripathi and R. C. Nainwal
Department of Agronomy, College of Agriculture, GBPUAT, Pantnagar (Uttarakhand)
e-mail : vpratapsingh@rediffmail.com

Weed infestation in soybean may reduce yield up to 77 per cent depending upon the intensity, nature, and the duration of weed competition (Tiwari and Kurchania, 1990). To avoid competition during the early growth stages, soybean field should be kept free from weeds for the first 30-40 days after sowing. Chhokar *et al*. (1995) reported that weed free maintenance up to 45 days after sowing resulted in 96 per cent increase in grain yield of soybean. During rainy season due to continuous rains, weed control operation is not completed at the right time. Under such circumstances use of herbicides has been found very effective. There are several pre plant and pre emergence herbicides commonly used for effective weed control in soybean. But, these are required to be used with in very short period of time after planting of soybean. Thus the present investigation was undertaken to evaluate the efficacy of a post emergence herbicide at different doses for the control of grassy weeds in soybean crop.

The experiment was laid out during the rainy season of 2007 and 2008 at Crop Research Centre, of G. B. Pant University of Agriculture & Technology, Pantnagar, in randomized block design consisting 8 treatments *viz*. haloxyfop (10 EC) with three doses 75, 100 and 125 g/ha, quizalofop (5EC) 50 g/ha, fenoxaprop (9.3 EC) 100 g/ha, two hand weedings (30 and 45 DAS), weedy and weed free with three replications. Soybean variety "PS 1241" was used for the experiment. All the herbicides were applied 21 days after sowing of the crop by Knapsack sprayer fitted with flat fan nozzle with a volume of 750 litre/ha of water. To evaluate the bio-efficacy of herbicide against grassy weeds, broad leaf weeds were removed at 20 days after sowing.

The most dominant grassy weed species found in weedy plot at different stages of crop growth were *Eleusine indica*, *Echinochloa colona* , *Digitaria sanguinalis*, *Dactylotenium aegyptium*, *Eragrostis japonica* and *Brachiaria* sp. All the weed control treatments gave significantly lower weed population and total weed dry matter accumulation over weedy check.

Among the herbicidal treatments, the lowest weed density of grasses was obtained with application of haloxyfop (10 EC) 125 g/ha except weed free plot which was at par with haloxyfop (10 EC) at 100 g/ha in both the years at 45 days stage of crop (Table-1). During first year the application of haloxyfop (10 EC) 125 g/ha was also found at par with quizalofop (5EC) 50 g/ha, however, during second year, significantly lower weed density was recorded with application of haloxyfop (10 EC) 125 g/ha. In general higher dry matter of weed was recorded during first year than second year might be due to higher weed population during first year. The highest weed dry matter was obtained with application of fenoxaprop (9.3EC) at 45 days stage during both the year. Application of haloxyfop (10 EC), 125 g/ha recorded the maximum weed control efficiency(WCE) 98.3 and 97.5 per cent in both the years of experimentation over all the herbicidal treatments at 45 days stage.

All the herbicide treated plot produced significantly higher grain yield than the control plot. The highest grain yield was obtained with application of haloxyfop (10 EC) 100g/ha which was found statistically similar to weed free treatment during both the years (Table-1). Based on two years studies, it may be concluded that haloxyfop (10 EC) 100 g/ha is most effective against grassy weeds when applied as post emergence .

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P-241 Pre-emergence herbicide pendimethalin residue in cotton cultivated soil

K. Nalini, P. Muthukrishan, C. Chinnusamy and P. Janaki
DWSRC, Dept. of Agronomy, TNAU, Coimbatore (Tamil Nadu)
e-mail: naliniagr@gmail.com

Cotton "the white gold' is highly susceptible to weed infestation during the initial period due to its slow growing nature. Cotton hybrids are cultivated at wider plant spacing and heavy fertilized, which in turn invites multiple weed species infestation. Due to increased scarcity for labourers, manual weeding is not economical even if it has higher weed control efficiency. Thus we rely on herbicides to manage weeds efficiently. Cotton with minimal weed competition during the initial phase would yield better. Thus there is need for selection of new molecules of pre - emergence to control weeds during initial crop period.

Field experiment was conducted during winter season of 2008-09 with cotton variety MCU-13 TNAU, Coimbatore. TNAU, Coimbatore -3 to evaluate the persistence behavior of new formulation Pendimethalin 38.7% EC in the soil. The treatments include T_1 - Pendimethalin 38.7% at 1.5 kg/ha, T_2 - Pendimethalin 38.7% at2.0 kg/ha, T_3 - Pendimethalin 38.7% at 2.5 kg/ha and T_4 - Pendimethalin 38.7% at4.0 kg/ha and it is compared with T_5 -Pendimethalin 30% EC at 1.0 kg/ha. Soil (0-15cm depth) from treated plots was collected at 0 (3 hrs after herbicide application), 10, 20, 30, 45 and 60 days after application of herbicide and after the harvest of the crop.

The residue of Pendimethalin was extracted from the sample with methanol and the extract was filtered and evaporated at 60^{O}C to about 10 ml. The concentrated extract was transferred to separatory funnel and 30 ml of 5% aqueous NaCl was added. The contents were partitioned with n-hexane passed through anhydrous sodium sulfate. Hexane layer was concentrated on rotary vacuum evaporator at 60^{o}C to approximately 5 ml and quantified by Gas Chromatograph (GC-Chemito Model 8610) equipped with ^{63}Ni electron capture detector. The operating conditions were column 190 to 195^{0}C with initial temperature hold for 2^{0}C, rampat 1^{0}C/mi, , Injector : 240^{0}C, Detector. 260^{0}C, Carrier gas (N_2) flow rate, 40 ml min^{-1} with run time of 15 minutes. The detection limit for pendimethalin was 0.001 mg/kg. Retention time: 4.8 min. Average pendimethalin recovery from soil was 82%.

