

ANNUAL CONFERENCE

OF

INDIAN SOCIETY OF WEED SCIENCE

ABSTRACTS OF PAPERS



Held on 21-23 July, 1980



Venue : ORISSA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY,
BHUBANESWAR - 751003

ORISSA INDIA

ALL INDIA WEED SCIENCE CONFERENCE

ABSTRACTS OF PAPERS

ORISSA UNIVERSITY OF AGRICULTURE & TECHNOLOGY

and

INDIAN SOCIETY OF WEED SCIENCE.

21.7.80 to 23.7.80

BHUBANESWAR

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ACKNOWLEDGEMENT

The convenor of the All India Weed Science conference wishes to express his deep sense of gratitude to Dr.K.Kanungo, Vice-Chancellor, Orissa University of Agriculture & Technology Bhubaneswar , for readily consenting to host the conference at the University campus.

Sicere and grateful thanks are also due to the colleagues in the various departments of the College of Agriculture , Orissa University of Agriculture & Technology, for their unstained co-operation in organising the conference .

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A.Misra
Professor and Head of the
Department of Agronomy., &
Convenor ,All India Weed
Science conference.

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I. WEED BIOLOGY & ECOLOGY

1. Germination in *Striga asiatica*(L.) Kuntze by Thirty Crop and Weed Root Exudates. P.N. Rao and B.V.N. Reddy.
Department of Botany, Nagarjuna University, Nagarjunanagar
522 510, Guntur Dist., Andhra Pradesh, India.

Witchweed (*Striga asiatica*) seeds usually germinate only in the presence of a stimulatory substance exuded by the roots of host plants. Thirty such exudates have been used presently in a study of germination behaviour of pretreated seeds. Of the hosts tried, twenty are cultivars of sorghum, two of bajra (obtained from ICRISAT, Hyderabad) and the rest are dominant weeds of the Nagarjuna University Campus. Germination manifested in the exudes of the host plants tried without exception. Maximum percentage of germination was observed in continuous light, contrary to earlier reports, and at 100% concentration of the root exudate. No synergistic action was observed when germination was tried in combinations of root exudates of host weeds. Growth of seedlings could be traced upto the chlorophyllous stage of the cotyledons in the plain elute and their cotyledons revealed striking stalked glands. These two observations are significant and add to our previous data on witchweed seed germination. Sandwich technique of germination study yielded better results with only *Phyllanthus simplex* as the host. Experiments with crop hosts of different ages, 15, 30-35 and 45-50 days showed maximum percentage of germination at the 30-35 days age of the crop.

2. Host specificity of *Striga hermonthea* and *Striga asiatica* to some Maize, Sorghum and Pearl-millet varieties.
M.M. Hosmani and C. Parker. University of Agricultural Sciences, Dharwad, Karnataka 580 005, India; and Tropical Weeds Section, Weed Research Organization, Begbroke Hill, Yarnton, Oxford, OX5, 1PF, England.

A pot experiment was conducted in Weed Research Organization, Oxford, England on host specificity of *Striga hermonthea* and *S. asiatica*. The seeds of *S. hermonthea* occurring on sorghum and millets were collected from Sudan, Nigeria and Niger (Africa) and *S. asiatica* occurring on sorghum in Andhra Pradesh and Maharashtra in India and Tanzania (Africa).. Eleven maize varieties, two sorghum varieties, Swarna and SRN 4841 and a pearl-millet variety,

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Ex Borme were screened for host specificity of S. hermonthea and S. asiatica. In general all maize varieties stimulated higher germination of S. hermonthea and S. asiatica seeds collected from Africa but they did not stimulate germination of S. asiatica seeds collected from India. Sorghum varieties stimulated S. hermonthea germination occurring on sorghum but these sorghum varieties did not stimulate germination of S. hermonthea occurring on millets indicating existence of host specificity.

Weed Flora in Southern Guinea Zone of Nigeria. D.J. Chandra Singh, Agric. Research Station, Mokwa, Ahmadu Bello University, Nigeria.

Nigeria is the most populous and agriculturally important country in West Africa. Ecologically the country is divided into 5 major zones as (1) Sudan zone (2) Northern Guinea Savanna Zone (3) Southern Guinea Savanna Zone (4) Sahel Zone and (5) Forest Zone. The weed flora of Southern Guinea zone is presented in the paper.

The Savanna zones almost lie parallel to equator and starting from Sahara of the north they end up with Swamps, on the coasts of Atlantic ocean. The above zones are differentiated by climate and Vegetation. The Southern Guinea zone extends from 7°50' latitude to 10° and 3° - 10' longitude to 8°. The zone is relatively moist with an annual rainfall of 1,000 to 1,500 mm in 190 to 250 rainy days. Most of the crops like yam, maize, sorghum, millet, groundnut, gingelly, and cotton are grown rainfed. The cropping period extends from late April to early November.

Because of the heavy rainfall received over a considerable long period weeds appear luxuriant and infestation levels are alarming unless control measures are taken up. The dominant grassweeds are

<u>Andropogon</u> sp.,	<u>Imperata cylindrica</u> Becur
<u>Panicum maximum</u> , Jacqs	<u>Paspalum orbiculara</u> , Forest
<u>Setaria anceps</u>	<u>Echinochloa colonum</u> , L. link
<u>Digitaria horizontalis</u> , willd	<u>Pennisetum purpureum</u> , School
<u>Eleusine indica</u> , Quarn	<u>Brachiaria deflexa</u> , Robyns
<u>Rottboellia exaltata</u> l.f.	
<u>Dactyloctenium aegyptiacum</u> , willd.	

The dominant broadleaved weeds are. Cleome viscosa, L., Euphorbea heterophylla, L., Euphorbea hirta, L., Commelina benghalensis, L., Var benghalensis, Commelina diffusa, Burm, F., Amaranthus viridis, L., Borreria radiata, L., Vernonia pauciflora, Vernonia peroteti, Vernonia ambigua, Boerhaavia diffusa, L., and Boerhaavia coccinea.

The degree of infestation, appearance and duration of life cycles of some important weeds are presented and discussed in paper.

Preliminary Germination Studies in Wildoats and Phalaris.
Kusha Verma and N.T. Yaduraju. National Bureau of Plant Genetic Resources, New Delhi-110 012, and Indian Agricultural Research Institute, New Delhi-110 012, India.

Preliminary studies were made on the germination of wild oats and Phalaris collected over a period of three years. Germination was highest in wild oats at temperature of 20°C followed by 25°C. At 30°C the germination was very poor. However the germination at fluctuating temperature of 30°C during day time and 20°C at night time was comparable with germination at either 20°C or 25°C. The freshly harvested seeds of wild oats (1979) did not germinate at any temperature. However, after six months they gave a germination of 37% at 20°C and 40% at 25°C as compared to the corresponding germination of 96% and 92% for 1977 seeds. Germination of fresh seeds was improved by either prechilling or removing the husk. But the highest germination (72%) was obtained with prechilling of dehusked seeds. The germination of one and two year old Phalaris (1977 and 1978) seeds was highest at 15°C (96%) followed by 80% at 20°C. The germination was very poor (4 to 9%) for 1977 seeds.

Problem Weeds in Wheat and Paddy Farming Systems Adoption of Methods by Farmers' in Haryana. R.K. Malik, V.M. Bhan, S.K. Katyal, R.S. Balyan and B.V. Singh, Department of Agronomy, Haryana Agricultural University, Hissar-125 004, Haryana, India.

Field survey was undertaken in the Ambala, Karnal, Sirsa and Sonapat districts of Haryana to find out the major problem weeds in wheat and paddy fields, the methods being adopted by the farmers to control these weeds, to find out

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the source of information to the farmers regarding the weed control techniques, and to know the deficiencies or problems faced by the farmers in the adoption of effective methods of control of major weeds. Fifty farmers in concentrated five villages were sampled in each district for the study. Phalaris minor was found to be the major weed problem in all the four districts. The infestation was irrespective of the size of holding. Sonapat district had much less infestation of Phalaris minor while other three districts were having almost equal intensity of Phalaris minor. Maximum chemical method were used in district Sirsa where cent per cent farmers used herbicides followed by Ambala (64-76%), Sonapat (31-40%) and Karnal (15-37%). Farmers with more than 10 acres holding used more herbicides as compared to less than 10 acres. Mechanical methods were more popular in Sonapat. Methabenzthiazuron was used in maximum area in the districts of Ambala, Karnal and Sirsa as compared to Dosanax. About 40 to 45% of the farmers used 2,4-D in Sonapat district. Echinochloa crusgalli and E. colonum constituted major weed problem in the paddy fields in all the four districts. About 63-69%, of the farmers used chemicals in Sirsa, 30-40% in Karnal and above 25% in Ambala district. Farmers of Sonapat under study used only mechanical methods. Butachlor was used by 70-95% of the farmers under study. High cost of herbicides, lack of technical information and non-availability of spraying equipment seems to be the major reason for lack of popularity in the use of herbicides.

6. Physical analysis of weed seeds in wheat and their description. K. Verma. National Bureau of Plant Genetic Resources (NBPGR), IARI Campus, New Delhi-110 012, India.

In a country of wide ranges of climatic and soil conditions and with extensive movement between the different regions, accurate identification of both crop seeds and weed seed contaminants is necessary for correct labelling of seed moving in commercial channels. A reference set of crop and weed samples with complete and accurate data is invaluable in the work of seed identification. In order to know the weeds occurring in wheat a survey of wheat fields was done at IARI, Faridabad, Gurgaon, Karnal and Khanajawala block. The weeds present at different locations were:

Chenopodium album, Chenopodium murale, Coronopus didymus, Melilotus alba, M. indica, Fumaria parviflora, Polygonum plebejum, Saponaria vaccaria, Spargula arvensis, Trigonella incisa, Rumex dentatus, Vicia hirsuta, V. sativa, Lathyrus sativa, Avena fatua, Phalaris minor, Euphorbia dracunculoides, Argemone maxicana, Stellaria media, Asphodelus tenuibolus, Sonchus oleraceus, Lathyrus aphaca, Launea nudicaulis, Medicago denticulatus, Convolvulus arvensis, Lolium temulentum, Ranunculus scleratus, Silene conidea and Carthamus oxycantha. Seeds of all these 29 weeds do not come with wheat crop, as they do not mature with the crop. Some of the weeds which mature with the crop are described in the text. The most useful clues for recognition of seeds are usually the shape, size, peculiarities of the surface and colouring. The presence of any noticeable external features such as wings, pappus, spines, awns or hairs is also likely to be helpful in placing the seed correctly.

7. Survey of North-West India for Weed Flora of Wheat. V.S. Khandal. May & Baker (India) Limited, Bombay-400 025, India.

A survey study of North-West India (Punjab and Haryana) was undertaken to note the weed flora and their intensity of infestation in various blocks of 11 districts, namely Sonapat, Karnal, Kurukshetra, Ambala, Patiala, Roop, Ludhiana, Kapurthala, Jullunder, Amritsar and Gurdaspur. In all 400 fields were randomly selected and weed flora of each plot was recorded thrice i.e. 35th-60th day of sowing and also before harvesting in March/April. To note weed infestation rate, 8 spots were randomly selected in each field and all weed species were recorded separately in a frame of one sq.m. Intensity of species was spaced out in a map. Infestation rates of Phalaris minor and wild oats (Avena ludoviciana and Avena fatua) were mapped out block wise. In order to note the area of Phalaris minor infestation total number of fields infested in each block were recorded by using random method. Phalaris minor and wild oats were also cultured in a pot to study the seedling behaviour and morphology of both obnoxious weeds. Weed flora components of above districts were monocots: Phalaris minor, Avena ludoviciana, Avena fatua and Poa annua. Dicot: Chenopodium album, Medicago denticulata, Melilotus indica, Melilotus alba, Anagallis arvensis, Fumaria parviflora, Convolvulus arvensis, Vicia fabia and Lathyrus aphaca.

Along with the above main components of weed flora of wheat in North-West India, the following were also noted monocot: Lolium temulentum, Polypogon sp., Cynodon sp., Dicot: Chenopodium murale, Solanum xanthocarpum, Argemone mexicana and Spergula sp.

8. Ecological Survey of Weeds Infesting Major Crops in the Upper Luni Basin. Vinod Shankar Division of Basic Resources Survey, Central Arid Zone Research Institute, Jodhpur-342.003, Rajasthan, India.

Investigation of crop area weeds constituted a part of the overall study on the vegetation ecology of the Upper Luni Basin formed by the river Luni and its tributaries which originate from the western flank of the Aravali ranges. Besides observations on weed flora of crops in general, thirteen crop fields located on habitats ranging from sediments to older alluvial plains, were selected for detailed study on weed composition, density and dry matter yields. The crops include Moong (Vigna radiata) Moth (phaseolus aconitifolius) Bajra (Pennisetum typpoides) Jowar (Sorghum vulgare) Makka (Zea mays L.), Til (Sesamum indicum), Jeera (Cuminum syminum L.) and Menhdi (Lawsonia alba L.). The dry matter yields of weeds far exceeded that of crops indicating heavy agricultural losses under unweeded condition. Among the weeds the percentage composition of the annual grasses was very high. The grass species varied apparently according to soil types. On the heavy soil, Cynodon dactylon, Dichanthium annulatum, Digitaria marginata, Bothriochloa pertusa and Desmostachya bipinnata were noticed. On the loamy and sandy loam soils Cenchrus ciliaris, C. setigerus, C. biflorus, Eleusine compressa, Dactyloctenium indicum, Eragrostis spp. and Aristida spp. were common grasses. The density of the leguminous weeds was low and majority of legumes i.e. Tephrosia spp., Atylosia spp. and Indigofera spp. were unpalatable to the livestock. Weeds such as Celosia argentea, Chenopodium album, Asphodelus tenuifolius, Echinops echinatus and Trianthema monogyna ranked next to grasses. By far, Celosia argentea and Echinops echinatus were the most noxious weeds infesting nearly every crop field surveyed.

9. Studies on the Seed Germination of *Trianthema monogyna* L.
H.S. Gill and L.S. Brar, Department of Agronomy, Punjab
Agricultural University, Ludhiana, Punjab, India.

The germination capacity of *Trianthema monogyna* under variable temperatures, ages of the seed, soaking of seed in water was studied under controlled conditions. The results indicated that irrespective of the age, water soaked seeds gave comparatively more germination than the unsoaked seeds. At higher temperature, particularly at 40 and 45°C, fresh seeds have more germination than the one year-old seeds, but in both the cases, higher temperature (45°C) reduced the seed germination. Seeds of this weed germinated over range of 25 to 45°C. However, the optimum temperature was observed to be 40°C. In another study, it was found that the seeds of this weed germinated even after 15 days of flowering and lower nodes formed mature and viable seeds than the seeds on nodes towards the short apex.

10. The Major Weeds of Rabi in Sagar Division. J.P. Tiwari
Department of Agronomy, Jawaharlal Nehru Krishi Vishwa
Vidyalaya, Jabalpur-482 004, Madhya Pradesh, India.

The weed survey at Sagar Division revealed that the infestation of weeds in Rabi crops varied with nature of soil types, low or uplands, cropping system single or double and irrigated or unirrigated conditions. In unirrigated uplands, single cropped fields, severe infestation of *Convolvulus arvensis*, *Launea aspenifolia* and *Vicia sativa* was noted. Other weeds which were noted in patches included *Rumex dentatus*, *Chenopodium album*, and *Argemone maxicana*. In unirrigated fields at Sahgarh, Navgaon and Panna, *Asphodelous tenuiflorus* was prevalent intensively. Amongst monocot weeds *Saccharum spontaneum*, *Cynodon dactylon*, and *Dichanthium* spp. were found in patches. *Melilotus* spp., *Lathyrus aphaca* and *Anagallis arvensis* were sparingly noted.