The highest concentration of Pendimethalin was determined in soil from plots which received 4.0 kg/ha (T_4)and it was lower in Pendimethalin 38.7% EC applied at 1.5 kg/ha (T_1). Fifty per cent of applied herbicide was degraded from the soil before 30 days after application. Calculated average half life for the Pendimethalin 38.7% and 30 % EC was 25 and 11 days respectively. Pendimethalin in soil decreased with time and at harvest the residue were below the detectable level.

P-242 Survey and quantification of quarantine invasive weed *Solanum Carolinense* L. in different ecosystems of Tamil Nadu.

P. Ayyadurai, C. Chinnusamy, K. Govindarajan and P. Muthukrishnan
DWSRC, Dept. of Agronomy, TNAU, Coimbatore (Tamil Nadu)
e-mail: ayyaagridurai@yahoo.co.in.

A survey of weed flora in different ecosystem (cropped, non-cropped and garbage areas) in *kharif* and *rabi* season (2009 – 10) was conducted in 8 districts *viz*. Coimbatore, Namakkal, Trichy, Dindugal, Krishnagiri, Salem, Karur and Ariyalur district of Tamil Nadu, during survey total invasive weed species were recorded in study area to enhance preparedness to exotic weeds invasion. Result revealed, that Parthenium hysterophrous was dominant weed in all 8 districts in different ecosystem of *kharif* season.

The invasive weed of, *Solanum Carolinense* L. has been observed in 44 places of different survey spot in three districts *viz*., Salem, Krishnagiri and Dindugul during *kharif* season 2009. in salem district about 13 *Solanum Carolinense* was identified in Pedanaickkenpalayam and Omalur block. In kaveripattinam block of krishnagiri district 11 *Solanum Carolinense* has been found. Kodaikanal and Pethampampatti block of Dindugul district consisted of about 20 *Solanum Carolinense* weeds.The observed features of this plant are described below, Plants are one meter tall armed, with small spines. The stem of the plant is erect and posses the stellate hairs. Hairs were greenish to purple in color. Leaves were typically lance-ovate in outline, often lobed with spines on midrib and veins and arranged in alternate manner, regarding the inflorescence, it was auxiliary racemes some are branching and have the compact flower. Flower is five lobed and corolla was white to lilac or purple in colour. Flower has stellate pubescence externally and glabrous internally. It contains five numbers of stamens filaments which are yellowish green in colour. Style of the flower is glabrous and greenish in colour. Stigma is dark in colour ovary was superior, glandular, pubescent and whitish in colour. Calyx is deeply lobed in five numbers and calyx tube is purple green in colour. Fruit is yellowish in colour and globular. Immature fruit is green in colour and turn orange at the time of maturity. Fruit is a single berry contains 40 to 120 seeds. Seeds are flattened, roundest with a peak yellowish to orange brown.

A mature fruit of *Solanum Carolinense* berry reproduce about 40 to 120 seeds. This results in increased population in the garbage area. The semi hard wood stem and the farmers unable eradicate easily.

P-243 Weed density and yield of zero-till cotton (*Gossypium hirsutum* L.) as influenced by crtical period of crop-weed competition

P. Ayyadurai and R. Poonguzhalan
SSI, DWSRC, Dept. of Agronomy, TNAU, Coimbatore (Tamil Nadu)
e-mail: ayyaagridurai@yahoo.co.in.

In India, cotton is grown in an area of nearly 8.82 million ha, with a production of 2.43 million tonnes and the lint productivity of cotton in India is 465 kg/ha. Cotton is grown under varied environments and seasons. In Tamil Nadu, the zone of summer rice-fallow cotton is confined to the delta districts of Thanjavur, Thiruchirapalli, Villupuram and Vellore. Rice-fallow cotton cultivation is a unique system of cultivation, wherein the cotton seeds are dibbled amidst the rice stubbles without tilling the soil to effectively utilize the residual soil moisture. Thus, in this system, cotton faces a severe competition from the early emerging weeds and weeds that are already present in rice field at the time of harvest. The problem of weed menace in rice-fallow cotton would be aggravated if the previous rice were not weeded adequately. Field experiment was carried out to study the crop-weed competition in zero-till cotton at Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Karaikal during summer 2007. The dominant weed flora of the experimental field were *Echinochloa colonum* Link., *Leptochloa chinensis* (L.) Nees, *Cyperus rotundus* (L.), *Trianthema portulacastrum* (L.), *Rotala densiflora* Koehne., *Eclipta alba* and *Phyllanthus maderaspatensis*. The maximum density (575.3 m^{-2}) and dry matter production (3514 kg/ha) of weeds were observed in weedy upto harvest, throughout the crop growth period. The density and dry matter production by weeds increased with increase in the duration of weed infestation. In general, the density and dry weight of weeds increased upto 80 DAS and then declined. The density and dry weight of weeds decreased substantially with increase in the duration of weed free period. Keeping the field weed free for first 40 days reduced the weed density by 53 per cent and dry weight by 50 per cent. Weed competition during the first 20 days after sowing resulted in an average yield loss of 12.5 per cent which increased with full season competition. The seed cotton yield increased from 2058 kg/ha to 2676 kg/ha as the initial weed free period was increased from 40 to 60 DAS. Maintaining the field weed free upto 80 DAS resulted in the highest seed cotton yield and maximum profit. However, maintaining the field weed free beyond 80 DAS resulted in significantly lower yield due to lower boll setting percentage.

Weed infestation for first 20 DAS did not cause significant reduction in yield. The yield was statistically at par with the maximum yield when the weed free period last upto 59.5 days or more. Thus, the critical period of weed competition in rice fallow cotton was found to be between 20 and 60 DAS.

P-244 Problematic and invasive weed flora in different eco system in Dindugul district, Tamil Nadu

S. Dhanasekaran, C. Chinnusamy, K. Govindarajan and P. Muthukrishnan
DWSRC, Dept. of Agronomy, Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu)
e-mail:dhansagri@yahoo.co.in

Weed menace is major problem in the cropped and non-cropped eco systems. The weeds cause high yield losses to the farmers in India. The weeds that are causing damage are indigenous in nature. Weed species enter our country through import. Imported food grain was the major source of alien weed species. A survey programme was launched in Dindugul district to identify such alien weeds to covered 306 villages in 14 blocks of the district.

The invasive weeds identified in this region are *Parthenium hysterophorus, Solanum carolinense, Cenchrus tribuloides Cynoglossum officinale, Ambrosia trifida, Ageratum conyzoide, Lantana camera and Solanum elaeagnifolium.*

Ambrosia trifida is annual small shrub, 1 to 4 m height and it occurs in rain fall zone. It prefers moist soil with summer rain fall found in all type of soil and in disturbed habitats, river, villages, road sides, waste lands, and pond bund. *Cenchrus tribuloides* is annual grass with loosely tufted clump of tillers has node and internodes. It is grown lawns, fields, pasture lands, waste grounds, and purpose sandy and moist soil. *Cynoglossum officinale is* It is as erect biennial herbs of 1.3 m tall and very hardy plant often emit a masty odour. It is grown Pastures, road sides, forest edges cause, gravelly, sand sandy soils. *Solanum Carolinense* is perennial, shrubby erect plant. It grown in grain and vegetable fields, orchards pastures and nurseries. Also found on road side in waste land, river banks, and gardens in wide range of soil types. Thrive well in sandy or gravelly soil. *Solanum elaeagnifolium* is perennial, shrubby plant. It grown in road side waste land garbage area garden land grain cultivated fields. *Viola arvensis* is Annual weed grows up to 35cm, life span 125 days. Found in lawns, gardens and waste lands. *Ageratum conyzoide* is Shrubby it grown in road sides, garden land & cropped land. *Lantana camara* is annual weed shrubby plant road sides, forest area, garden land, garbage area. *Parthenium hysterophorus* is herb grown in cropped and non cropped, garbage area, road sides and waste land.

The problematic weeds identify in this region are *Trianthima portulacastrum, Euphorbia hirta, Tritax procumbens, Panicum repens, Cyperus rotundus, Lantana camara, Parthenium hysterophorus, Sida acuta, Cynodon dactylon* and *Gompherena documbens.*

The sample places consist of 10 each from cropped &Non Cropped area covering an area of one square meter/place. The sampling was done in 4 plots to cover one square meter the population of weeds is counted using quadrate method. The data is recorded and subjected to further analysis. During the survey programme, I will identify invasive weeds *Solanum carolinense*, *Lantana camara***,** *Ageratum conyzoide, parthenium hysterophorus, Solanum elaeagnifolium* at Dindugul district. *Solanum carolinense* was identified in Thoppampatti Block puliyampatti village and kodaikanal block adukkan, Thandikudi, Kumbaraiyur, Kamanur, Pachalur villages. The result reveals that high relative density broad leaved weeds *Euphorbia hirta* (6.22 %), Grasses *Panicum repens* (6.20 %), sedge *Cyperus rotundus* (29.52 %) in cropped area. Broad leaved weeds *Gompherena documbens* (7.84 %) followed by *Parthenium hysterophorus* (6.60 %), grass *cynodon dactylon* (7.68 %) and sedge *Cyperus rotundus* (22.34 %) in non cropped eco system.

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Identification of quarantine alien weeds in Salem district of Tamil Nadu

K. Elangovan, C. Chinnusamy, K. Govindarajan and P. Muthukrishnan
DWSRC, Department of Agronomy, TNAU, Coimbatore (Tamil Nadu)
e-mail : elango_agri.26k@rediffmail.com

Wheat is grown extensively and produced in large quantities in Central India. Due to the shortfall of the food grain production, Government of India has imported thousands of tones of food grains and the import usually was subjected to strict phytosanitary regulations. Due to the paucity of time and to meet the emergency situation, the phytosanitary measures were relaxed. Because of these relaxations alien weeds entered our country and have reached the agriculture fields via the public distribution system through which the imported food grains were distributed. So as to advise the farmers on the technical methodology to eradicate the alien weeds, National invasive weed surveillance (NIWS) Programme was launched. As part the NIWS, a survey was conducted to identify these weeds in Salem district. The survey programme has covered 385 villages in 20 blocks in cropped and non cropped eco system.

During the survey programe, an identified invasive weed *Solanum carolinense* was identified in Salem district. It was seen Therkkunadu, Melnadu,Keelnadu villages of Peddanaickenpalayam block and Sikkampatti village of Omalur block. The weed flora in the cropped area of the survey in Salem District is presented. The general weed flora constituted mainly of broad leaved weeds which was composed of more than twenty five species. Among them *Cleome viscosa* has recorded higher relative density (14.45 %) than other species. *Cynodon dactylon* has registered higher relative density (18.10 %) of grasses than other grasses weeds. *Cyperus rotundus* and *Cyperus difformis* were the two sedge weeds found in the survey area. Among the two sedge species relative density of *Cyperus rotundus* was higher (19.31 %).

In the non – cropped area, the relative density of weed was calculated and presented. The broad leaved weeds have registered higher relative density (58.18 %) followed by grasses (24.70 %). Number of broad leaved weed species was also higher. Among the broad leaved weeds, *Parthenium hysterophorus* (15.0 %) has registered higher relative density. In grasses, *Cynodon dactylon* (16.53 %) has recorded higher density. *Cyperus rotundus* and *Cyperus difformis* were the two sedges found in the survey area and between the two sedges the density of *Cyperus rotundus* has recorded higher relative density (16.53 %).