Weeds in low land double cropped/irrigated fields consisted of Lathyrus aphaca, Anagallis arvensis, Chenopodium album, Vicia sativa, Melilotus spp. and Sonchus arvensis. These habitats were also severely infested with Ageratum conizoides, Rumex dentatus, Ceanothus axillaris and Eragrostis spp. The presence of Medicago denticulata, Trifolium flagiferum and Cichorium intybus was also noted in the irrigated fields. Amongst monocot Eragrostis spp., Cynodon dactylon, Dichanthium spp. and Saccharum spontaneum were common. Phalaris minor was prevalent in the irrigated fields where maxican wheat is being grown, and has been disseminated through the seed. The seed supplying agencies are responsible for distribution of this weed. The common shrubs were Zizyphus rotundifolia, Acacia spp. Calotropis procera, Butea frondosa, and Carissa carandis.

11. Allelopathic Effect of Parthenium on Wheat Seed Germination.
H.S. Shaikh, B.T. Chaudhari, P.K. Khedekar and R.V. Nalamwar.
Department of Agronomy, Punjabrao Krishi Vidyapeeth, Akola
444 041, Maharashtra, India.

Parthenium has detrimental effects on the germination and growth of the crop grown in its vicinity. Parthenium extracts cause toxic effects in terms of poor germination and growth of the crop, particularly of wheat. To test this, a laboratory experiment with extracts of different plant parts of parthenium such as roots, stem, leaves, seeds and flowers along with control (distilled water) was conducted. Data indicated that the germination of wheat seed was more than 70% in control, whereas it was 23.75, 40.50, 0.75, 12.50 and 9.0% in extracts of roots, stem, leaves, flowers and seeds of parthenium respectively. This clearly indicated the bad effect of parthenium extracts on wheat seed germination due to the presence of parthenin and hysterin in the weed.

12. Allelopathic Potential of Seeds of *Chenopodium album* L. and *Melilotus parviflora* Desf. S. Sarma. Department of Agricultural Botany, Gauhati University, Gauhati-781 014, Assam, India.

Biological inhibitors present in the air-dry seeds and seed cover of common lambsquarters (*Chenopodium album* L.) and *Melilotus parviflora* have been studied by means of paper chromatography and various bioassays. The ethyl acetate fraction of methanol extract contained various groups of inhibitors having different Rf values when chromatographed on paper in isopropanol: ammonia: water (10:1:1 v/v). Inhibitors present in the seeds and seed cover of both the species inhibited, lettuce seed germination and root growth, and they caused leakage of betacyanin from red beet tuber slices. Group of inhibitors present in the Rf value range of 0.7-1.0 and they were more active than the other groups. Preliminary investigation showed that some inhibitors were phenolic in nature.

13. Preparation and Use of Leaf Nutrient Concentrate from *Parthenium* Weed. K.G. Joshi and R.N. Joshi. Department of Botany, Institute of Science, Aurangabad and Department of Botany, Marathwada University, Aurangabad-431 004, Maharashtra, India.

Studies in our laboratory have shown that *Parthenium hysterophorus* L., when harvested at the pre-flowering stage, has potential of becoming a food resource. The leaf nutrient concentrate obtained from fresh material by the process of green crop fractionation is very high in good quality protein, vitamin A, vitamin E, xanthophyll and minerals. The extractability of protein from the plant declined considerably with the age and when there was a delay between harvesting and processing. The decline was accompanied by an increase in the non-protein nitrogen in extracts. The delay is, however, inevitable where transportation of crop to a central processing unit is required. In the present investigation an attempt was made to see if extractability of protein could be improved by washing the freshly cut vegetation in water, in solutions of ammonium hydroxide, sodium bicarbonate and kinetin and then storing it for periods of 4 and 8 hours. The effects of

washings on carotene and zanthophyll contents were also studied. In another study, a white 'cytoplasmic' protein fraction was separated from a dark green 'chloroplastic' fraction. The former fraction is likely to be suitable for incorporation in human foods whereas the latter fraction may find use in poultry rations.

14. Effect of Temperature on the Germination of Parthenium Seed. H.S. Shaikh, B.T. Chaudhari, P.K. Khedekar and C.S. Vaidya. Department of Agronomy, Punjabrao Krishi Vidyapeeth, Akola 444 041, Maharashtra, India.

Since Parthenium is a newly introduced weed, it was thought necessary to study in the laboratory the germination capacity of the weed under different temperatures. More than 80% parthenium seeds could germinate under the temperatures ranging from 25°C to 30°C. Germination was found to increase with the increase in temperature from 10°C to 30°C. Temperature more than 30°C reduced germination percentage of parthenium seeds. The optimum temperature for the germination of the weed seed seemed to be in the range of 25°C to 30°C.

15. Growth Analysis of Parthenium hysterophorus L. J.P. Tiwari and C.R. Bisen. Department of Agronomy, J.N. Krishi Vishwa Vidyalaya, Jabalpur-482 004, Madhya Pradesh, India.

The seeds of Parthenium hysterophorus L. germinated within a week with the onset of monsoon and flowering started after a month and continued upto 78 days. The flowering and maturity were nonsynchronous and its life span was completed within 123 days. The seeds had no or variable dormancy. Its 2 or 3 generations can be seen in the same year depending upon frequency and intensity of winter rains. P. hysterophorus L. seemed to be photo and thermonisensitive and found growing throughout the year. The plant height varied from 70 to 130 cm and leaf length 7 to 15 cm which resembled to the leaf of chrysanthemum. It produced 184.6 heads per plant and 5 seeds per head. The reproductive capacity was noted to be 692.25 individual's in the next generation. The highest weed growth rate (WGR) was during 25 to 50 day plant stage ($5.25 \text{ g m}^{-2} \text{ day}^{-1}$) and 50 to 75-day plant stage ($5.09 \text{ g m}^{-2} \text{ day}^{-1}$) which enabled it to smother other associated weeds.

16. The Weed Problems of Cigarette Tobacco Crop in Nepal.
P.P. Regmi and R.C. Sahu. Tobacco Development Company,
Ltd., Janakpurdham, Nepal.

Cigarette tobacco (Nicotiana tabacum) is one of the important agro-industrial cash crops of Nepal. It is subject to the infestation of various terrestrial and two or three species of parasitic weeds. The different types of prevailing weed flora that deteriorate the yield and quality of cigarette tobacco can be observed under different stages of actual tobacco growing lands. When observed on the basis of the degree of prevalence, some weeds are found to be very common such as Nut-grass (Cyperus rothundus), Cud-weed (Gnaphalium indicum), Lamb's quarter (Chenopodium album), etc. Some are found to be common such as Prickly poppy (Argemone mexicana), Russian thistle (Cirsium arvense) etc., and few are less common such as Pimpernel (Anagallis arvensis), Chenopodium murale etc. Orobanche spp. existing with two to three species such as O. cernua, O. ramosa, O. indica etc. happen to be most troublesome complete root parasites infesting tobacco crop. Still another feature of weed problem is the prevalence of some weed flora such as Ageratum conyzoides, Eupatorium odoratum etc., which whether or not infesting the actual tobacco crop are known to play notorious alternate hosts to insect vectors like aphids and whiteflies. The types of terrestrial weeds observed in the field are very limited number. The studies of weed flora prevailing is based on simple visual observation. There has been so far no experimental studies in any aspect of weed problems except the work on the methods of orobanche control, started since last year. The measures for the control of the terrestrial as well as parasitic weeds followed by the local farmers are mostly tradition bound.

17. Portulace - A Salt-loving Weed in Salt-affected areas of Ghataprabha Project. V.S. Gidnavar. Department of Agronomy, University of Agricultural Sciences, Bangalore, Karnataka State, India.

The area under irrigation is increasing every year and as a result the salt problem coupled with high water table in the irrigation project area is also increasing at a faster rate. Several methods for combating salinity are in practice. These include agronomic and cultural practices such as opening drains, leaching, laying out the fields in to ridges and furrows for cultivation. Application of amendments like gypsum in combination with organic manure has given good dividends in sodic soils.

In the studies made at Agricultural Research Station Arabhavi (Karnataka State) a weed by name Trianthem portulacastrum. (family Aizoaceae) was found to be salt exuding in nature. This was further proved by analysis of the weed species for pH and EC (1:10). The EC (electrical conductivity) was as high as 8 Om^m/mhos and sodium 4.5%. So also the plant was containing fairly high amount of N, P and K indicating that under adverse soil characteristics, this weed can grow well by absorbing many nutrients from the salt-affected soils and compete with crops like wheat and maize.

II. WEED COMPETITION

3. Influence of Grassy and Broadleaved Weeds on Crop-Weed Competition in Drilled Rice. V.M. Bhan, N.G. Naidu and Dheer Singh. Department of Agronomy, G.B. Pant University of Agriculture and Technology, Pantnagar-263 145, Uttar Pradesh, India.

Field studies were conducted on drilled rice (Var. Jaya in 1975 and Bala in 1976) to study the influence of period of weed-free maintenance on the emergence of grassy and broadleaved weeds, competition among them, and their effect on the grain yield of rice. Plots were kept weed free for 0, 15, 30 and 45 days after sowing. In each treatment, subplots were kept where only grassy or broadleaved weeds were kept along with normal native weed population. Grassy weeds dominated over broadleaved weeds. The intensity of grassy weeds was more in plots maintained weedfree for initial 15 to 30 days. Broadleaved weed population increased at later stage when weed free maintenance was kept from 30 to 45 days after sowing. Population and dry matter produced by weeds seems to have influenced the grain yield. Grain yield in grassy weed infested plots was reduced because of severe competition as also noticed in plots where normal mixed population of weeds was available. Keeping the crop weed free for initial 45 days in grassy and grassy + broadleaved weed population plots resulted in greater grain yield than in weedy check. In case of broadleaved weeds, weed-free maintenance during the initial 15 days was sufficient to get grain yield similar to that obtained in grassy and grassy + broadleaved weeds infested plots where weedfree condition was maintained for 45 days initially.

19. Critical duration of weed competition in dwarf wheat Var-sonalika, S.S. Solanki, C.R. Bisen and J.P. Tiwari. Department of Agronomy, J.N. Krishi Vishwa Vidyalaya, Jabalpur-482 004, Madhya Pradesh, India.

The significant reduction in grain yield was noted when the weed competition was allowed for more than 30 days. The yield of the plots where the weeds were allowed to grow upto 45, 60 and 75 days were reduced and at par with weedy check. The reduction in yield was mainly due to significant reduction in effective tillers. The weed removal at 30 days after sowing seemed to be essential as it gave significantly higher yield (24 q/ha) amongst the plots weeded only once. Amongst 2 weeding treatments, the plots, where weeds were removed first at 30 days and second at 45 days after sowing gave the highest yield (26.04 q/ha). Weeding twice at 30 and 45 days was found to be the most economical followed weeding only once at 30 days.

20. Studies on Economising Nitrogen Fertilization in Wheat Through Chemical Weed Control. K.C. Gautam and Mahatim Singh. Division of Agronomy, Indian Agricultural Research Institute (IARI), New Delhi-110 012, India.

Field investigations were carried out to ascertain the relationship between the use of fertilizer nitrogen and weed control measures in wheat (Triticum vulgare) for exploring the possibility of effecting economy in nitrogen fertilization by controlling weed growth through the use of herbicides. Weed population was significantly lowered with increase in the levels of nitrogen. In case of dry matter production of weeds the trend was quite reverse and maximum dry matter was produced under 120 kg N/ha level preemergence application of methabenzthiazuron at 1.4 kg/ha and penoxalin at 1.5 kg/ha and postemergence application of metoxuron brought down significant reduction in weed population and dry matter production of weeds. Nitrogen depletion by weed growth was markedly checked by methabenzthiazuron and penoxalin application. Earbearing tillers, grain yield and nitrogen uptake by crop were increased statistically with the additional dose of nitrogen. Significant differences were observed in earbearing tillers, grain yield and removal of nitrogen by crop plant under methabenzthiazuron, penoxalin and repeated weeding treatments as compared to other treatments.

21. Studies on the Competition of Phalaris in Wheat.
N.T. Yaduraju, Gita Kulshrestha and V.S. Mani. Indian
Agricultural Research Institute, New Delhi-110 012, India.

A pot experiment was carried out at Indian Agricultural Research Institute, New Delhi during 1978-1979, to study the competition of phalaris in wheat (Cv. Sonalika) sown at different dates, 6th November, 23rd November, 6th December and 23rd December 1979. There were two levels of phalaris competition i.e. four and eight plants/pot. Two plants of wheat and phalaris were maintained separately for comparison. The treatments were replicated four times. Wheat sown after 23rd November reduced the dry matter production of wheat substantially. The reduction in dry matter of wheat when four and eight phalaris plants were planted per pot was to the extent of 33% and 55% respectively. The total dry matter production of phalaris was highest when wheat was sown on 23rd November. However, sowing on 23rd December did not significantly reduce the dry matter production as compared to sowing on 6th November. This indicates that delayed sowings would be as congenial for the growth and development of phalaris as the early sowings. Dry matter production/plant of phalaris did not vary significantly between two densities of phalaris. This indicated that importance of higher densities of phalaris in inflicting losses to wheat crop. The total dry matter production of wheat and phalaris combined was, however, lower as compared to dry matter production of wheat grown without any competition. Pure stand of phalaris recorded the lowest dry matter production. When wheat and phalaris were grown together, the number of tillers/plant of both species reduced significantly than when they were grown alone.

22. Chemical Weed Control in Relation to Nitrogen Nutrition in Maize. N.T. Yaduraju, V.S. Mani and Bhagwan Das. Indian
Agricultural Research Institute, New Delhi-110 012, India.

A replicated field trial was carried out at Indian Agricultural Research Institute, New Delhi, during kharif 1979 to study the response of nitrogen in weedfree and weed-infested maize (Hybrid EH-400175). Maize was sown on 17th July, 1979 and atrazine 1.0 kg/ha was used to maintain weedfree condition. Further hand weeding were also done

if found necessary for the same purpose. Superimposed on these two main treatments were the four nitrogen levels, 0, 40, 80 and 120 kg N/ha. Half the nitrogen level and the entire quantities of 60 kg and 40 kg/ha of P_2O_5 and K_2O were applied at the time of sowing and the other half of the nitrogen was applied 45 days after sowing. Harvesting was done on 17th October, 1979. It was found that weeds reduced the yield of maize by about 40 per cent. The yield response of maize to nitrogen was only upto 80 kg/ha which was significantly superior to 40 kg/ha. The interaction was not significant. However at 0 kg level of N in weedfree treatment, the yield was 1960 kg/ha as compared to 1660 kg/ha and 1530 kg/ha at 80 and 120 kg/ha levels respectively in weed infested treatment. This indicates the importance of checking weed growth for obtaining maximum returns from the costly input fertilizer nitrogen.

23. Effect of Different Grain Legumes on Weed Growth in Intercropped Sorghum. D. Boobathi Babu, Y.B. Morachan and S. Sankaran. Department of Agronomy, Tamil Nadu Agrl. University, Coimbatore-641 003, Tamil Nadu, India.

The effect of different grain legumes, blackgram (Co.3) cowpea (C152), and lablab (Co.8) on weed infestation and growth in intercropped sorghum as compared with sorghum mono culture was studied. At 15 days, a substantial reduction in weed population was observed when blackgram was used as an intercrop, and poor canopy development and inadequate coverage when cowpea was used. Lablab had only marginal influence. At 60 days cowpea controlled 70.4% of Cyperus rotundus, 76.9% of Dactyloctenium aegyptium and 54.9% of Echinochloa colonum. Lablab reduced weed population by 27%. The data indicated the possibility of 15 to 35% reduction in weed growth by growing blackgram as an intercrop. The intercrops differed in their relative growth rates, spreading habit, canopy structure and competitive ability and accordingly differed in their weed suppressing ability. The blackgram showed high smothering ability early during the crop season over the other intercrops while cowpea and lablab by virtue of their canopy development increased their competitive ability with weeds later in the season.

24. Effect of Duration of Weed Competition on Bajra and Til Crops Under Rain-fed Conditions. R.P. Bansal and D.N. S. Plant Ecology Laboratory, Botany Department, University Jodhpur, Jodhpur-342 001, Rajasthan, India.

Effect of several weeds on the growth and yield of rain-fed crops, bajra (Pennisetum typhoideum Rich.) and (Sesamum indicum L.) has been presented in this paper. were allowed to grow for different durations in these crops and then they were manually removed systematically until harvest. The weed population consisted of both annual grasses and dicot weeds. Grasses outnumbered early in the season and soon became more numerous and remained the dominant competitors. Competition of weeds for different periods resulted in the decrease in growth and yield of both crops. This inhibition increased with an increase in the duration of weed competition. A decrease in crop yield upto 82.4 percent in bajra and 78.6 percent in til was noted. Chlorophyll and carotenoid pigments also decreased significantly.

5. Nutrient Competition Studies Under Different Weed Control Systems in Cotton (Gossypium hirsutum L.) in Black Cotton Soils of Madhya Pradesh. S.C. Jain, B.G. Iyer, H.C. Jain and N.K. Jain. All India Coordinated Cotton Improvement Project, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Indore-452 001, Madhya Pradesh, India.

Competition for mineral nutrients, mainly for N, P and K between crop plants and associated weeds influences the crop yields adversely. Studies to estimate the validity of such losses, occurring particularly in cotton (Gossypium hirsutum L.) in relation to the conventional, chemical and integrated systems of weed control were carried out at two locations, Indore and Khandwa during 1976-77 and 1977-78. Data on nutrient (NPK) removal revealed that the crop was deprived of 500 to 800 percent of total nutrients due to competition caused by 7600 to 10300 kg/ha of dry matter of weeds, resulting in poor crop yields in unweeded conditions. Weeds were effectively controlled by diuron (3-(3,4-dichlorophenyl)-1, 1-dimethylurea) 0.75 kg/ha at pre-emergence followed by either diuron or MSMA (monosodium methanearsonate) at postemergence or with interculture

operations in an integrated system. Preplanting incorporation of fluchloralin (N-propyl-N-(2'chloroethyl)-2, 6-dinitro-n-trifluoromethyl-aniline) and penoxalin (N-(1-ethylpropyl)-3,4-dimethyl-2, 6-dinitrobenzenamine) restricted the benefits derived on weed control and seed cotton yield, particularly in medium soils of Indore. Band placement of diuron or hand weeding as measures to cut down the weed control expenses showed promise only in light soils of Khandwa. Every 100 kg of dry matter produced by weeds took a heavy toll of nutrients (0.88 N, 0.26 P, 1.05 K kg/ha in 1976-77 and 0.37 N, 0.37 P, 1.85 K kg/ha in 1977-78) and brought down the mean yield levels by about 450 to 600 kg/ha.

- ✓26. Crop-Weed Competition Studies in Cotton (Gossypium hirsutum L.) variety H-777. R.S. Balyan, V.M. Bhan and R.K. Malik. Department of Agronomy, Haryana Agricultural University, Hissar-125 004, Haryana, India.

Investigations were carried out to study the effect of duration of weed free maintenance and time of weed removal on the yield of cotton. Keeping the field weed free for the complete crop season increased seed cotton yield from 36 to 40 per cent. Keeping the field weed free for 30 days after sowing increased seed cotton yield by 30 per cent in 1978 and 33 per cent in 1979. Further increase in the period of weed free maintenance did not cause any significant increase in the yield. While studying the time of weed removal, it was observed that delay in the removal of weeds after 60 days of planting, significantly decreased the yield. Increase in the yield of seed cotton was accompanied by simultaneous increase in the number of bolls per plant. The higher number of bolls per plant seems to be due to better growth of plants as evidenced by increase in dry weight of leaves, cotton sticks and height of the plant. Wider row spacing of 60 cm gave significantly higher seed cotton yield over 45 cms during both the years.

27. Effect of Time of Weed Removal on Growth, Yield and Quality of Groundnut. S.P. Singh, S.K. Yadav, (Miss) K. Gupta and V.M. Bhan. Department of Agronomy, Haryana Agricultural University, Hissar, Haryana, India.

Weeds compete with crop plants for essential growth factors and thereby adversely affect the growth, yield and quality of crops. To get maximum return from weeding, its time should be so adjusted that most of the weed seeds have germinated and they have done minimum loss to the crop. In a field trial conducted during kharif 1979-80, the effect of weed removal in groundnut at 2, 4, 6, 8, 10 and 12 weeks after sowing was compared with weed free and unweeded control treatments. Maximum dry matter production of weeds (4910 kg/ha) was recorded at 8-week stage of groundnut crop. Weed-free treatment produced highest pod yield of 3310 kg/ha followed by weeding after 4 weeks (3240 kg/ha) and 2 weeks (3000 kg/ha) after sowing, which were statistically at par with weed-free treatment. The yield of groundnut declined sharply as the weeding was delayed beyond 4 weeks. Weeding could not increase groundnut yield if it was done 10 weeks after sowing. The effect of time of weeding on the growth and quality characters of crop are also discussed.

28. Crop Weed Competition Studies in Rainfed Groundnut (Arachis hypogaea L.) in Saurashtsa. R.B. Patel and B.R. Raghvani. Department of Agronomy, Gujarat Agricultural University, Junagadh-362 001, Gujarat, India.

Field studies were conducted to determine the critical period of weed competition in groundnut on medium black soil of College farm, Gujarat Agricultural University, Junagadh during kharif 1979. The ten treatments included weeding at 15 days, 15 and 30 days, 15, 30, 45, 60 and 75 days, 30 days, 45 days, 60 days and 75 days after sowing and no weeding. The treatment in which weeding at 15, 30, 45 and 60 days after seeding gave significantly highest pod yield of 407 kg/ha than other treatments. This treatment also produced maximum fodder yield of 1177 kg/ha. The dry weight of weeds increased subsequently with delay in weeding upto 60 days with no severe competition thereafter. It was also found that with increase in the

number of weedings from planting, the dry weight of weeds decreased.. Weeding after 60 days of planting can be safely avoided without adverse effect on yield. Thus, the results indicated that the period from planting to 8 weeks is the critical period for weed competition in rainfed groundnut.

The weed flora observed in the experimental plots were of both of monocots and dicots. They were Cynodon dactylon, Cyperus spp., Convolvulus arvensis, Eleusine indica, Chloris virgata, Echinochloa crusgalli and Anaphalis cutchica.

29. Effect of Different Weed Groups on 5 Groundnut Varieties. S.M. Kondap, M.R. Reddi, K. Rama Krishna and N. Gopal Naidu. Department of Agronomy, College of Agriculture, (APAU), Rajendranagar, Hyderabad-500 030, Andhra Pradesh, India.

A field experiment was conducted at Agricultural College Farm, Hyderabad during Kharif 1979 to study the effect of different types of weeds monocots, dicots and a combination of both, on five Groundnut varieties, TMV-2, Spanish improved, J-11, EC-21137-1 and K 71-1. The yield reduction due to the presence of monocots+dicots was maximum (24.6%) followed by monocots alone (20.6%) and dicots alone (12.8%). Among the varieties tested, K 71-1 gave maximum yield (925 kg/ha) while EC-21137-1 gave the lowest yield (438 kg/ha). The variety K 71-1 also performed well in all the weed groups. Regarding dry weight of weeds, maximum growth was recorded when EC-21137-1 (858.6 g/m²) was grown. Minimum weed growth (423.3 g/m²) was obtained when K 71-1 was grown. The ability of K 71-1 to suppress and compete with the weeds might be one of the reasons for recording higher yields in this variety. In the weed flora Lagascea mollis was predominant followed by Celosia argentea and Panicum repens.

30. Critical Duration of Weed Competition in Tall Wheat under Irrigated Condition. S.S. Solanki, C.R. Bisen and J.P. Tiwari. Department of Agronomy, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur-482 004, Madhya Pradesh, India.

A field experiment was carried out to find the effect of duration of weed competition on crop growth and grain yield of irrigated tall wheat, var. N₄. Six treatments were

employed in which weeds were allowed to grow for 35, 50, 65, 80 and 95 days and full crop span after sowing. The effective tillers per plant were reduced when the weed competition was allowed for more than 50 days. The grain weight and number per ear were also reduced with increasing duration of weed competition though the reduction was non-significant. Their cumulative effects resulted in significant reduction in grain yield. The higher yield was obtained when the plots were kept clean after 50 days of sowing (39.98 q/ha) followed by 35 days (38.15) after sowing. This experiment clearly indicated that the weed competition allowed for more than 50 days causes significant reduction in grain yield in tall wheat. The yield reduction in check where the weeds were allowed to grow during the full crop span was 15.72 q/ha i.e. about 38% loss over the crop where the weed competition was eliminated after 35 days or 50 days after sowing.

31. Weed Competition in Sunflower. A.K. Ghosh, P.A. Sarkar and R.D. Singh. Department of Agronomy, Allahabad Agricultural Institute, Allahabad-211 007, Uttar Pradesh, India.

The influence of associated weeds in sunflower (*Helianthus annuus* L.) at different stages of crop growth and at different frequencies of weed removal was investigated at the Allahabad Agricultural Institute during the rainy season of 1973 and 1974. Weeds were removed at 15, 30, 45 and 60 days after sowing (DAS) and the frequency of weed removal varied from one to four, depending upon the stage or stages at which weeds were removed. There was an additional treatment of unweeded check, for comparison.

Early weeding 15 DAS, with or without subsequent weeding, gave the most vigorous growth of sunflower plants (169 cm in height) and highest seed yield (1800 kg/ha). With every 15-day delay in the first weeding, plant vigour and seed yield were proportionately decreased. In plots receiving no weeding, the plant height was 138 cm (60 DAS) and seed yield 1170 kg/ha. There was a steady increase in plant vigour and seed yield with increase in the frequency of weed removal from none to four. Thus, for four weedings,

at 15, 30, 45 and 60 DAS, the average plant height (60 DAS) was 175 cm and the seed yield 1840 kg/ha. In comparison, the corresponding figures for one, two and three weedings were 150, 153, and 164 cm, and 1510, 1460 and 1660 kg/ha, respectively.

32. Competition Potentialities of *Digera alternifolia* (L.) Aschers in Arid Land Crop Fields. N. Ashraf and D.N. Sen. Laboratory of Plant Ecology, Botany Department, University of Jodhpur, Jodhpur-342 001, Rajasthan, India.

Digera alternifolia, a common rainy season weed of cultivated fields, causes considerable reduction in crop growth and yield. It appears alongwith the crop seedlings, grows along with them upto harvest and competes severely for moisture, nutrients and space. There was an yield reduction of upto 25.2 percent in case of bajra (*Pennisetum typhoideum* Rich.) and 42.0 percent in case of til (*Sesamum indicum* Linn.) due to weed competition. A notable decrease in chlorophyll and carotenoid contents was also found in the leaves of crop plants. Reduction in chlorophyll a was more pronounced in case of bajra, while it was carotenoid content in case of til. Til crop was found more susceptible than bajra for this weed competition.

33. Studies on the Field Crop-Parthenium Competetion for Nutrients. Y.C. Panchal, S.J. Patil, P.C. Reddy and B.S. Janagoudar. Department of Crop Physiology, University of Agricultural Sciences, Dharwad Campus-580 005, Karnataka, India.

Weeds, particularly *Parthenium hysterophrus* L. pose a great menace in the field crops grown in the irrigated areas of Malaprabha and Ghataprabha Projects. Studies on the dynamics of crop-weed competetion were taken up at ARS., Navalgund under irrigated conditions in Kharif 1979.

Experimental results in case of cowpea (*Vigna sinensis* L. Sari. (V.G.452)) have indicated that reduction in grain yield was upto 22.6% in crop plus weed and upto 31.3% in crop plus parthenium treatment as compared to weed-free check. There was no significant difference in yields due to alachlor and nitrofen treatments with the weed free check.

Field experiments in case of maize (Zea Mays L.) indicated that competition by weed/parthenium reduced the grain yield by 21 percent as compared to the weed-free check. Preemergence herbicide treatment with simazine showed very effective control of weeds and grain yields were on par with the weed-free check.

When the crops are allowed to compete either with general weeds or with Parthenium, the weeds usurp about 16 to 20 percent nitrogen. There was decrease in the biological yield by 10-15 percent due to weeds and parthenium competition. Similar trend was noticed, in test weight of grains and other yield components.

34. Crop Weed Competition Studies in Mung (Phaseolus aureus Roxb) under rainfed area of Saurashtra. R.B. Patel, and B.R. Raghvani. Department of Agronomy, Gujarat Agricultural University, Junagadh-362 001, Gujarat, India.

A field trial was conducted to determine the critical period for crop weed competition in mung on medium black soil of college farm, Gujarat Agricultural University, Junagadh during kharif 1979. Six treatments comprised of weeding at 15 days, 15 and 30 days, 15, 30 and 45 days, 30 days, and 45 days after sowing and no weeding were included. Seed and stover yield were not significantly influenced by different treatments. However, treatment involving weeding at 15 and 30 days after sowing recorded highest yield of 456 and 1458 kg/ha of seed and stover yield, respectively. The dry weight of weeds increased subsequently with delay in weeding upto 45 days. It was also found that with increase in number of weedings the dry weight of weeds decreased significantly. It is indicated that the period from planting to 4 weeks is the critical period for crop weed competition in moong.

The weed flora found in the experimental plots were monocots and dicots. They were Xanthium strumarium, Eclipta alba, Digeria arvensis, Claredendrone sabrina, Chloris virgata, Desmodium diffusum, Imopea reniformis, Echinochloa crusgalli, Digitaria sanguinalis, Penicum celonum, Anaphalis cutchica and Cyperus spp.

35. Crop Weed Competition Studies in Greengram. S.M. Kondap, K. Rama Krishna and M.R. Reddi. Department of Agronomy, College of Agriculture, Rajandranagar, Hyderabad-500 030, Andhra Pradesh, India.

A field trial was conducted at the Agricultural College Farm, Rajendranagar, Hyderabad, during Kharif 1979 to study the weed competition in greengram and to determine its critical period. Various weed free and no weeding periods were tested. The initial weed-free condition upto 3rd, 4th or 5th weeks from sowing gave more yield than weed-free situation given later. Weed-free treatment upto 5th week (207 kg/ha) was at par with weed-free situation till harvest (209 kg/ha). The yield data indicated that the critical period of weed competition was from 3rd to 5th week from sowing and there appears to be little need of maintaining weed free condition after 5th week. Maximum reduction of yield was found in no-weeding treatment till harvest (49.5%) followed by weed-free treatment upto 1st week (48.2%). Weed free condition after 1st or 2nd week from sowing was superior to initial weed free period upto 1st or 2nd week. Cyperus rotundus, Lagascea mollis, Flaveria australisica and Euphorbia hirta were the major weeds found during the experimentation.

36. Optimum Time of Weed Removal in Black Gram (Vigna mungo L.) O.P. Vats and J.S. Sawhney, Department of Agronomy, Punjab Agricultural University, Ludhiana, Punjab, India.

Studies were conducted at Punjab Agricultural University, Ludhiana, on medium fertility loamy sand soil during the Kharif 1973 and 1974 to assess the losses caused by weeds and the optimum time of their removal in an erect-growing variety, T-9, of black gram. In comparison to weed-free condition, the unweeded plots recorded a loss of 50 percent in the grain yield, whereas, it was 40, 31 and 39 percent when weeds were removed only once at 2, 4 and 6 weeks after sowing. In the treatments where the first weeding was done 2, 4 and 6 weeks after sowing and thereafter, the crop was kept free of weeds, the reduction in yield was only 5, 5 and 29 percent, indicating thereby that the losses caused by weeds upto 4 weeks were nominal. However, two weedings (first at 4 weeks and second at about 7 weeks) recorded a

rain yield of 79 per cent of the weed free condition. The results showed that the weed competition started as early as two weeks and reached to its most critical phase 6 weeks after sowing, after which even keeping the crop free of weeds was not of much help. Thus weeding at 4 weeks could be considered as the most critical time for initiating weeding operation in black gram.