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Alien invasive weeds in different eco system of Krishnagiri district Tamil Nadu

E. Jegadeesan, C. Chinnusamy, K. Govindarajan and P. Muthukrishnan
DWSRC, Department of Agronomy, TNAU, Coimbatore (Tamil Nadu)
e-mail: e.jegadeesan @yahoo.com

Invasive weed species are non-indigenous that adversely affect the habitats and invade economically, environmentally or ecologically. NIWS project was programmed to identify, eradicate and advice technically about the invasive or alien weeds introduced to our country. Invasive weeds reported in our country are *Solanum carolinense, Cenchrus tribuloides, Cynoglossum officinale, Ambrosia trifidal* and *Viola arvensis*. Ten samples each from cropped and non cropped area covering an area of 1sqm per place were selected randomly for a village and weeds were observed and counted. In Krishnagiri district, 337 villages in 10 blocks have been surveyed. The invasive weeds *viz. Parthenium hysterophorus, Ageratum conyzoides, Solanum*

carolinense, Lantana camera, cyperus rotundus, Echinochloa colonum, Echinochloa crus-galli, panicum repens, sida acuta and Argimon mexicana were observed in both cropped and non cropped ecosystem. The effect of invasive weeds explained to the farmer of kaverippattinam village, krishnagiri district. Among these weeds, *Parthenium hysterophorus* recorded higher relative density of 16.26% and density of 29.51% in cropped eco- system.

Generally the weed flora in cropped area of Krishnagiri district was grouped under broad leaved weeds, sedges and grasses. Among the broad leaved weeds *Euphorbia hirta* was relatively higher (6.76 %) than other broad leaved weeds *Cyperus rotundus* and *Cyperus difformis* were the two sedges found in the survey area. Between the two sedges, the density of *Cyperus rotundus* was higher. The grasses weeds consisted of five of which *Cynodon dactylon* was selectively higher than all other weed species. In grasses, *Cynodon dactylon* has recorded higher density than other grasses. Among the sedges weed, *Cyperus rotundus* has recorded maximum percentage of relative density (22.36 %).

Solanum carolinense is a perennial, shrubby, erect weed It was found on road side waste land. Root tape root system deep spreading *rhizhomes*. Regeneration by seeds, roots, root cuttings. During the survey, an invasive weed species namely *Solanum carolinense* was identified in roadside at Kaveripattinam village of Kaveripattinam block, then next identify in Jagadab village inner side of Kaveripattinam block, Krishnagiri District *Solanum carolinense* belongs to Solanaceae family and native of Gulf states. It is a shrubby erect plant (0.85m height) observed with 18 numbers of fruits at ripening stage.

P-247 Survey and identification of alien invasive weed in Karur district, Tamil Nadu

M. Thiyagarajan, C. Chinnusamy, K. Govindarajan and P. Muthukrishnan
DWSRC, Department of Agronomy, TNAU, Coimbatore (Tamil Nadu)
e-mail: thiyaganagri@gmail.com

Invasive weed species like *Parthenium hysterophorus, Solanum elaeagnifolium, Cenchrus tribuloids* and *Viola arvensis,* have infested our form lands in bigway. They entered the country through the imported food grains. Plan quarantine (Regulation of import into India) order 2003, plays an important role in restricting the entry of alien weeds pests and disease. But the shortage in production of food grains during natural calamities like drought, floods, etc. Led to the relaxation of phytosanitary measures to boost the food grain imports. These imported food grains were the source of invasive weeds. This led to further reduction of food grain. This poses a serious challenge to the food security of our country.

This necessitates urgent action to identify and formulate suitable weed control technologies. The National Invasive weed Surveillance programme (NIWS) has been launched for this purpose. As part of NIWS programme, a survey has beenconducted on a continuous basis in Karur District covering 158 Villages in 8 community development blocks.

The sample was taken from 10 places each from cropped, Non cropped and garbage area. Each sample covers an area of one square meter per place. The sampling is done in 4 cropped, non cropped and garbage points to cover one square meter. The population of weed is counted using quadrate. The data is recorded and subjected to further analysis.

During the survey, *Parthenium hysterophorus* was identified to be the most invasive of all the alien weeds. It was observed in cropped, non cropped and garbage eco system. It had a higher relative density of 6.56 no/m^2 in cropped area, 10.13 % in non cropped area and 10.23% garbage eco system. This has clearly indicated its menace its menance which warrants quick and effective remedial measures.

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Seed coat hardness of ivy leaf morning glory (*Ipomoea hederacea* (L.) Jacq.) with reference to scarification, seed ageing and germination

D. K. Pandey
DWSR (I.C.A.R.), Maharajpur, Jabalpur (M.P.)
e-mail: daya-pandey@hotmail.com

Weed seed dormancy determines continuation of source of infestation and survival of the species in the environment. The ivy leaf morning glory (*Ipomoea hederacea* (L.) Jacq.) is an obnoxious weed of Convolvulaceae infesting Kharif crop fields over a wide agro-ecological niches competing with crops for resources. The hard coat status of the weed seeds with reference to scarification, seed ageing and germination does not seem to have been investigated. The seed coat hardness status of the weed with reference to ageing, scarification requirements and germination of the species occurring in the agroecosystems warrants to be investigated for i. determination of scarification requirements of the seeds for viability assessment, ii. understanding probable germination and infestation of the weed subsequent to seed formation, iii. likelihood of potential threat from the seeds trapped in microclimatic or ecological niches, and iv. germination of the seeds as a consequence of ageing for different durations to facilitate understanding and better management of the weed. Prompted by these considerations, the present investigation was undertaken to study the seed coat hardness of ivy leaf morning glory (*Ipomoea headraces* (L.) Jacq.) with reference to scarification, seed ageing and germination.

The seeds of ivy leaf morning glory were collected from the stands of the weed in and around the Directorate of Weed Science Research, Jabalpur, dried in the sun and stored hermetically in bottles. The seeds used in the experiments were collected in the years 2000, 2001, 2003, 2004, 2005, 2006, 2007, 2008 and 2009. The seeds were subjected to germination testing at 30°C for 16 days in the dark and final germination was recorded. The seeds which failed to germinate were considered to be either dormant or dead, subject to confirmation by retesting after scarification. The seeds which failed to show full germination were subjected to scarification by immersing in concentrated sulfuric acid for 10, 20, 30, 40, 60, 80, 100, 120, 140 and 160 minutes and washed with water to remove the last traces of the acid. The untreated and treated seeds were subjected to the germination testing and the final germination was counted. All the treatments and germination tests were repeated at least three times.