37. Studies on yield reduction due to *Cyperus rotundus* in different crops. S.M. Kondap, M.R. Reddi and K. Rama Krishna. Department of Agronomy, College of Agriculture (APAU), Rajendranagar, Hyderabad-500 030, Andhra Pradesh, India.

A replicated field trial was conducted during Kharif 1979, at the Agricultural College Farm, Rajendranagar, Hyderabad to study the yield reduction due to the infestation of *Cyperus rotundus* alone in different crops. Eight crops which are commonly grown in this region were taken up and only *Cyperus rotundus* was allowed to grow in these crops to study the competitive ability of these crops. Maximum reduction in yield was observed in soybean and while minimum yield reduction was in maize crop. The percentages reduction in the yields of these crops were 57.85% in soybean, 31.72% in groundnut, 23.45% in blackgram, 22.54% in greengram, 21.82% in horsegram, 16.26% in cowpea, 12.48% in sorghum and 6.21% in maize. Soybean showed significantly lower competitive ability with *Cyperus rotundus* than other crops. Weed growth was significantly more in soybean and less in cowpea and horsegram. This was due to the smothering effect of these two crops which suppressed the weed growth.

38. Weed Flora and Their Relative Intensity, as Influenced by some Preemergence Herbicides and Their Effect on Growth, Yield and Uptake of Nutrients in Potato. J.T. Nankar and Mukhtar Singh. Department of Agronomy, Marathwada Agricultural University, Parbhani, Maharashtra, and Department of Agronomy, Punjab Agricultural University, Ludhiana, Punjab, India.

In field studies on sandy soils of Jullundur (Punjab) in spring 1974 and 1975 and autumn 1974, fluchloralin, alachlor, nitrofen, sirmate, simazine, linuron, metobromuron, methabenzthiazuron, 2,4-D, alachlor nitrofen and alachlor followed by 2,4-D were applied at preemergence. All the preemergence herbicides except 2,4-D checked the population of *Poa annua* effectively in the spring as well as autumn crop. Metobromuron, linuron, simazine, methabenzthiazuron and fluchloralin showed good promise in controlling the main dicot weeds, *Chenopodium album*, *Lepidium spp.* and *Spergula arvensis*. In spring, untreated control produced 783.2 kg/ha dry matter of weeds which removed 13.7 kg N, 2.9 kg P and 16.9 kg K/ha. Linuron and metobromuron which drastically reduced weed growth, particularly of dicots and this resulted in the removal of only 0.34 kg N, 0.07 kg P and 0.41 kg K/ha. None of the preemergence herbicide treatments inhibited weed emergence. Linuron increased the yield of potatoes by 88.6 and 132.2 q/ha in respective seasons. The corresponding increases in yield with metobromuron were 85.8 and 139.2 q/ha. The uptake of nitrogen by the crop was 56.2 and 52.5 kg/ha, which increased by 43.0 and 58.2 kg/ha with linuron and by 41.2 and 62.2 kg/ha with metobromuron, in respective spring seasons. Simazine gave lowest values of nutrient uptake in spring 1974, and 2,4-D in spring 1975. The other preemergence treatments gave intermediate values. In autumn, the values of nutrient uptake under different treatments showed much smaller variations than those observed in spring. Thus in the spring crop, effective control of weeds by the application of linuron and metobromuron and the reduction of nutrient losses through them were reflected in increased yield and uptake of nutrients by the crop.

40. The Critical Period of Crop-Weed Competition in the Mixed Cropping of M.P. Chari + Guar. R.K. Pandey and S.D. Gupta. Indian Grassland and Fodder Research Institute, Jhansi-284 003, Uttar Pradesh, India.

The study was carried out on medium textured soil of Indian Grassland and Fodder Research Institute, Jhansi during 1975 and 1976. Fifty kilograms seed of M.P. Chari was sown mixed with 20 kg seed of guar/ha in 25 cm sparse rows. Eight weedfree conditions created for the periods 1, 2, 3, 4, 5, 6, 7 and 8 weeks after sowing by weekly weeding, were evaluated along with weedy control. Mixed cropping of guar with M.P. Chari did not appear feasible in common rows during monsoon season. The early phase of crop growth (3-4 weeks after sowing) proved critical for weed competition as weedfree condition created for the period of 3-4 weeks after sowing effectively checked weed intensity and promoted fodder yield (d.m.) significantly over weedy check. During this period, weed intensity posed constant to increasing trend from one week stage of crop onwards. After 4th week, the broad leaf and grassy weeds were observed declining in their plant intensities consistently. Under this retreating phase of weed infestation, the additional weekly weedings executed as per plan after 4 weeks of sowing could not contribute over weedfree conditions created initially upto 3-4 weeks. It was thus concluded that forage crop got a congenial start under weedfree condition of early phase and led to an aggressive growth avoiding latter effect of recessive weeds.

41. Nutrient depletion capability of wood sorrel. L.P. Misra and D.L. Sharma. Regional Fruit Research Station, Mashobra, Simla-171 007, Himachal Pradesh, India.

At the Regional Fruit Research Station, Mashobra, wood sorrel (Oxalis latifolia H. B. and K.) was found infesting apple nursery. This is the most common weed which grows profusely during rainy season. Since it spreads mainly by its underground bulbs, hand or mechanical weeding turns out to be a futile exercise. Above ground foliage and bulbs were collected from three plots of one meter square area. The observations were made for two seasons in order to confirm the results. O. latifolia accumulated about 30 tons/ha of fresh weight and 2 tons/ha of dry matter during one season of growth. At the same time it depleted the soil by taking up 68 kg/ha nitrogen, 4 kg/ha phosphorus and 48 kg/ha potash through its above ground foliage.

III. HERBICIDE PHYSIOLOGY AND RESIDUES

41. Effect of Solubilization on Herbicide Activity. V.S. Rao and B. Kotoky. Tocklai Experimental Station, Jorhat-785008. Assam, India.

Solubilization is a process during which the herbicides are conferred with both hydrophilic and lipophilic properties which aid in rapid absorption by the plant and free and rapid translocation inside the plant. In the 1979 Parbhani meeting of ISWS, the authors reported that at equal rates, the solubilized formulation of glyphosate was more effective than the commercial formulations in controlling Imperata cylindrica, the most persistent perennial grass in tea. The present paper reports the effect of solubilization on the activity of other postemergence herbicides and the relative efficacy of different solubilizers. There was slight enhancement in the herbicide activity when dalapon, MSMA and asulam were solubilized and applied on the target weeds. Glyphosate, however, showed much greater activity when applied in solubilized formulation and this offered the possibility of reducing the optimum rate of application by 50%.

These results suggested that solubilization can improve the herbicides whose activity is possibly limited by either poor penetration into the plant or slow translocation inside the plant. Further research is required to study this aspect in greater detail.

42. Toxicity, Absorption, Translocation and Metabolism of 2,4-D in *Physalis minima* L. and *Lycopersicon esculentum* Mill. Govindra Singh and V.M. Bhan. Department of Agronomy, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Nainital-263 145, U.P., India.

Greenhouse and field studies were conducted to study the toxicity, absorption, translocation and metabolism of 2,4-D in P. minima and L. esculentum plants resistant and susceptible to 2,4-D, respectively. There was not much difference in the total amount of 2,4-D-¹⁴C absorbed by two species at the end of 168 hours after treatment. The total radioactivity recovered from entire plant of P. minima

decreased with increase in exposure period. A reverse trend in the recovery of total radioactivity from the entire plant of L. esculentum was observed. Absorption of 2,4-D-¹⁴C inside the plant as well as translocation from the 'treated leaf' were highest at 4-leaf stage of growth in both the species. Four metabolites of 2,4-D-¹⁴C from P. minima were detected by paper chromatography. At the end of 168 hours after treatments, only 38.6% activity was identified as 2,4-D-¹⁴C in P. minima while it was 97.2% in case of L. esculentum. The rate of metabolism of 2,4-D-¹⁴C in P. minima increased with the advancement of growth. Relatively higher amount of 2,4-D in 'Free form' was observed in L. esculentum as compared to P. minima. P. minima was able to avoid injury due to 2,4-D application by lowering the amount of 2,4-D inside the plant to a nontoxic level through its excretion by roots, rapid metabolism and binding of 2,4-D with constituents.

43. Mitigation of Diuron Toxicity on Tea. B. Kotoky, S.N. Sarmah and V.S. Rao. Tocklai Experimental Station, Jorhat-785 008, Assam, India.

In order to mitigate diuron toxicity caused by accidental spraying in young tea or at rates higher than the recommended optimum in mature tea, sucrose and activated carbon were used to study their antidotal properties in a set of field and pot experiments. Activated carbon, incorporated into soil immediately after preemergence application of diuron, reduced the herbicide toxicity to a great extent. The best result was obtained when it was incorporated at 20 to 25 kg/ha immediately after diuron spraying. Superimposition of foliage application of 5% sucrose solution had no added benefit over activated carbon in preventing diuron toxicity. Spraying of 5% sucrose alone on the foliage of tea plants either immediately after diuron application or after the diuron toxicity symptoms have developed, showed no mitigatory effect. In experiment on the mode of application of activated carbon, it was found that application of activated carbon as a tank-mix with diuron solution was better in reducing herbicide toxicity than when applied as dust on the soil after diuron application.

44. Toxicity, Absorption, Translocation and Metabolism of 2,4-D in *Lathyrus aphaca* L., *Melilotus indica* AIL. and *Pisum sativum* L. A.K. Pathak and V.M. Bhan. Department of Agronomy, G.B.P. University of Agricultural Sciences, Pantnagar, Uttar Pradesh, India.

Field and glass house experiments were conducted at G.B. Pant University of Agriculture and Technology, Pantnagar to study the toxicity, absorption, translocation and metabolism of 2,4-D in *Lathyrus aphaca* L., *Melilotus indica* AIL. and *Pisum sativum* L. The dry matter content of all the three species decreased significantly with increase in the rate of application of 2,4-D upto 2.0 kg/ha. 2,4-D application caused maximum dry matter reduction at 6-leaf stage of *L. aphaca* 4-leaf stage of *M. indica* and 3 leaf stage of *P. sativum*.

Absorption of foliarly applied 2,4-D-¹⁴C was maximum at 4-leaf stage of *M. indica* and *P. sativum* and 5-leaf stage of *L. aphaca* 2,4-D-¹⁴C accumulation inside the plant and translocation from the treated leaf was maximum at 4-leaf stage of growth in all the species. The rate of 2,4-D metabolism increased with the advancement of growth. With increasing pre-treatment concentration of cold 2,4-D, there was significant increase in absorption of applied 2,4-D-¹⁴C in each of the species. However, with increasing concentration, translocation of absorbed 2,4-D-¹⁴C from the treated leaf tended to decrease. Surfactant increased foliar absorption of 2,4-D-¹⁴C in all the species studied. Translocation rate of absorbed 2,4-D-¹⁴C when applied with surfactant was higher only in case of *L. aphaca*.

45. Cytogenetic Abnormalities Induced by Alachlor, Butachlor and 3-4-Dichloropropionilide in Barley. B.D. Singh. Department of Genetics and Plant Breeding, Banaras Hindu University, Varanasi-221 005, Uttar Pradesh, India.

Cytogenetic effects of alachlor, butachlor and 3-4-dichloropropionilide (250, 500, 1000 and 2000 ppm) were studied in barley after seed treatment or a single spray on 45-day old seedlings. During anaphase of mitosis, bridge, laggard and fragments were observed. Herbicide treated seeds showed much higher frequencies of mitotic aberrations than the control. 3-4-dichloropropionilide was more potent than butachlor and alachlor.

Aberrations at MI of meiosis were univalent, non-orientation and precocious separation and at AI were, bridge, laggard and fragment. Herbicides increased the incidence MI and AI aberrations. Alachlor had greater effect than the other two herbicides. The frequency of aberrations in the herbicide sprayed populations was relatively lower than that in the case of seed treatment. It is clear that the three herbicides induce chromosomal aberrations in barley both after seed and spray treatments.

46. Changes in Nitrogen and Sugar Content of Herbicide treated Gram and Raya Plants. Jai Prakash, S.K. Pahwa and Kaushalya Gupta. Department of Agronomy, Haryana Agricultural University, Hissar-125 004, Haryana, India.

Gram (Cicer aeritenum) was sown in a field laid in randomised block design with four replicates. It was treated with fluchloralin (0.25, 0.5 and 0.75 kg/ha), fluorodifen (0.5 and 0.75 kg/ha), nitrofen (1.0, 1.25, and 1.5 kg/ha) and simazine (0.25 and 0.5 kg/ha) one day after sowing. Raya (Brassica juncea) too was sown in field in similar way and was treated with fluchloralin (0.25, 0.5 and 0.75 kg/ha), nitrofen and fluorodifen (0.5, 0.75 and 1.0 kg/ha) one day after sowing. Controls for both the crops were no weeding and hand weeded plots. Plants of both the crops were collected on 30 and 60 days after sowing for estimation of sugars and nitrogen. The gram leaves from herbicide-treated plants in general had less sugars at both stages in comparison to plants from unweeded plots. Sugar content of shoots was higher on 30th day after sowing but varied (2.1 to 6.0%) with treatment on 60th day in comparison to control (2.1%), but in roots it was always more than control. Nitrogen content of different parts did not vary much on 30th day but on 60th day there was considerable variation both within the herbicides and their doses, and control. In Raya, sugar content of leaves from herbicide treated plots was higher on 30th day but varied (5.5 to 10.9%) on 60th day in comparison to plants from unweeded plots (8.3%). Sugar content of roots varied considerably at both the stages. Nitrogen content of roots was higher in treated plants in comparison with control with the exception of nitrofen which caused reduction at both the stages.

47. Soil-Herbicide Studies in Southern Guinea Zone of Niger
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Zaria, Nigeria.

Soil herbicide interaction forms an important study in weed control programmes specifically in the use of preemergence herbicide in rainfed agriculture. These studies aim at determining half life of herbicides in different types of soils to assess residual effects on succeeding crops. Bioassay test developed by Crafts (1942) was used for the studies. The principle of this bioassay test is that plant growth of an indicator plant reflects the toxicity or otherwise of soil applied herbicide. The soils are saturated with herbicides to their field capacity and plant growth is assessed by taking fresh weight after three weeks. The fresh weight of aerial shoots is taken. Plant growth data is transformed into percentage of control. The plant growth for each three weeks period is designated as runs. So the continuous persistence or otherwise of the herbicide is indicated by continuous bioassay test. In this case three runs were conducted.

Atrazine and linuron were used at doses ranging from 0.25 kg/ha to 2.0 kg/ha with groundnut and maize as indicator plants. The test were conducted in three types of soils collected from Ilorin, Kainji and Bodesadu.

The data indicate tolerance of maize and groundnut for low doses of both atrazine and linuron ranging from 0.25 to 1.0 kg/ha and the toxicity of herbicides at higher doses indicate a falling trend from second run to first run.

48. Studies on Residual Life of Soil Applied Herbicides
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The duration of weed control resulting from herbicide applied on the soil is determined by the length of time they retain their toxicity in soil. Emergence of weed species in a particular piece of land subsequent to herbicide treatment will provide a reliable measure of the residual life of herbicides. Utilising this yard-stick

for determining the residual life, a field experiment was initiated in June 1979 in the Agronomy Division Farm of the Indian Agricultural Research Institute. The experimental plots replicated three times were untreated control, diuron, linuron, metribuzin, simazine and atrazine, each at 2 kg/ha and nitrofen, alachlor and fluchloralin (Basalin) each at 4, 4 and 1 total product/ha respectively. The weed spectrum comprised of 7 annual monocot species, 9 annual dicot species, 3 perennial monocots and 1 perennial dicot. The lowest population was observed in the diuron-treated plots. Even the population of the perennial monocot, nutsedge (*Cyperus rotundus*) was virtually absent in diuron-treated plots. The dry weight of weeds was also the lowest with 0.6 kg/3 plots in diuron treatment while it was 12.75, 10.00 and 10.10 and 10.75 kg in control, nitrofen, basalin and alachlor treatments respectively. The dry weight under metribuzin, simazine, atrazine and linuron varied as 1.50, 2.00, 2.45 and 3.70 kg respectively. These results indicated that diuron had the longest residual life while nitrofen, alachlor and fluchloralin had the lowest residual life.