The results showed that freshly harvested seeds were mostly dormant and a few (about 5-10%) were able to germinate. The scarification for 80-160 minutes resulted in germination of almost all seeds. After about one year through 9 years the seeds showed good germination without scarification. The scarification for 20-60 minutes, however, improved germination in the seeds aged for 4-9 years. The degree of scarification required for overcoming the hard coat mediated dormancy varied irrespective of ageing of the seeds. There did not appear any significant loss of viability of the seeds during ageing for up to 9 years. The capability of the seeds to withstand scarification for so long is interesting and implicates possible role of the hard coat in preserving the seeds especially against mechanical, chemical and biological stresses.

The results showed that i. the seeds of ivy leaf morning glory can be tested by subjecting for germination as such and after scarification for 10-20 minutes for reliable assessment of viability, ii. the fresh seeds immediately after maturation are unlikely to cause heavy infestation of the weed due to hard coat imposed dormancy, iii. the seeds aged for a year or more had very high potential of infestation due cessation of the coat imposed dormancy, iii. the seeds trapped in microclimatic or ecological niches might pose potential threats of infestation for over 9 years, and iv. the seeds appear to have relatively low rate of seed ageing and predisposed loss of viability. These findings may have relevance to testing of the seeds for diverse purposes, weed infestation and its management strategies.

P-249 Efficiency evaluation of new formulation of Oxyfluorfen (23.5%ec) on weed control in tea (*Camellia sinensis)*

B. Jayakumar, A. Balakrishnan, C. Chinnusamy and P. Muthukrishnan
Department of Agronomy, TNAU, Coimbatore (Tamil Nadu)
e-mail: agrijayakumar@gmail.com

Camellia sinensis is an evergreen plant that grows mainly in tropical and sub-tropical climate. India was the top producer of tea for nearly a century, but was displaced by China as the top tea producer in the 21st century. Weeds can reduce the productivity of tea by 10 – 50 % depending on the intensity of weed growth, extent of competition, weed species and the competitive ability of cloning. Weeds complete with the crops for nutrient, sunshine and moisture, reducing the yield, weeds also produce adverse effects on restrict branching and frame development in young tea, serve as alternate host for some important pest of tea, reduce water flow in the drains. Grassy weeds reduce the productivity of tea by 21 %, while broad-leaved weeds accounts for 9-12 %. Weed management in tea plantations is a critically important operation, particularly during the early establishment and post-pruning phases. Weeds grow profusely from the time of tea planting until the tea canopy covers the inter-row spaces adequately. Furthermore, weeds disturb the major field operations. Adverse effects on newly planted tea with delayed weeding for more than 3 months during the planting. However, more weed interference with newly planted tea and weed control is needed.

Field experiment was conducted at TANTEA Research Farm, Coonoor during November 2009 in a Randomized Block Design to find out the efficiency evaluation of new formulation of oxyfluorfen (23.5% EC) on weed control in tea (*Camellia sinensis*). The different doses of oxyfluorfen are 150, 200, 250,300,400g ai/ha. From this various treatments no phytotoxic effect were found. Different doses of oxyfluorfen was sprayed, all the weed control treatments have a definite influence on weed dry weight, weed control efficiency and green leaf yield. Among the different weed control treatments pre-emergence application of oxyfluorfen at 300g ai/ha recorded lesser weed density and dry weight. The pre-emergence application of oxyfluorfen at 300g ai/ha recorded higher weed control efficiency than others. The highest green leaf yield was recorded with application of oxyfluorfen 300g/ha.

P-250 Alien invasive weed scotch broom (*Cytisus scoparius*) on tea gardens in terrains of Nilgiris district of Tamil Nadu

B. Jayakumar, C. Chinnusamy, A.Balakrishnan and P. Muthukrishnan
Department of Agronomy, TNAU, Coimbatore (Tamil Nadu)
e-mail: agrijayakumar@gmail.com

Cytisus scoparius (Linn) is a perennial, leguminous shrub has become a serious invasive in different parts of the world. It belongs to the family Leguminosae, native of western and central Europe commonly called as Scotch Broom. It grows to a height of 3-5 feet and produces numerous long, straight, slender bright green branches, tough and very flexible, smooth and prominently angled. The leaves are alternate, hairy when young the lower one shortly stalked, with three small, oblong leaflets, the upper ones, near the tips of the branches, sessile and small, often reduced to a single leaflets. It has generally no leaves, the green stems undertaking their duties instead. It grows in wet places it can develop three foliate leaves. The large bright yellow, papilionaceous, fragrant flowers bloom from April to July. The flowers have a great attraction for bees they contain no honey, but abundance of pollen. In the broom the stigma lies in the midst of the five anthers of the longer stamens. The style was horizontal with a flattened end below the stigma.

Scotch Broom is a prolific seed producer and seed bank species, and over half of its annually produced seeds remain viable. Seed production begins as early as two to three years. By the time the plant reaches maturity (about 3-8 years) it can produce 2000 to 3500 pods, encasing up to nine seeds per pod. During

drought conditions, seed production is less than wetter periods. Long-range dispersal of the Scotch Broom in the Nilgiris is carried out both by man and other natural vectors such as water and wind. Scotch Broom is extensively used as a frost cover for the plantation nurseries, vegetables and gardens. It is also used for fencing and as mulch by some organic tea planters. All this facilitates the transportation of seeds all over the upper Nilgiris. In the Nilgiris, seeds of Scotch Broom are also dispersed by Sambar (*Cervus unicolor*). Seed load in Sambar pellets was highest in May (30 seeds/100 pellets) almost no seed load was noted in September and October.

Broom is often sprayed with herbicide, but it has a large and persistent soil seed bank and is difficult to eradicate from a site. The manual/mechanical removal, and burning or disposal of plants is the most effective. Several broad spectrum herbicides can be used for this species in non-cropped terrains. Triclopyr, imazapyr, aminopyralid and glyphosate can be applied alone or in combination with 2,4-D. Livestock grazing as a control measure may be effective, although *C.scoparius* is slightly toxic and unpalatable to most livestock. Despite the damage caused by the seed weevil (*Apion fuscirostre*) to as much as 60% of the seed at some sites, the weevil has only limited impact on controlling the weed.