50. Residual Effect of Herbicides Applied to Intercropped Sorghum on Succeeding Crops. D. Boobathi Babu, S. Sankaran and V.B. Morachan. Department of Agronomy, Tamil Nadu Agri. University, Coimbatore-641 003, Tamil Nadu, India.

A major problem arising from herbicide usage in sorghum is associated with phytotoxic residues that remain from one season to the next and injure sensitive crops grown in rotation. Hence the residual effect of pre-emergence herbicides viz., alachlor 1.0 and 1.5 kg/ha and dinitramine 0.3 and 0.5 kg/ha applied to intercropped sorghum was studied on succeeding crops viz., maize, finger millet, pearl millet, foxtail millet, proso millet and sunflower. Data from the experiments revealed no adverse effect of the herbicides on germination and dry matter accumulation of the test crops studied; indicating no residual phytotoxic effect of these herbicides.

51. Studies on the Residual effect of different Herbicides applied to Cotton on the Preceding Crops of Barley, Taramira and Wheat. H.S. Brar and H.S. Gill. Department of Agronomy, Punjab Agricultural University, Ludhiana, Punjab, India.

The soil residues of different herbicides applied to cotton (fluchloralin 1.20, 1.68, trifluralin 0.4, 0.96; oxadiazon 1.0, 1.5; sirmate 3.6, 4.5; diuron 0.8, 1.2; nitrofen 1.90 and diuron 0.4 + MSMA 2.4 kg/ha) and their safety to crops of wheat, barley and taramira which followed cotton was studied under field conditions of Punjab Agricultural University, Ludhiana during 1973-74 and 1974-75. To study the persistancy of herbicides, a bioassay experiment was conducted during both the years on loamy sand soil.

The data on emergence counts, plant height, yield contributing characters and yield in case of wheat, barley and taramira were recorded. None of the herbicidal treatments given to the cotton crop showed any adverse effect on the germination, growth and yield of these crops sown after cotton. Even the herbicides like diuron, which was phytotoxic to cotton crop on light textured soil, failed to show any phytotoxicity to these preceding crops.

52. Physiological Effects of Herbicides on Wheat. N.C. Sinha and B.D. Patil. Weed Ecology and Control Division, Indian Grassland and Fodder Research Institute, Jhansi-284 003, Uttar Pradesh, India.

In a pot culture experiment, foliar spray of herbicides simazine (10^{-6} and $10^{-9}M$), diuron (10^{-6} and $10^{-9}M$) and 8 hydroxyquinoline (10^{-4} and $10^{-5}M$) was made 30 and 45 days after planting wheat. The irrigation was scheduled at wilting stage to field capacity. Foliar spray of both diuron and simazine stimulated photosynthesis, relative water and proline contents percent stomatal closure and inhibited respiration process. Lower dose of diuron caused more stimulation in comprision to both levels of simazine. Simazine at higher concentration did not appreciably influence these physiological functions but reduced the assimilatory capacity and final grain yield.

Inhibitor 8-hydroxyguinoline ($10^{-4}M$) with different mode of action than diuron and simazine showed distinct enhancement in stomatal closure with concomitant reduction in photosynthesis and dry matter production which, in turn, resulted in poor grain formation.

Proline which acts as reservoir for water and nitrogen under drought condition was increased with sub-lethal level of diuron. This resulted in increased grain yield. Thus diuron can possibly be used as protective practice for crop saving under drought condition.

53. Physiological Effects of Weedicides on Arhar under prolong Drought condition. N.C. Sinha and Patesh Singh. Indian Grassland and Fodder Research Institute, Jhansi, Uttar Pradesh, India.

An experiment was conducted on medium black soil of Indian Grassland & Fodder Research Institute, Jhansi during Kharif 1979 to screen out suitable weedicides enhancing fodder value of arhar (var. Pusa ageti) by studying the physiological effects of weedicides under prolong drought condition. Preplanting application of EPTC (3.0 and 6.0 kg/ha) trifluralin (1.0 and 2.0 kg/ha); preemergence application of metribuzine (0.5, 1.0 and 2.0 kg/ha) and prometryne (0.5 and 1.0 kg/ha) were compared with unweeded control plots. The major weed flora were Cyperus iria, Echinochloa colonum, Bergia capensis and Hylandia latibrosa.

Although all the weedicides were very effective in suppressing the weed flora except EPTC, the crop-stand was higher by the application of metribuzin 0.5 kg/ha, trifluralin 1.0 kg/ha and prometryne 0.5 kg/ha. Plants of trifluralin (1.0 kg/ha) treated plot developed a higher degree of hardiness and drought resistance capacity as evaluated on the basis of stem dry weight/cm of length, and relative water content (rwc) alongwith lower value of chlorophyll stability index (CSI). Thus, under drought condition, trifluralin application 1.0 kg/ha brought marked improvement in photosynthetic pigmentation, assimilation efficiency (76 mg/cm length) and thicker plant canopy, (22.5 cm²/cm length), which, in turn, yielded maximum fodder per plant in terms of protein content and dry matter

production (3.123 g). In spite of having higher photosynthetic pigmentation, metribuzin (0.5 kg/ha) treatment could not bring higher fodder than trifluralin treatment and thus reached third in the treatmental position while prometryne, second. The remaining concentration of different weedicides showed phytotoxic effect and reduced the fodder yield of arhar drastically.

IV. WEED CONTROL IN RICE

54. Weed control as a means of increasing effectiveness of fertilisers in rice production. S. Rani Reddy, S.B. Hukkeri and G.H. Sankara Reddi. A.P. Agricultural University, Tirupati 517 502, Andhra Pradesh and Indian Council of Agricultural Research, New Delhi 110 001, India.

Weed control has been the most laborious but indispensable operation for sound crop production. Presence of weeds in rice field drastically reduced efficient use of fertilisers. Among the tillage practices, the practice of puddling twice at 15 days interval remarkably reduced weed infestation and increased fertiliser efficiency which led to maximum yield of rice. Dry matter of weeds in this treatment was only 550 kg/ha as against 3910 kg/ha in dry ploughing treatment. This practice gave 155.6 per cent increase in grain yield over dry ploughing practice. Fertiliser use efficiency was slightly more in continuous submergence than in partial submergence. Among the weed control treatments, manual weeding was the best for increasing fertiliser use efficiency. Dry weight of weeds was only 3.2 q per ha in this treatment as against 20.3 q per ha in no weeding. Manual weeding resulted in 44.4 per cent increase in rice yield compared with no weeding. Among the two herbicides butachlor (Machete) was superior to propanil (Stam F-34) in increasing fertiliser efficiency. Economics of different treatments indicated that the practice of puddling twice was the best for efficient weed control and maximising grain yield of direct seeded low land rice.

55. Comparative Efficacy of Pre and Postemergent Herbicides on the Yield of Madhu Paddy. D. N. Nagaraj, T. N. Ashok Kumar and K. Krishnamurthy. Department of Agronomy, University of Agricultural Sciences, Hebbal, Bangalore 560 024, Karnataka, India.

A study was undertaken during Kharif 1975 at the Main Research Station, University of Agricultural Sciences, Hebbal, Bangalore, with a view to know the impact of pre-and post-emergent herbicides on weed growth and seed yield of Madhu Paddy. Treatments were penoxalin at 0.66 kg (EC), 1.0, 1.5 and 2.0 kg/ha (G) (3-4 DAT), butachlor at 1.25 kg/ha (both EC and G, 6-7 DAT), benthocarb at 4 kg + 2, 4-D at 1 kg/ha (7 DAT), 2, 4-D at 1 kg (7 DAT) + propanil at 1.05 kg/ha (28 DAT), bentazone at 1.44 kg/ha, hand weeding (twice) and unweeded control.

Penoxalin at 2.0 kg/ha (G) and benthocarb + 2, 4-D combination resulted in higher seed yield (5926 to 5910 kg/ha) owing to better control of weeds which enabled

plants to produce more panicles and grains/panicle. The next best treatments were penoxalin at 0.66 kg (EC) and 1.5 kg(G), 2, 4-D + propanil and hoeing (5598 to 5732 kg/ha) which gave moderate weed control. Bentazone and penoxalin at 1 kg(G) gave lower yield comparable to unweeded control owing to poor weed control efficiency. Thus penoxalin at 2.0 kg (G) and benthicarb at 4 kg + 2, 4-D at 1.0 kg/ha were found promising for weed control in Madhu paddy. (DAT : Days after application)

✓ 56. Screening of Preemergent Herbicides in Paddy Varieties.

B. N. Shivananje Gowda, K. Kenchaiah, K. Krishnamurthy, and V. C. Reddy. All India Co-ordinated Research Programme on Weed Control, University of Agricultural Sciences, Gandhi Krishi Vignana Kendra, Bangalore-560 065, Karnataka, India.

Eight varieties of paddy were screened against eleven preemergent herbicides and one postemergent herbicide (propanil) during summer 1979 in wet land, University of Agricultural Sciences, Bangalore. All these were compared with hand weeding (twice) and unweeded check to know the comparative efficacy of weed control and differential response of varieties to these herbicides. Among the herbicides, penoxalin (EC) at 2 kg/ha produced higher grain yield (6531 kg/ha) than 2,4-D ethylester at 0.8 kg/ha (granule), 2,4-D sodium salt at 0.8 kg/ha, hand weeding, butachlor (G) at 1.25 kg/ha, molinate (g) at 3 kg/ha and benthicarb (EC) at 2 kg/ha (5105 to 5488 kg/ha) due to better control of weeds, while others produced lower yield. Fluchloralin (G) at 0.75 kg/ha gave yield comparable to unweeded check (3652 to 3744 kg/ha).

Among varieties, Jaya, IET-2254, IR-20 (5302 to 5119 kg/ha) gave fairly higher yield followed by IET-2295, Pushpa, Madhu (4585 to 4676 kg/ha) and it was fairly lower in Mangala (4255 kg/ha). Varietal differences were also observed. Higher yields were obtained in IET-2295, IET-1991, IR-20 and Jaya with Penoxalin; IET-2254 in Penoxalin and molinate, Madhu with butachlor, benthicarb and molinate, Pushpa with butachlor and penoxalin and Mangala with benthicarb, penoxalin and butachlor. Plots receiving oxadiazon and fluchloralin in Jaya and IET-2254, nitrogen and bifenox in IET-2295, fluchloralin and bifenox in IET-1991, fluchloralin, bifenox and butachlor in IR-20, oxadiazon (EC) and fluchloralin in Madhu, oxadiazon (G), fluchloralin and propanil in Pushpa and nitrofen, oxadiazon (G) and propanil in Mangala recorded lower grain yield.

✓ 57. Screening of Slow Release Herbicide Formulations in Paddy.

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Two varieties viz. IR-20 and IET-2295 were screened against 14 herbicidal treatments consisting of butachlor, molinate, nitrofen (at various concentration, two forms of peoria (slow release) granule (PG) and granular (G) and combination of these), 2,4-D sodium salt, and propanil during summer 1979 in wet land, University of Agricultural Sciences, Bangalore. These were compared with hand weeding (twice) and unweeded control to know the comparative efficacy of slow release formulations in weed control. Among the herbicides butachlor PG 11% at 0.94 kg + butachlor G 10% at 0.31 kg/ha (5204 kg/ha), molinate PG 24% at 2.25 kg, butachlor G 11% at 0.94 to 1.25 kg/ha (4912 to 4945 kg/ha) gave grain yield similar to hand weeding (4922 kg/ha), while others produced lower yield. Unweeded check produced the lowest seed yield (2894 kg/ha) due to weed competition which reduced the number of spikelets/panicle and 1000 seed weight.

Herbicides differed in controlling monocot and dicot weeds. Butachlor PG 11% at 0.94 kg to 1.25 kg and butachlor PG 11% at 0.94 kg + butachlor G 10% 0.31 kg/ha controlled both monocots and dicots, while others were more effective on dicots. Between granular forms peoria form of butachlor, molinate and nitrofen gave better control of weeds for a longer period right from early stage than their normal granular formulation and eventually produced more grain.

58. Relative Efficiency of Granular and Emulsifiable Forms of Herbicides on Direct Seeded Rice. M. S. Soundar Rajan, K. Ramakumar Reddy, V. Venkataramana Reddy and G. H. Sankar Reddi. Department of Agronomy, Andhra Pradesh Agricultural University, Tirupati, Andhra Pradesh, India.

Field experiments were conducted in two summer seasons on direct seeded rice (Oryza sativa L.) to find out the relative efficiency of granular and emulsifiable forms of herbicides. The treatments consisted of preplant application (15 days before seeding) of emulsifiable forms of fluchloralin, butachlor, nitrofen, alachlor and 2,4-D Na salt at 0.48, 0.90, 1.00, 2.00 and 1.20 kg/ha respectively. The postemergence treatments consisted of application of granular forms of amiben, weedex, nitrofen and butachlor at 2.00, 0.80, 1.60 and 1.00 kg/ha respectively. These were compared with no weeding, hand weeding twice and postemergence application of propanil at 1.225 kg/ha. All the emulsifiable forms of herbicides controlled weeds effectively comparable to hand weeding as reflected in low weed dry weight and increased number of panicles. Granular forms of herbicides were ineffective in checking weed dry matter production. The grain yield was significantly increased due to preplant application of emulsifiable forms of herbicides. Maximum grain yield and net return in both the seasons was obtained with preplant applications of 0.90 kg/ha of emulsifiable form of butachlor.

59. Effect of Preemergence Herbicides on Weed Control and Yield of Drilled Rice. V. M. Bhan, D. B. B. Choudhary and R. A. Maurya. Department of Agronomy, G. B. Pant University of Agriculture and Technology, Pantnagar 263145, Uttar Pradesh, India.

Field studies were conducted to determine the effect of pre emergence application of butachlor (2-chloro-2, 6'-diethyl-N (butoxymethyl) acetanilide) and oxadiazon (e-tertiary butyl 1,4,2'-4-dichloro-5' isopropyl, 1,3,4-oxadiazoline-5-one) on dry matter production of weeds and grain yield of drilled rice. The severity of weeds can be gauged from the grain yield in weedy plots where it was only 1458 kg/ha when compared with 7295 kg/ha in a weed-free plot.

Application of butachlor and oxadiazon increased significantly the grain yield of rice over weedy check but was significantly less than that obtained under weedfree check. The gap between weedfree (obtained by mechanical weeding) check and weed control by herbicides is very wide. This clearly demonstrates the limitation of herbicides, especially the preemergence group, which have activity only for a short duration.

60. Prospects of Different Methods of Weed Control in Direct Seeded Upland Rice. S. S. Kolhe and B. N. Mittra. Agricultural Engineering Department, Indian Institute of Technology (IIT), Kharagpur 721302, India.

Poor weed control is one of the major barriers to higher rice production in upland areas. A field experiment was conducted with three methods of weed control, chemical (butachlor, MCPA and propanil), mechanical (wheel hoe) and cultural (hand weeding) on upland rice, variety Bala, during 'boro' (February-May) 1979 to study the relative efficacy of pre and post emergence herbicides individually and in combination with hand weeding and/or hoeing. Post-emergence application at 2.0 kg/ha 20 days after sowing in combination with hand weeding within rows and hoeing 40 days after sowing had the most beneficial effect on the yield and yield components of rice. This treatment recorded the highest grain and straw yields of 2552 kg/ha and 4594 kg/ha, respectively and gave maximum additional income over unweeded control. Further, the weed growth in terms of dry matter was considerably low. The weed control efficiency was also higher than the treatment with two weedings.

61. Chemical Weed Control in Transplanted Paddy. C. P. Singh and J. R. Ramtane. Agronomy Section, Agricultural Research Station, Konkan Krishi Vidyapeeth, Karjat, Kulaba, Maharashtra 410 201, India.

A field experiment, to study the efficacy of granulated herbicides in transplanted conditions using Jaya variety of paddy, was conducted during 1973-79 and 1979-80 at the Agricultural Research Station, Karjat. During both the years all the herbicides were used as granules except oxadiazon which was used as emulsion and were applied 4 days after transplanting of the crop. The results during 1973-79 indicated that handweeding (twice) treatment recorded significantly highest grain yield over the remaining treatments. None of the weedicides under test proved to be a good control measure. During 1979-80, the weedicide oxyfluorfen (RH-2915) (0.5 kg/ha) recorded significantly highest grain yield. However, the yield differences due to hand weeding and application of herbicides bifenos 2,4-D EE, Exp. 3391, molinate, simetryne MCPB, and oxadiazon were found to be on par with oxyfluorfen. The application of oxyfluorfen caused some toxicity on leaves but after a week the crop recovered.

62. Effect of Nitrogen and Weed Control measures on the Growth and Yield of Upland TTB 4/7 Rice Crop. N. N. Kakati and A. K. Pradhani. Department of Agronomy, Assam Agricultural University, Jorhat, Assam, India.

Weeds are a big menace for the upland rice crop. Application of nitrogen encourage them. Fertilising an upland rice crop without adequate weed control measure is uneconomic. Handweeding is a common weed control practice. Butachlor and Propanil are two popular herbicides for rice. A replicated field experiment with rice cv. TTB 4/7 was conducted during the 'Kharif' 1979 at the Farm of Assam Agricultural University, Jorhat using four levels of nitrogen viz., 0, 30, 60 and 90 kg/ha and six weed control treatments viz., weed free (C1), hand weeding once at 10 days after sowing (C2), hand weeding once at 30 DAS (C3), Butachlor 1.5 kg a.i./ha + hand weeding at 45 DAS (C4), Propanil 2.0 kg a.i./ha + hand weeding at 45 DAS (C5) and Weedy check (C6). The dominant weeds in the experimental area were : Cynodon dactylon, Digitaria sanguinalis and Eleusine indica of grasses, Cyperus iria, C. pilosus and Kyllinga brevifolia of sedges and Azertum conyzoides and Borreria hispida of dicot weeds. TTB 4/7, responded to the application of nitrogen upto 90 kg/ha. The highest response of 11.7 kg grain per kg of the nutrient was observed in 60 kg N/ha. Weeds depleted 22.91 kg N/ha when the nutrient was applied at 90 kg/ha and when the weeds were allowed to grow unchecked. The weeds caused grain yield loss upto 81 per. The reduction in grain yield was primarily due to reduction in panicle numbers caused by either low level of nitrogen or high weed infestation. Single hand weeding at

30 DAS yielded better than its counterpart at 20 DAS. Butachlor was found more effective than propanil in respect of grain yield and control of weeds.
(DAS : Days after sowing)

63. Chemical Weed Control in Rice under semi-dry condition.
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An experiment was conducted at Rice Research Station Pattambi to identify new herbicides for weed control in rice under semi-dry condition. Five herbicides were tried alone and in combination with 2,4-D sodium salt. Echinochloa colonum Link., Cynodon dactylon Pers., Ischaemum rugosum Salisb., Cyperus rotundus L., Cyperus difformis L., Ageratum conyzoides L., Amaranthus viridis L. Phyllanthus niruri L., etc were the major weed species found in the field. Propanil, benthicarb, nitrofen and penoxalin in two doses viz 1.0 and 1.5 kg/ha were sprayed and found to be less toxic to rice seedlings. When the above herbicides were applied in combination with 2,4-D sodium salt (0.5 kg/ha) caused severe phytotoxicity on the seedlings. Penoxalin 1.5 kg/ha recorded the highest weed control efficiency (98.2%). Benthicarb 1.5 kg/ha recorded higher weed control efficiency than benthicarb + 2,4-D sodium salt 0.75 + 0.5 kg/ha. The weed control efficiency was lowered when propanil, nitrofen and penoxalin were applied in combination with 2,4-D sodium salt. Propanil, nitrofen, benthicarb and penoxalin at the dose of 1.5 kg/ha produced higher grain yield than the lower dose (1.0 kg/ha). The combined application of above herbicides with 2,4-D sodium salt reduced the grain yield. Propanil, nitrofen, benthicarb or penoxalin 1.5 kg/ha found to control most of the weeds effectively under semi-dry condition.

64. Effect of Granular Herbicides in the control of Weeds in
Direct Seeded Rice on Puddled Soil. S. J. Pillai, T. F.
Kuriakose and K. J. Joy. Department of Agronomy, Kerala
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An investigation was carried out to assess the efficacy of some of the new granular herbicides in controlling weeds in direct sown rice under puddled condition. The herbicides were applied 6 days after sowing. Pendimethalin 0.75 kg/ha and molinate or simetryne or MCPA (1.8 or 0.1 or 0.1 kg/ha) caused severe phytotoxicity to young rice seedlings. Butachlor + 2,4-D isopropyl ester 0.75 + 0.5 kg/ha and benthicarb/2,4-D isopropyl ester 1.0/0.5 caused slight scorching of leaves.

Piperophos/dimethametryne 0.4/0.1 kg/ha; benzglycerath 0.75 kg/ha and piperophos/2,4-D isopropyl ester 0.33/0.17 kg/ha caused less phytotoxicity on the seedlings but more weeds present in these plots. Benthocarb/2,4-D isopropyl ester 1.0/0.5 kg/ha recorded the highest weed control efficiency (96.1%) and 56.7% increase in grain yield over unweeded control. There was less number of panicles per square meter in pendimethalin, benzglycerath and piperophos/dimethametryne treated plots than unweeded check. However the panicle weight in all the herbicide treated plants was higher than control.

65. Influence of Different Herbicides on Weed Control in Direct Seeded Flooded Rice. S. J. Pillai and A. K. Ghosh. Department of Agronomy, Allahabad Agricultural Institute, Allahabad, U.P., India.

A field experiment was conducted to study the efficiency and selectivity of some herbicides. Benthocarb + 2,4-D isopropyl ester 1.0 + 0.5 kg/ha, butachlor 1.0 kg/ha, butachlor 1.0 kg/ha and 2,4-D alone 0.5 kg/ha applied 10 days after sowing significantly reduced the plant population and plant height in the initial stages due to phytotoxicity. The combined application of (tank mixture) benthocarb + 2,4-D showed synergistic effect whereas bentazon + 2,4-D showed antagonistic effect with regard to phytotoxicity on rice seedlings. 2,4-D-treated plants produced small leaves looking like onion leaves. Bentazon 3.0 kg/ha and 2,4-D 0.5 kg/ha controlled sedges and broad leaved weeds whereas benthocarb 1.0 kg/ha and butachlor 1.0 kg/ha controlled grasses and broad leaved weeds. The highest weed control efficiency was recorded in treatments with benthocarb + 2,4-D 1.0 + 0.5 kg/ha followed by butachlor and benthocarb 1.0 kg/ha. The combined application of benthocarb + 2,4-D and 2,4-D alone treated plants had taken more number of days for flowering. Hand weeding of direct seeded rice did not remove the weed competition early enough to give higher yield. There was an inverse relationship between the dry weight of weeds in the early stages and grain yield.

(SJP: at present working at Rice Research Station, Pattambi, Kerala)

66. Relative efficiency of Herbicides under Pre and Post-planting Methods of application in Transplant rice. G. C. Tosh and K. C. Nanda. Weed Research Scheme, Orissa University of Agriculture & Technology, Bhubaneswar 751003, Orissa, India.

A field experiment was carried out in kharif 1979 to study the effectiveness of five herbicides under pre and post-planting methods of application in transplanted rice.

The emulsifiable concentrate of fluchloralin, oxadiazon, penoxalin, butachlor and benthicarb at 0.75 kg/ha were applied just prior to planting as pre-planting spray while the post-planting application was made on 7 days after planting mixed in urea. These herbicide treatments were compared with conventional manual method of weeding and unweeded control. Results of the trial showed that pre-planting application of all herbicides gave comparatively better control of weeds than their post-planting application treatments. Pre-planting treatments of fluchloralin, butachlor and penoxalin showed low weed population and low weed weight resulting in more number of panicle-bearing tillers in rice. The pre-planting application of fluchloralin recorded the maximum grain yield (3380 kg/ha) and butachlor (3280 kg/ha) and penoxalin (3190 kg/ha) were next in order. The grain yield in conventional manual method was 3172 kg/ha. The lowest yield was recorded in unweeded control (2780 kg/ha).

67. Evaluation of the Efficiency of New Granular Herbicides for Weed Control in Transplant rice. Anirudha Mishra and G. C. Tosh. Department of Agronomy, Orissa University of Agriculture & Technology, Bhubaneswar 751 003, Orissa, India.

Six granular herbicides were tested 7 days after planting @ 0.75 kg/ha in transplant rice during kharif 1978 and 1979. Fluchloralin (Basalin), penoxalin (Stomp), 2,4-D IPE (Weedex), butachlor (Machete), nitrofen (TOK-E) and benthicarb (Saturn) were compared with unweeded control and cultural method (weeding by rotary weeder followed by a manual weeding) treatments. None of the herbicides tested showed any phytotoxic effects on rice plants. There was significant reduction in the number and dry weight of weeds in treated plots when compared with unweeded control plots. Weed control with basalin was most effective and was closely followed by butachlor, nitrofen and Tok-G and 2,4-D IPE in that order. Maximum grain yield was obtained with basalin (3254 kg/ha) and was followed by butachlor (3185 kg/ha) and nitrofen (3092 kg/ha). The grain yield in the cultural method treatment was 3090 kg/ha while in unweeded control the yield was minimum (2605 kg/ha).

68. The Performance of a Rice Variety 'Aswathy' under Different Methods of Direct Seeding and Weed Control. P. B. Pillai and P. Sreedevi. College of Horticulture, Kerala Agricultural University, Vellanikkara, P.O. Via Mannuthy 680651, Trichur, Kerala, India.

Depressed yield as a result of crop weed competition is one of the important features of direct seeded upland

rice. One field experiment to study the performance of a rice variety "Aswathy" under different methods of direct seeding and weed control in upland rice was conducted at the Rice Research Station, Mannuthy. The treatments comprised combinations of five weed control treatments viz. the application of propanil 1.5 kg/ha, butachlor 2 kg/ha paraquat + 2,4-D 0.6 + 0.56 kg/ha respectively, hand weeding and unweeded control with four spacing treatments viz. 80 cm flow line, 45 cm flowline, 60 cm flow line and 20 x 15 cm dibbling. The least value for mean dry weight of weeds was observed in the hand weeded plots followed by butachlor treated plots. In the case of spacing effects 60 cm flow line showed higher value for the dry weight of weeds. The maximum grain and straw yields were observed in hand weeded treatment followed by butachlor. The effects due to spacing and interaction were not significant. This suggested that butachlor was the best herbicide for controlling weeds in direct seeded upland rice.

69. Comparative Efficiency of Different Formulation of a few Herbicides in Controlling Weeds in Transplanted Summer Rice in Gujarat. C. L. Patel and H. S. Patel. N. M. College of Agriculture, Gujarat Agricultural University, Navsari, Gujarat, India.

With a view to findout one or more suitable herbicides for summer rice in South Gujarat, an experiment was carried out on IR.22 rice during summer 1979 at Navsari to assess the efficiency of liquid and granular formulation of a few rice herbicides. Oxadiazon 25 EC 0.75 kg/ha, oxadiazon 2/G 0.5 kg/ha, nitrofen 7/G 2 kg/ha, butachlor 5/G at 1.5 kg/ha, butachlor 50 EC at 1.5 kg/ha mixed with sand, and also mixed with urea, and fluchloralin 3/G at 0.75 kg/ha, fluchloralin 45 EC at 0.90 kg/ha mixed with sand and also with urea, all applied at 5 DAT, and propanil EC at 0.7 kg a.i/ha applied at 20 DAT were compared with handweeding at 20 and 40 DAT and unweeded control. Data were gathered on weed population at 60 DAT, dry weight of weeds, mean number of panicles and grain and straw yields. The results have indicated that hand weeded plot recorded the minimum population and dry weight of weeds, maximum weed control efficiency (89.6%), mean number of panicles per sq.m.(273), 5003 and 5459 kg/ha of grain and straw yields respectively. Among the herbicides oxadiazon 2/G 0.5 kg a.i/ha was found to be the best as it controlled very effectively sedges with a weed control efficiency of 83.95%. The mean number of panicles, grain & straw yields were also maximum among herbicidal treatments. This was followed by Butachlor 5/G 0.5 kg a.i/ha, Butachlor & Fluchlorain were compatible with fertilizer Urea. None of the herbicidal treatments produce any phytotoxicity in rice seedling.

70. Effect of Methods of Weed Control on performance of Rice Varieties. R. P. Singh and B. Gopal Reddy.

Department of Agronomy, Banaras Hindu University, Varanasi 221 005, Uttar Pradesh, India.

An experiment was conducted to study the rice-weed competition under different methods of weed control and varieties on upland conditions during Kharif 1979. Unchecked competition between weeds and rice throughout the growing period caused maximum reduction in grain yield. In weed control treatments, two hand weeding on 20 and 40 days after sowing had the maximum grain yield followed by preemergence application of butachlor. Among varieties, the maximum grain yield was obtained from medium duration rice variety, IR.8, while the maximum competing ability with weeds was shown by the longer duration variety, Jagannath. Short duration variety, Cauvery, proved poor in grain yield as well as weed competition.

71. Effect of Soil Manipulation, Herbicides and Micro-nutrients on the yield of Transplanted rice. B. K. Mishra and Jitendra Pandey. Department of Agronomy, Rajendra Agricultural University, Bihar, Tirhut College of Agriculture, Dholi, Muzaffarpur, Bihar, India.

An experiment with Cv Jaya was conducted in low land to findout the effect of soil manipulation (P0 soil compaction 1.70 J/cg., P1 puddling and P2 Puddling before transplanting), application of Zn and Fe each at 25 kg/ha and 50 kg/ha and weed control treatments (propanil 3.5 kg/ha 15 days after transplanting butachlor 2.0 kg/ha at preemergence, and handweeding 35 days after transplanting) on the grain yield of transplanted rice in calcareous soil. Among the soil manipulations, compaction gave the highest yield followed by no puddling and puddling. The soil compaction and no puddling treatments did not vary significantly between themselves but they were superior to puddling treatment. Application Zn and Fe gave higher yield but did not reach the level of significance. Weed control treatments gave higher yield over unweeded control. Application of butachlor produced the highest yield followed by handweeding and propanil. Butachlor proved superior to propanil but was at par with handweeding. Its application brought about significant reduction both in weed population and weed dryweight.

72. Effect of Different Methods of Weed Control and Direct Seeding on the Dry Matter Accumulation and Nutrient Uptake of Weeds. P. B. Pillai and P. Sreedevi. College of Horticulture, Kerala Agricultural University, Vellanikkara, Mannuthy 680651, Trichur, Kerala, India.

An investigation to study the effect of different methods of weed control and direct seeding on the dry matter accumulation and nutrient uptake of weeds was conducted at the Rice Research Station, Mannuthy. The experiment had 20 treatment combinations. Weed control treatments include application of propanil, butachlor, paraquat + 2,4-D, handweeding and unweeded control. The different levels of spacing were 30 cm flow line, 45 cm flow line, 60 cm flow line and 20 x 15 cm dibbling. The least value for mean dry weight of weeds was observed in the hand weeded plots followed by butachlor treated plots. In the case of spacing, 60 cm flow line showed higher value for the dry weight of weeds. Nitrogen, phosphorus and potassium uptake by weeds were lowest in the hand weeded treatment. Among herbicides, butachlor resulted in lowest uptake of nitrogen, phosphorus and potassium which was due to the low dry matter accumulation of weeds. The spacing and interaction effects did not show any significant difference.