P-251 Effect of integrated weed management on pigeon pea productivity

M. B. Dhonde and C. B. Gaikwad.

Department of Agronomy, Mahatma Phule Krishi Vidyapeeth, Rahuri (M.H.)

e-mail :- cbgaikwad@indiatimes.com

Management of weeds is a challenging task in context to increased cost of cultivation reduced man power availability and increased concerned about soil and water conservation. Weed Management has become increasing reliant on herbicides for successful crop production. Weed management plays significant role in enhancing the crop yield. Control of weeds during *kharif* Season is becoming a serious problem due to scare labour coupled with high wages. Slow growth during initial stages favours luxuriant growth of weeds resulting in heavy yield losses. Weed compete with crop plants for moisture, nutrients, light and space. It is therefore, necessary to control weeds so as to obtain maximum yield and maximum water and fertilizer use efficiency. It is also necessary to develop cheaper method of weed control with herbicides alone or in combination with other mechanical methods. Integrated weed management helps in reducing the weed population without much adverse effect on the crop.

Pigeon pea is one of the most important pulse crop. It contains 23.3 per cent protein, 3.5 per cent minerals, 57.6 per cent carbohydrates and provides an energy of 335 Kcal 100/g (Anonymous, 1981.) The experiment was conducted with same crop in randomized block design with three replications during *kharif* season 2003. There were 9 treatment combinations comprises of mechanical, herbicidal, mechanical coupled with herbicide and a control treatment.

The results revealed that the values of all growth characters of pigeon pea variety BSMR-736 were significantly more in weed free treatment. This was followed by Pendimethalin PE at1.0 kg/ha plus hand weeding at 45 DAS. However, the values of growth attributes of pigeon pea in integrated weed management treatment viz., Pendimethalin PE at1.0 kg/ha plus hand weeding at 45 DAS were recorded as mean plant height was (178.05 cm), mean plant spread was (88.93 cm), mean number of branches were (14.20), dry matter per plant was (61.13g) at 120 days of crop growth. The increased value of these characters ultimately resulted in good yield of grain.

Among the integrated weed management treatment the maximum grain yield of pigeon pea was significantly more in Pendimethalin PE at1.0 kg/ha + hand weeding at 45 DAS (22.30 q/ha) it could be due to more weed competition for moisture, sunlight and plant nutrients. Obviously the grain yield showed better performance in IWM treatments due to less weed competition than weedy check.

Thus for effective control of weed and from economic point of view pre emergence application of Pendimethalin PE at1.0 kg/ha and one hand weeding at 45 DAS observed to be beneficial.

P-252 Bio-herbicidal potential of allelochemicals from tropical soda apple (*Solanum viarum* Dunal) fruit pulp on aquatic weeds

D. K. Pandey
Directorate of Weed Science Research (I.C.A.R.), Maharajpur, Jabalpur (M.P.)
e-mail: dkpandey54@yahoo.com

Herbicides have proved to be magic molecules facilitating crop production to feed ever increasing global population with depleting quantity and quality of the resources. Heavy environmental costs and development of herbicide resistance in weeds consequent upon use of the synthetic herbicides prompt search for the alternatives. Quest for newer bio-active molecules continues for pest including weed management. The molecules of biological origin are considered to be easily biodegradable, and hence, are unlikely to pose environmental pollution problems. We do not have choice of safer herbicides for the aquatic ecosystems. It is an established fact that phytotoxic allelochemicals chemistry may be used to develop newer herbicides. For example, phytotoxic substance 1, 8-cineole, a terpenoid, produced by plant has structural similarity with cinmethylin, a natural herbicide. Exploring phytotoxic compounds produced by plants for development of new herbicide is one of the priority areas in the present day eco-friendly pest management strategy. The present study was undertaken to investigate bioherbicidal potential of tropical soda apple (*Solanum viarum* Dunal) fruit pulp allelochemicals as such information is not available in the literature.

The tropical soda apple fruits were harvested from the stands of the weed from around Jabalur, washed, seeds removed and the fruit pulp dried in the shade, ground to about 80 mesh and stored in airtight containers until used. The fruit pulp powder was suspended in water at 1% (w/v) with intermittent stirring at ambient temperature 20-26°C for 24 hours. Subsequently, the solution was removed and spread over thin surface and dried at the ambient temperature. This was designated as allelochemical crude.

The allelochemical crude was suspended in water in triplicate at 0.01, 0.025, 0.05, 0.1, 0.25, 0.50, 0.75 and 1.0% (w/v). Water alone served as the control. Preweighed floating weeds viz., water hyacinth (*Eichhornia crassipes* Mart Solmns.), pistia (*Pistia stratiotes* L.), spirodella (*Spirodella polyrhiza* L.), lemna (*Lemna pausicostata* Hegelm.) and azolla (*Azolla nilotica* Decne) and submerged weeds viz., hydrilla (*Hydrilla verticillata* L. f. Royle), ceratophylum (*Ceratophyllum demersum* L.), potamogeton (*Potamogeton crispu*s L.) and green musk chara (*Chara zeylanica* Willd.) were loaded into the suspensions and incubated outdoors. Evapotranspiratory loss of water was replenished twice daily. The toxicity symptoms were monitored and biomass was recorded 5, 10 and 15 days after initiation of the treatments.

The results revealed that the allelochemical crude was inhibitory to water hyacinth at 0.5-0.75% and lethal at 1%. The allelochemical crude inhibited pistia at 0.25-1.0% and was not killed even at the highest concentration. The spirodella was inhibited at 0.5-1% and not killed up to 1%. The azolla was killed at and above 0.5%. The submerged weeds hydrilla, ceratophylum, potamogeton and green musk chara were killed at and above 0.5%. The allelochemical crude appears to be much more phytotoxic to the submerged weeds than to floating weeds. The toxicity symptoms on floating weeds were dull green appearance, progressive desiccation and necrosis from the margins starting from old leaves or fronds, and flaccid roots leading to death and decay of the plants in 5-15 days. The toxicity symptoms in submerged weeds were dull green appearance, loss of turgidity, bleaching and fragmentation followed by death and decay of the treated plants.