73. Propanil-Carbaryl Phytotoxicity to Rice. S. P. Sharma, M. Lall and A. Pal. Central Plant Protection Training Institute, Hyderabad 500 030, Andhra Pradesh, India.

Field experiments were conducted in 1978 and 1979 to find out the safe interval between propanil and carbaryl application in transplanted rice var. IET 1444. Carbaryl was applied as tankmix with propanil and 3, 6, 10, 15 and 20 days after the propanil application. Propanil alongwith carbaryl and followed by carbaryl application caused phytotoxicity to rice and reduced the grain yield significantly. However, the adverse effect on grain yield and its attributes was reduced with the increase in interval between the applications of these two pesticides. The severe phytotoxicity and maximum reduction in yield were recorded when propanil and carbaryl were applied together. Propanil alone also caused phytotoxicity and reduced the grain yield, which might be due to the susceptibility of the variety to propanil.

74. Effect of some Granular Herbicides on Weed Control and Yield of Transplanted Rice. B. B. Mandal, P. Bandyopadhyay, P. K. Jana and S. P. Bhattacharyya. Department of Agronomy, Bidhan Chandra Krishi Viswa Vidyalyaya, Kalyani, Nadia, West Bengal, India.

Granular herbicides applied at 4 days after transplanting revealed that butachlor + 2,4-D IPE 15 + 16 kg/ha gave an excellent weed control and kept

the weeds under check throughout the period of crop growth. Oxadiazon 25 kg/ha, C-19490/2, 4-D IPE 15 kg/ha, X-52/2, 4-D IPE 20 kg/ha and butachlor 30 kg/ha also controlled weeds satisfactorily in transplanted rice. Increased grain yield of 32.03, 31.58 and 31.13% over unweeded control was obtained in weed free check, butachlor + 2,4-D IPE 15 + 16 kg/ha and oxadiazon 25 kg/ha treatments respectively.
(Herbicide rate kg total formulation per hectare)

75. Effect of Herbicides on the Response of Micro-nutrients to Transplanted Low Land Rice in Calcareous Soil. Jitendra Pandey and B. K. Mishra. Department of Agronomy, Rajendra Agricultural University, T.C.A. Dholi, Muzaffarpur, Bihar, India.

Field trial with Cv. Jaya was conducted to study the effect of herbicides butachlor and propanil on the response of micro-nutrients Zn and Fe. Butachlor (2.0 kg/ha pre), propanil (3.0 kg/ha post) and handweeding (once) and micro-nutrients Zn and Fe each 25 and 50 kg/ha as zinc sulphate and ferrous sulphate, were tried alone and in combinations. Application of butachlor brought about significant increase in grain yield as compared to propanil but was at par with hand weeding. There was no statistical difference between handweeding and propanil. Application of butachlor gave an extra yield of 9.71 q/ha and 4.31 q/ha over propanil and handweeding respectively. Its application gave complete control of predominant weed species : Paspalum scorbiculatum, Echinochloa crusgalli, Echinochloa colonum, Caesulia axillaris, Fimbristylis spp., Cyperus rotundus, Cyperus luzulae, C. iria, Cynodon dactylon, Juncus spp., and decreased the weed population and weed dry weight significantly as compared to propanil but did not differ statistically to handweeding. Herbicides had no effect on the response of applied micro-nutrients. Application of Zn 50 and Fe 25 gave an increase in grain yield of 14.3 and 3.0 percent respectively over control. Higher application of Fe proved detrimental to crop yield.

76. Effect of levels and times of different herbicides in transplanted rice. M. Singh, R. P. Singh and A. K. Das Gupta. Department of Agronomy, Banaras Hindu University, Varanasi 221 005, Uttar Pradesh, India.

Two postemergence herbicides, Propanil and AC 92553 were tested for transplanted rice variety Jaya during Kharif 1974. Herbicide AC 92553 was applied at 1.6, 2.4 and 3.2 kg/ha and propanil at 2.4 kg/ha only. Both the herbicides were applied on 6 and 21 days after

transplanting. Propanil controlled the weeds better than AC 92553. Application of different herbicides could not bring significant variation in grain yield. However, the maximum grain yield was recorded from the propanil-treated plot at 2.4 kg/ha when it was applied 6 days after transplanting. AC 92553 application gave better grain yield and yield attributes at lower dose (1.6 kg/ha) than at higher dose (2.4 & 3.2 kg/ha). However, weed control efficacy was better at higher dose, irrespective of time of application.

77. New Herbicides for Controlling Weeds of Transplanted Rice.
M. S. Patel, M. G. Jethwa, M. P. Patel and N. R. Patel.
Main Rice Research Station, Agricultural University,
Anand Campus, Nawagam 387 540, Gujarat, India.

In order to test the effect of few new herbicides on weeds in rice fields, an experiment was conducted at the Main Rice Research Station of Gujarat Agricultural University during Kharif 1978 and 1979. The results indicated that the propanil (6.25 l/ha), 2,4-DE (1.00 l/ha), 2,4-DE + propanil (1.00 + 1.50 l/ha), oxadiazon (0.50 l/ha), butachlor (1.50 l/ha) and oxadiazon + 2,4-DE (0.335 + 0.500 l/ha) applied four days after transplanting controlled the weeds effectively and increased the yield significantly. The herbicide 2,4-DE in combination with propanil and oxadiazon has not shown any additional effect. (Herbicide rate : litres total formulation per hectare)

78. Studies on weed Control in Rice with Herbicides.
K. Narayana Rao and K. Mahadeva Gupta. Andhra Pradesh
Agricultural University, Agricultural College, Bapatla
522 101, Andhra Pradesh, India.

A field trial was conducted during kharif 1979 at the Agricultural College Farm, Bapatla with bentazon, fluchloralin, propanil + urea, propanil alone, drepamon and granular formulations of nitrofen, bifenox, 2,4-D isopropyl and ethyl ester, oxyfluorfen and oxadiazon for control weeds in rice. The results showed good control of weeds by bifenox, followed by oxyfluorfen and oxadiazon. Fluchloralin granules were found to be more effective than EC formulation. Maximum grain yield was obtained in the treatment with bifenox 3.20 kg/ha and 2,4-D ethyl ester 0.80 kg/ha. Oxyfluorfen 0.55 kg/ha and nitrofen 3.0 kg/ha were on par with bifenox. Propanil 2.6 kg/ha and propanil 0.87 kg/ha + 3% urea were as good as hand weeding.

79. Fertilizer Use Efficiency in Paddy in relation to Weed Control through Herbicides. T. V. Muniyappa, S. V. R. Shetty, K. Krishnamurthy and B. Shivaraj. Department of Agronomy, University of Agricultural Sciences, Hebbal, Karnataka, India.

A study was conducted during Kharif 1974 and 1975 at Hebbal on Madhu variety of paddy with graded doses of fertilizer (25, 50, 75% of 100 N, 50 P₂O₅, 50 K₂O kg/ha) in combination with 2,4-D ethyl ester at 51.0 kg/ha and butachlor at 2.5 kg/ha. These were compared with 100% of the fertilizer dosage + one handweeding, no fertilizer with 2,4-D ethyl ester and unweeded control in order to know the impact of weed control through herbicides on fertilizer use efficiency. The study indicated that grain yield obtained in 100% fertilizer dosage + one hand weeding (5537 kg/ha) was comparable to the yield obtained in 75% of the fertilizer dosage + 2,4-D or butachlor (5259 to 5104 kg/ha) and 50% of fertilizer dosage + butachlor (5173 kg/ha). This comparable yield inspite of reducing the fertilizer dosage was mainly due to better control of weeds which enabled plants to express their potential in terms of increased panicle number and grains/panicle. This indicates the efficient use of fertilizer through weed control. The grain yield in other herbicidal treatments with reduced fertilizer dosage was significantly superior to unweeded check owing to better control of weeds. Further, the study also indicated that increased application of fertilizer in paddy treated with 2,4-D ethyl ester increased weed control efficiency as evident from decreased weed dry weight in plots receiving higher fertilizer.

80. Chemical Weed Control in Upland Rice. D. N. Borulkar and D. K. Shelke. Department of Agronomy, Marathwada Agricultural University, Parbhani 431 402, Maharashtra, India.

The field experiment was conducted to control weeds in upland rice with three different levels 1, 2, and 3 litres per hectare of propanil as postemergence, three and six weeks after sowing with and without 3 percent urea spray solution as against absolute weed control and using manual methods cultural practices. Keeping the plot free of weeds manually was significantly superior over the other treatments in increasing grain yield. There was no difference in the effect of different levels of propanil applied with or without urea and the weed control treatment by cultural practices.

Post emergence spray of Propanil at 2 litres per ha three weeks after sowing recorded significantly higher yield over control by better weed control. Similarly this treatment gave net profit of Rs 531/-ha as against the Rs 355/- under weed free control.

81. Weeds in Transplanted Rice Culture and their control.

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During kharif 1979, granular forms of different herbicides containing two esters (Isopropyl and Ethyl) of 2,4-D at 1.0 and 1.5 kg/ha Butachlor(G) 2.0 kg/ha Nitrofen(g) 2.0 kg/ha were compared with Propanil 3.0 lit + 2,4-D Na salt 0.8 kg/ha, hand weeding (twice), weed free check and Un-weeded control to test their efficiency in controlling weeds and effect on rice crop. Weed flora in the field were Echinochloa colonum, Cynodon dactylon, Ammania baccifera, Ludwigia spp., Eclipta alba, Monochoria vaginalis, Sagittaria sagittifolia, Cyperus spp., Fimbristylis spp., etc. In this transplanted rice culture under constant submergence broad leaved and sedge weeds constitute the major bulk and they were controlled effectively. The extent of control of total number of weeds was 71% under Butachlor followed by 2,4-D IPE 1.5 kg (70%) and 1.0 kg (67%), 2,4-D EE 1.5 kg (67%) and 1.0 kg (61%), Nitrofen (59%), Propanil + Na salt of 2,4-D (57%) but dry weight of weeds was lower under 2,4-D esters. No consistent difference was observed among yield attributes namely effective tillers per hill, number of fertile florets per panicle and test weight. For a short duration rice variety like Pusha 33-30, application of Butachlor increased the grain % yield by 12.2% followed by 2,4-D IPE 1.5 kg (10%) and 1.0 kg (9.9%), Nitrofen (8.6%), 2,4-D EE 1.0 kg (6.6%) and 1.5 kg (6.4%) and Propanil + Na salt of 2,4-D (0.84%) than un-weeded control. (Herbicide rates are kg a.i/ha)

V. WEED CONTROL IN WHEAT

82. Studies on standardising the rate and time of application of Isoproturon and Metoxuron in controlling Phalaris minor in wheat R.B.L. Bhardeaj Indian Agricultural Research Institute., New Delhi-12, India.

Studies were conducted at the Agricultural Research Sub-station Karnal (Haryana) of the Indian Agricultural Research Institute on a medium textured soil to standardise the rate and time of application of isoproturon (N,N-Dimethyl-N-4 Isopropyl-phenylurea) and metoxuron (N'-(3-Chloro,4-methoxyphenyl) N,N dimethyl urea) for controlling Phalaris minor in wheat. Both the herbicides were applied at 4, 5, 6 and 7 weeks after planting wheat. Each time isoproturon (Tokan 50% a.i.) was applied at 0.75, 1.0, 1.25 and 1.50 kg/ha. Rates of application used for metoxuron (Dosonex 80% a.i.) were 1.25, 1.50, 1.75 and 2.0 kg a.i per hectare. Effectiveness of Isoproturon (in terms of days taken to kill the weeds) increased as the rate of application was increased from 0.75 to 1.50 kg/ha. The 0.75 kg/ha rate applied at 4 and 5 weeks gave as much weed control as obtained at higher rates of application. At 1.0 kg/ha isoproturon gave satisfactory weed control up to 7th week. No phytotoxicity on wheat plants was observed due to application of herbicide thus proving wide dosage range of tolerance of wheat crop to this herbicide and also more time available for controlling the weed. On an average, yield reduction of the order of 60% was caused due to Phalaris minor infestation. Yield increases of the order of 174% were recorded by spraying isoproturon at 0.75 kg/ha. four weeks after sowing. These increases in grain yield were comparable with handweeding. Unlike isoproturon, metoxuron gave good control of Phalaris minor only at 1.50, 1.75 and 2.0 kg/ha. Moreover at 1.5 kg/ha., the herbicide appeared to be effective only when applied at four weeks or five weeks. Delayed application at this rate resulted in less satisfactory weed control. At 1.75 kg/ha however, metoxuron gave satisfactory weed control upto 6 weeks. Yield increase due to metoxuron were in comparison to, hand weeding.

83. Relative Effectiveness of some broadspectrum Herbicides in controlling Grass weeds in Wheat. R.B.L. Bhardwaj, Indian Agricultural Research, Institute, New Delhi-110012, India.

Field experiments were conducted at the Indian Agricultural Research Institute Sub-Station, Karnal (Haryana) to test the relative effectiveness of some broadspectrum herbicides namely Tolkan (N,N-Dimethyl-N-4-Isopropyl-phenylurea), Tribunil (1,3-dimethyl-3-(2-benzthiazolyl)urea), Dosanex (N'-(3-chloro,4-methoxyphenyl)N,N dimethyl urea) and illoxan (Methyl 2-(4-dichlorophenoxy) phenyl) propanoate against Phalaris minor and other weeds associated with wheat crop.

Tolkan gave highly selective control of Phalaris minor as well as many nongraminaceous weeds like Chenopodium album, Anagallis asvensis, Fumaria parviflora, and Carlina oxyacantha which were present in the experimental fields at all dosages ranging from 0.75 to 1.25 kg/ha. When applied about a month (a week after first irrigation) after sowing. Dosanex gave good weed control at 1.5 and 1.75 kg/ha. Fumaria parviflora, however, was not controlled by Dosanex. Tribunil gave excellent control of Phalaris minor and other nongraminaceous weeds at 1.5 kg/ha. Lower doses of Tribunil and Dosanex were slightly less effective. Illoxan at 0.75 kg also gave satisfaction weed control. At higher rates of 1.0 and 1.25 kg/ha. Illoxan appeared to give some setback to the wheat crop. Yield of wheat was increased markedly as a result of effective control of weeds especially Phalaris minor brought about by these herbicides. (In case of herbicides, their trade names were used)

84. Herbicidal Control of Wild Oats (Avena Ludoviciana Dur.) in Irrigated Wheat (Triticum aestivum L.).
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Punjab Agricultural University, Ludhiana, India.

Field studies on the control of wild oats in irrigated wheat on light texture soil (sand 90.2, silt 6.8 & clay 3.0 percent in the top 15 cm soil profile) were conducted during 1977-78 and 1978-79. Flam prop methyl (0.45 & 0.60 kg/ha), benzoyl prop ethyl (1.0 kg/ha) and difenzoquat (1.40 kg/ha) when applied at first node formation (30 to 40 days after sowing) gave an excellent control of wild oats. However, they did not control broadleaf weeds. Barban (0.35 kg/ha) applied at 1.5 to 2 leaf stage of wild oats gave an ineffective control of this weed. Tank mix application of 2,4-D (0.5 kg/ha) with flam prop methyl reduced the weed control efficacy of the latter. 2,4-D was, however, compatible with difenzoquat. Of the broad spectrum herbicides isoproturon as pre (1.25 kg/ha) and post emergence (1.0 kg/ha), metoxuron as pre (1.60 kg/ha) and post emergence (1.20 kg/ha) and methabenzthiazuron as pre (1.05 kg/ha) gave effective control of wild oats and associated broadleaf weeds. Methabenzthiazuron (1.05 kg) as post emergence (30 days after sowing after first irrigation to crop) was much inferior to its pre emergence application and post emergence application of isoproturon and metoxuron. The effective chemical treatments gave better control of wild oats than triallate (1.25 kg/ha; the standard treatment). Differences in grain yield among different treatments were significant during both the years. During 1977-78, maximum grain yield (4450 kg/ha) was recorded under isoproturon pre-emergence followed by metoxuron pre emergence (4380 kg/ha) and flam prop methyl (4310 kg) at 0.45 kg/ha. The handweeded crop and control (no weeding) gave 4080 and 2230 kg/ha grain yield, respectively. During 1978-79, methabenzthiazuron pre emergence metoxuron pre emergence flam prop methyl (lower dose) and barban gave 4250, 4240, 4100, 3920 and 3920 kg/ha grain yield, respectively against 3410 and 2370 kg/ha from control (no weeding) plots.