The allelochemical crude showed bioherbicidal potential to aquatic weeds, more so to the submerged weeds. The present investigation strongly supports necessity of further investigations on isolation of the active constituents and evaluation for use as a natural herbicide for aquatic ecosystems and / or taking a lead for development of new safer herbicides for the aquatic ecosystems.

P-253 Effect of different weed management methods on weed control and growth of sisal in primary nursery

Sitangshu Sarkar, Bijan Majumdar, A. R. Saha and S. K. Abdullah
Sisal Research Station, ICAR, PO: Bamra, Dist: Sambalpur (Orissa)
e-mail: sisal.india@gmail.com

A field experiment was conducted at Sisal Research Station (23.05° N, 84.23° E, and 256.03 m MSL), Bamra, Dist: Sambalpur, in 2009 to study the effects of different weed management methods on the weeds of Sisal (*Agave sisalana* Perrine ex Engelm., Family: Agavaceae) and their effect on the growth of sisal plants in primary nursery . Preemergence herbicide, Trifluralin (0.75 kg/ha) was applied in the soil as pre-plant soil incorporation 3 days before planting (DBP) of sisal bulbils; whereas, other pre-emergence herbicides namely metolachlor (0.50 kg/ha) and Pretilachlor (0.05 kg/ha) were applied 1 DBP. Quizalofop ethyl (0.050 kg/ha) was applied two times at 3 and 5 WAP. The 1st and the 2nd hand weeding were done at 3 and 5 weeks after planting (WAP). At 2 WAP, the highest weed control efficiency (WCE) was recorded with metolachlor (90.12%), followed by Pretilachlor (62.5%) and Trifluralin (46.25%). At 5 WAP, the lowest weed dry weight was recorded with hand weeding (5.35 to 8.43 g/m^2), followed by S-Metolachlor (9.86 g/m2). The WCE was also followed the same trend and the highest WCE was 89-93% in case of hand weeding followed by S-Metolachlor (87.13%). However, at 7 WAP, only two hand weeding proved effective which produced the lowest weed dry weight (7.43 g/m2), followed by one hand weeding (62.01 g/m2) and metolachlor (64.59 g/m2). Likewise, the WCE was the highest (92.34%) in two hand weeding treatment. Quizalofop ethyl controlled the grasses (98%) which in turn encouraged the growth of sedge weeds (2.33 times). Sisal leaf waste could not control the weeds, whereas, it supported weed growth (as well as growth of sisal bulbils) might be due to its benefit as mulching material conserving soil moisture. The effect of different weed management methods on sisal plants were compared based on the number of leaves and the dry weight of sisal plants. It was observed that after 6 months after planting, hand weeding twice produced the highest number of leaves (7.56/plant) followed by the number of leaves produced in Trifluralin (7.44/plant) and Pretilachlor (7.22/plant) treated plots; whereas, no weeding produced lowest number of leaves (5.33/plant). The biomass productions by sisal bulbils under different weed management methods are also different significantly. Hand weeding twice produced the most robust type of sisal plants (13.90 g/plant) followed by the plant dry weight obtained with sisal waste (13.27g/plant). All the tested herbicides reduced the biomass production by sisal plants as compared to hand weeding in the order of trifluralin (14.67%) > pretilachlor (22.06%) > metolachlor (35.91%) > quizalofop ethyl (39.18%). From the one year experiment it was clear that only hand weeding twice (3 and 5

WAP) was effective in controlling weeds in the primary nursery of sisal (92.34%) beyond 7 WAP. However, among the herbicides tested, S-Metolachlor was effective up to 5 WAP (87.13% WCE) after which it requires one hand weeding for managing the weeds in sisal nursery.

P-254 Bioefficacy of new formulation of oxyfluorfen on weed control in potato

S. Srinivasan, N. K. Prabhakaran, C. Chinnusamy and P. Muthukrishnan
Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore, (Tamil Nadu)
e-mail : sriniagri@gmail.com

Potato is one of the major tuber food crop in the world. The yield of the potato crop was mainly affected by the weeds. So we have to control the weeds with new formulations of herbicides. However new formulation of herbicides are essential required to control wide range of weed flora and also to prevent the weeds to develop resistance to herbicides. In view of the above facts a field trial was conducted at during autumn 2009-

2010 to evaluate the bio-efficacy of new formulation of Oxyfluorfen (23.5%) EC on weed control in potato crop at Central Potato Research Station, Muthorai, Ooty, Tamil Nadu. The experiments with 12 treatments and 3 replications waslayed out in randomized block design. Kufrijyoti variety of potato was planted on 9 september, 2009 at 60 cm spaced ridges with plant to plant spacing of 20 cm. Both the formulations of oxyfluorfen new and old (Goal), and pendimethalin were sprayed as pre emergence at next day of planting and paraquat, metamitron, ethofumesatewere sprayed as post emergence at 20 days after planting . the first five treatments ($T_1 - T_2$) are the new formulation of oxyfluorfen in different doses like 150 g, 200 g, 250 g, 300 g, 400 g/ ha. Other treatments are pendimethalin1.0 kg/ ha(T_6), oxyfluorfen (Goal) 200 g/ ha (T_7), paraquat 1.2 kg /ha (T_8), metamitron 2 lit/ ha (T_9), ethofumesate 1.32 lit/ ha (T_{10}), hand weeding at 15 and 30 DAP (T_{11}), and unweeded check (T_{12}). The all pre emergence treatments are followed by one Hand weeding at 30 DAP and post emergence treatment plots are followed by one hand weeding at 45 DAP. The experimental field was mainly infested by *spergulaarvensis, Poligonumnepalense,Pennisetumclandestinum, Raphanusraphanistum, Bidenspilosa and GallinsogaParviflora.*Lower total weed density and total weed dry weight, higher weed control efficiency and higher tuber yield also recorded in PE – oxyfluorfen 400 g/ha.

P-255 Ethnobotany of alien invasive weed gorse(*Ulexeuropaeus*) on forest ecosystems of Nilgiris district of Tamil Nadu

S. Srinivasan, C. Chinnusamy, N. K. Prabhakaranand P. Muthukrishnan
Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu)
e-mail : sriniagri@gmail.com

Gorse (*Ulexeuropaeus*) is an invasive weed belongs to the family fabaceae, native of western Europe commonly called as furze or Irish furze. *Ulexeuropaeus* is a spiny, evergreen exotic shrub which can grow up to 15 feet tall and 10 to 30 feet in diameter, depending on location. Branches end in a spine and are covered with green scale-like or prickly leaves 1/2 to 2 inches long. Showy yellow pea-like flowers, 1/2- to 3/4-inch-long, grow in clumps near the tips of its branches. The hard seeds are very small, shiny, and brown and are enclosed in 1/2 inch long hairy pods. The fruit is a legume (pod) 2 centimeters (0.79 in) long, dark purplish-brown, partly enclosed by the pale brown remnants of the flower; the pod contains 2-3 small blackish seeds, which are released when the pod splits open in hot weather.

Ulexeuropaeus is identified in hill soils of forest ecosystems in Nilgiris district, Tamil Nadu.Young gorse plants have a compact, rosette-like form, thin triple leaflets, and no thorns. Adult plants are usually shrub-like but may also form mats or cushions in exposed coastal sites. Individual plants grow outward forming a central area of dry, dead vegetation.Gorse is extremely competitive, displaces cultivated and native plants, and impoverishes the soil. Like many species of gorse, it is often a fire-climax plant, which readily catches fire but re-grows from the roots after the fire; the seeds are also adapted to germinate after slight scorching by fire. It creates an extreme fire hazard due to its oily, highly flammable foliage and seeds, and abundant dead material in the plant. It not only increases the risk of fire, but also produces a hotter fire than most weeds. Because of various characteristics of the plant, the soil is often bare between individual gorse plants,which increases erosion on steep slopes where gorse has replaced grasses or forbs. Spiny and mostly unpalatable when mature, gorse reduces pasture quality where it invades rangeland. Gorse understory in forests interferes with cultural operations, increasing pruning and thinning costs. It is further reported that when this plant is grazed by the livestock (Ex.Nilgiritahr), it is found to be fatal. Biological pest control is used on this plant in many areas. The gorse spider mite (*Tetranychuslintearius*) and the gorse seed weevil (*Exapionulicis*) reduce the spread of the plant.More over gorse is still used as soil stabilization, and revegetation. It has also been cultivated as an ornamental and as forage for livestock, which feed on the soft, new growingshoots.

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Efficiency enhancement of total herbicide glyphosate on problematic weeds under non-crop situation

K. Nalini, P. Muthukrishan and C. Chinnusamy
DWSRC, Dept. of Agronomy, TNAU, Coimbatore (Tamil Nadu)
e-mail : naliniagr@gmail.com

Surfactants in foliar deposits can penetrate and thereby influence the mobility of herbicides and other pesticides through the cuticle. Adjuvant were used to Increase biological activity of active ingredient, to manage potential liability situation such as drift, nonperformance or site contamination, to improve the economics of application through higher percent efficacy, to lesser potential for negative effects of the active ingredient on soil, water and environment, to enhance the application, deposition, absorption and translocation of spray and its components.

Surfactants have been evaluated with herbicides to quantitative determination of surface tension, contact angle and to determine the activity of different adjuvants to increase the Glyposate efficacy on broad weed spectrum.

Surfactants such as Salfix 100 (Anionic), Indtron AE (Non- Anionic), Alwet Gold (Anionic), Richwet (Anionic) and Surfactant (Anionic) were used. Techniques to measure surface tension of solution with surfactant was standardizes by using methods suggested by Hansen (1967). Contact angle was measured on leaves of different weeds. The field experiment was conducted during *rabi* 2009 in the field no.36c of Eastern block, Dept of Agronomy, TNAU, Coimbatore. The experiments were laid out in a randomized block design, replicated thrice.

The adjuvant Richwet recorded higher spread of herbicide in *Cyperus rotundus*, surfactant recorded higher spread of herbicide in *Parthenium hysterophorus, Oxalis latifolia* and *Trianthema portulacastrum*. All the adjuvants reduced the surface tension. However the lower concentration reduced the surface tension than the higher concentration. Surfactants are arranged in the following order on the basis of their effect on surface tension reduction: Richwet >Alwet gold>Salfix>Surfactant>Indtron.

The species wise weed density before herbicide spray was recorded and based on the relative density, the dominant weed species were fixed. The observation on phytotoxicity symptom was observed. Quantitative estimation of weed count on total weeds, weed dry weight and dominant weed species was made at 15, 30, 45 and 60 DAHS.

The weed flora of the experimental field consisted of grasses (66.29%), Sedges (13.51%) and broad leaved weeds (20.27%). The dominant weed flora consisted of *Cynodon dactylon*, *Setaria verticiliata*, *Cyperus rotundus, Digera arvensis* and *Parthenium hysterophorus.*The treatment plots applied with Glyposate + Richwet 0.5%. exhibited maximum degree of visual toxicity 82% and 90% at 7 DAHS in early germinating and grown up weeds.

In early germinating weeds, during 15 DAHS, lesser density and dry weight of weeds were observed in Glyposate + Richwet 0.50% (84 No.m^{-2}). In grown up weeds, during 15 DAHS, lesser density and dry weight of weeds were observed in Glyposate + Richwet 0.50% (90 No.m^{-2}) and it is followed by the application of Glyposate + Indtron 0.5% (100.08 No.m^{-2}). Similar trend has been observed during 30, 45 and 60 DAHS also. The higher weed density dry weight has been recorded in control spray of water. Weed control efficiency was higher in Glyposate + Richwet 0.50% followed by Glyposate + Indtron 0.5%.

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