During 1978-79, methabenzthiazuron as pre emergence gave 4250 kg/ha grain yield against 2490 kg/ha, when it was applied as post emergence after first irrigation to the crop (crop in active tiller; 4 leaf stage).

85. Performance of New Herbicides for Control of Weeds in Wheat under Farmers' field conditions.
S.K.Katyal, B.V.Singh and V.M.Bhan, Department of Agronomy, Haryana Agricultural University, Hissar 125004, Haryana, India.

Adoptive research trials on chemical weed control in wheat were conducted at two locations on farmers field in Sonapat District (Haryana). Post emergence application of methabenzthiazuron (Tribunil) at 0.75 and 1.5 kg/ha, metaxuron (Dozanex) at 1.5 and 1.75 kg/ha and isoproturon (Tolkan) at 0.75 and 1.0 kg/ha were compared with weed free check and unweeded control. The result of the trials revealed that mixed infestations of grassy and broad leaved weeds reduced the grain yield of wheat by 34-40%. Yield losses due to grassy weeds alone were about 37%. Highest grain yield of 4850 and 4894 kg/ha was obtained from weed free plots at Jagdishpur and Jharot villages respectively. Herbicide treatments significantly increased grain yield over weedy check. However, the three herbicides did not differ significantly on their effect on weed control and grain yield.

86. Testing the Efficacy of Herbicides to Overcome the Grassy Weeds in Wheat. S.D.Dhiman, Dharam Pal Sharma, Department of Plant Breeding and Agronomy, Haryana Agricultural University, Hissar 125004, Haryana, India.

Field studies were undertaken to evaluate the comparative efficacy of methabenzthiazuron (N-(benzothiazol-2-yl)-N,N'-dimethyl urea) 1.25 and 1.5 kg/ha, metoxuron (N-(3-chloro-4-methoxyphenyl)-N,N'-dimethyl urea) 1.25 and 1.75 kg/ha, isoproturon 0.75, 1.0, 1.25 and 2.0 kg/ha and terbutryne (2-(tert-butylamino)-4-(ethyl-amino)-6-(methylthio)-S-triazine) 10.75 kg/ha along with hand weeding for the control of grassy weeds under normal conditions at Hissar and late planting conditions at Kaul. Under unweeded check treatment, the population of Phalaris minor was 7.3 and 14.5 plants/m² at University Research Farm, Hissar and Regional Sub Station at Kaul respectively. The dry matter of weeds from this treatment was 3.9 and 26.9 g/m² at Hissar and Kaul respectively. The variation in grain yield between unweeded check and hand weeding was significant at Hissar but not significant at Kaul. Therefore, hand weeding was not effective to overcome the weed problem at Kaul. Methabenzthiazuron and isoproturon were found equally effective and were slightly better than metoxuron and terbutryne. Higher dose of metoxuron and isoproturon reduced dry matter of weeds by 25-40%.

87. Field Evaluation of Methabenzthiazuron for control of Grassy Weeds in Wheat Under Different Agro-climatic Conditions. S.K.Katyial L.C.Godara and R.K.Bag Department of Agronomy, Haryana Agricultural University, Hissar 125004, Haryana, India.

Forty one field demonstrations for evaluating the performance of methabenzthiazuron (Tribunil) were laid out in the Sirsa and Hissar districts of Haryana. Wheat crop grown in two rotations, paddy-wheat and cotton-wheat. Methabenzthiazuron at 1.5 kg/ha was sprayed by both pre and post emergence. In paddy-wheat rotation, the pre emergence application of methabenzthiazuron increased the yield by 27.8% in Sirsa district and 15% in Hissar district. In cotton-wheat rotation pre emergence application increased grain yield by 40% in Sirsa and 15% in Hissar district. When it was applied post emergence in paddy-wheat rotation the grain yield increased was 31% in Sirsa and 17% in Hissar district. Similar observations were recorded where cotton-wheat rotation was followed. The population of Phalaris minor was higher in wheat plot under paddy wheat rotation when compared to cotton-wheat rotation.

88. Studies on Relative Efficacy of pre and post-emergence Application of Herbicides in Controlling Weeds in Wheat. K.C.Gautam. Division of Agronomy, Indian Agricultural Research Institute, New Delhi-110012, India.

Pre and post emergence applications of methabenzthiazuron at 1.4, nitrofen at 1.0, terbutryne at 0.8 and metoxuron at 1.2 kg/ha were compared with unweeded control and repeated weeding treatment for weed control efficiency, crop selectivity and wheat grain production. Results revealed that methabenzthiazuron application either as pre or post was equally effective against Phalaris minor, Avena fatua and broad leaved weeds. Grain yield was significantly increased under methabenzthiazuron as compared to nitrofen pre emergence, terbutryne and metoxuron post emergence application and unweeded control. Nitrofen pre-emergence did not control most of the weeds where as its post-emergence application gave an excellent control of grassy and broad leaved weeds with slight injury to wheat although yield was not reduced at all. Terbutryne and metoxuron when applied pre emergence effected good control of Phalaris minor, Avena fatua, Chenopodium album, Anagallis arvensis and Melilotus spp. and enhanced the grain production of wheat significantly to their post emergence application and unweeded control.

89. Control of Grass Weeds (Phalaris minor and wild Oats) in wheat by Isoproturon V.S.Khandal, May & Baker (India) Ltd., Bombay A.D. Phadke, Rhone-Poulenc, Bombay.

Weed flora and their intensity in 400 wheat fields in Punjab and Haryana were recorded. Fields were randomly

Main flora were P. minor, A. ludoviciana, Chenopodium albur, Lathrus aphaca, Medicago denticulata, F. parviflora, Melilotus indica, Aragallis arvensis and Convovulus arvensis. A. fatua, Lolium temulentum, Poa annua were also noted amongst monocots and Argemona mexicana in dicots.

Isoproturon (50 wp) was tried at 0.75 and 1 kg. per hectare and it was found most effective in controlling the above mentioned weeds at the higher dose, except for F. parviflora where only 75% control was recorded. Convovulus arvensis was also found to be moderately resistant to 1 kg/ha of isoproturon. When used at 30-35 days after sowing isoproturon 1 kg/ha was found suitable for this area and no phytotoxic effect was noted on the crop, even in sandy soil. As a result of broad spectrum activity of isoproturon in controlling weeds, a significant increase in yield (30-80%) was noted. The yield contributing factors such as number of panicles/ m² and 1000 grain weight were found significantly higher in isoproturon treated plots compared to handweeded plots and the current herbicide practice.

90. Reaction of Wheat Genotypes to Herbicides Jitendra Pandey and V.S. Mani Department of Agronomy, I.A.R.I. New Delhi-12, India.

Field trials with two genotypes Arjun and Sonalika three herbicides 2,4-D (0.36 kg/ha) methabenzthiazuron (1.40 kg/ha) terbutryne (0.4 kg/ha) and handweeding and a control to study the reaction of genotypes to herbicides at three levels of nitrogen (40, 80 and 120 kg N/ha) was carried out during rabi season for two consecutive years. All the three chemicals reduced the weed population and amongst them methabenzthiazuron and terbutryne applied pre emergence were found more effective than 2,4-D applied 35 days after sowing. Methabenzthiazuron had an edge over terbutryne in checking the accumulation of dry matter by weed growth. Increasing level of N suppressed the weed growth but promoted the accumulation of the dry matter by weeds leading to greater amount of depletion. Weed growth removed the nitrogen to the extent of 18 kg N/ha. Weed control treatments on an average increased the grain yield by 400 kg/ha over weedy check. In 1976-77 Sonalika out yielded Arjun by 540 kg/ha. This increase was due to greater dry matter production thereby indicating in greater adaptability of Sonalika. Ear number, spikelet number and 1000 grain weight appeared to be stable characters. Ear deformities were observed in Arjun due to 2,4-D applied at post emergence. The weed control treatments manifested their effects on spikelet and grain number per ear and 1000 grain weight. Ear number was unaffected by weed control treatments in both the years. 2,4-D reduced the spikelet number but increased the 1000 grain weight. Protein percentage in grain was also improved due to 2,4-D.

91. Screening of Different Types of Herbicides in Controlling Various Types of Weeds in Wheat.
S.P. Bhattacharya and D.C. Paul, Department of Agronomy, Bidhan Chandra Krishi Viswa Vidyalaya, Kalyani, Nadia, West Bengal, India.

Field experiment was conducted at Bidhan Chandra Krishi Viswa Vidyalaya, Kalyani, during rabi season of 1978-1979 to study the effect of different types of herbicides on the grain and straw yield of wheat and to recommend the most economic dose of herbicides. Application of nitrofen at the rate of 2 kg/ha one day after sowing was found best among the eight treatments in respect to grain (3480 kg/ha) and straw (4650 kg/ha) yield. This treatment could control many noxious weeds like Chenopodium album, Vicia hirsuta, Melilotus alba, Nicotiana plumbaginifolia, Cynodon dactylon etc. It was most unfortunate that none of the herbicides tested could control the Cyperus rotundus satisfactorily but the growth of the same was severely hampered. There was no significant difference between nitrofen at the rate of 2 kg/ha one day after sowing and had weeding at 25 and 50 days after sowing in respect of grain and straw yield. From the data it was quite evident that nitrofen was at par with hand weeding which is disadvantages because of high labour wages and non-availability of labour at the critical period of crop growth. Maximum increase in yield over control was obtained with nitrofen 56.8% and 54% in case of grain and straw respectively. 2,4-D (Sodium salt) at the rate of 0.8 kg/ha 25 days after sowing had no significant difference with nitrofen. 2,4-D had no phytotoxic effect and also controlled most of the predominant broad leaved weeds.

92. Chemical Control of Phalaris minor in Irrigated
A.K. Bhatiya, N.L. Das, S.S. Solanki and J.P. Tiwari
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Weed Control efficiency of nine herbicides was tested in irrigated wheat where Phalaris minor was dominant weed and their influence on grain yield was evaluated. The weed control efficiency was the highest (84.8%) in case of metaxuron 2.5 kg/ha post emergence followed by methabenzthiazuron 1.5 kg/ha pre emergence (82.7%) and methabenzthiazuron 1.5 kg/ha post emergence (64.5%) and penoxalin 1.0 kg/ha pre emergence (64.2%). The highest yield of 2402 kg/ha was produced under treatment of methabenzthiazuron 1.25 kg/ha pre emergence (2369 kg/ha), metoxuron 2.5 kg/ha post emergence (2165 kg/ha) and nitrofen 1.5 kg/ha pre emergence + 2,4-D 1.0 kg/ha post emergence (2114 kg/ha) while under weedy check the yield was 950 kg/ha. The increased yield was attributed to higher number of effective tillers, increased ear length and 1000 grain weight.

93. Weed Control Experiment in Wheat and Barley
M.L.Malla, R.M.Joshi & L.D.Pant, Agronomy
Division, Agronomy Experimental farm Khumaltar,
Nepal.

An experiment on the use of herbicide to control weeds in wheat and barley was conducted on the Agronomy experimental farm during the year 1978-79 with an object of studying the effectiveness of herbicides on weed control. Hence two types of herbicides namely as 2,4-D Na salt and nitrofen were used in different doses as post emergence spray. The dominant weeds were Chenopodium album and Phalaris minor. Chenopodium was effectively controlled by 2,4-D Na salt 0.5 kg/ha. But handweeding giving the highest grain yield of 2574 kg/ha in case of wheat and 4091 kg/ha in case of barley. This indicates that hand weeding checked the growth of Phalaris minor (Herbicide rate: kg a.i/ha).

94. Comparative Efficacy of Herbicides and Their Economics for Weed Control in Wheat. N.N.Angires and S.C.Modgal. Department of Agronomy and Agrometeorology, Himachal Pradesh Krishi Vishva Vidyalaya, Palampur-176062. Himachal Pradesh, India.

Wheat crop under midhill conditions of Himachal Pradesh is usually invaded by both broadleaved weeds like Cornopus didymus, Ranunculus arvensis, Vicia sativa, Setaria media and grassy weeds like Avena fatua, Phalaris minor, and Lolium temulentum. A field experiment was conducted for two years at Palampur on acidic clay loam soils to study the comparative effectiveness of various herbicides alone and in combination in controlling these weeds in wheat crop. During 1975-76, application of 2,4-D 0.5 kg/ha as pre emergence was found to be most economical followed by butachlor 1.5 kg/ha (pre emergence) + 2,4-D 1 kg/ha (post) and terbutryne 0.80 kg/ha (post emergence). These treatments, however, did not influence wheat yield. On the basis of percentage efficacy of weed control, butachlor 1.5 kg/ha (pre emergence) + 2,4-D 1 kg/ha (post emergence), was the best treatment followed by 2,4-D 0.5 kg/ha (post emergence). But in 1976-77, application of 2,4-D 1 kg/ha (post emergence) proved to be economically the best though differences in grain yield due to triallate 1.25 kg/ha (presowing) + nitrofen 1.25 kg/ha (pre emergence) + 2,4-D 1 kg/ha (post emergence), triallate 1.25 kg/ha (presowing) + 2,4-D 1 kg/ha (post emergence), terbutryne 0.8 kg/ha and 1.0 kg/ha and 1.0 kg/ha (post emergence and pre emergence), respectively, and nitrofen 1.25 kg/ha (pre emergence) were at par with one another. From the percentage weed control efficiency point of view, triallate 1.25 kg/ha (pre sowing) + nitrofen 1.25 kg/ha (pre emergence) + 2,4-D 1 kg/ha (post emergence) treatment was the best, followed by terbutryne 0.8 kg/ha (post emergence).

Alachlor alone and in combination with 2,4-D had good weed control efficacy, but was found toxic for the wheat crop.

95. Chemical Weed Control in Dwarf Wheat, C.R. Baisen and J.P. Tiwari, Department of Agronomy, JN Krishi Vishwa Vidyalaya, Jabalpur-482004 Madhya Pradesh, India.

Field trial was conducted to find out suitable herbicides for control of mixed population of narrow and broad leaved weeds in dwarf wheat variety Sonalika. The weed flora consisted of Phalaris minor, Cynodon dactylon, Melilotus spp., Chenopodium album, Portulaca oleracea, Vicia spp. and Anagalis arvensis. The results indicated that out of the 7 herbicides tried penoxalin 1 kg/ha as pre emergence, Metoxuron 1 kg/ha and methabenzthiazuron 0.75 kg/ha both as pre and post emergence, Terbutryn 0.75 kg/ha as post and nitrofen 1 kg/ha as pre + methabenzthiazuron 0.75 kg/ha as post emergence gave effective control of Phalaris minor, Chenopodium album, Melilotus spp., and Portulaca spp. in comparison to other treatments. Improvement in yield attributing characters like effective tillers, ear length, and number of grains per ear was observed under treatments penoxalin, metoxuron, metoxuron + nitrofen, and methabenzthiazuron. As regards grain yield, penoxalin 1 kg/ha pre (27.78 q/ha), metoxuron 1 kg/ha post (25.11 q/ha) nitrofen 1 kg/ha pre + metoxuron 0.75 kg/ha post (27.11 q/ha) and methabenzthiazuron 0.75 kg/ha post (24.51 q/ha) were at par and gave significantly higher yield over weedy check (14.05 q/ha). These herbicides yielded 2 to 5 q/ha more than one hand weeding 4 weeks after sowing.

96. Influence of Herbicide Application on Ear and Grain Growth of Wheat. J.P. Tiwari, and C.R. Baisen, Department of Agronomy, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur-482004, Madhya Pradesh, India.

In a field experiment the influences of herbicides applied as preplant (trifluralin 1 kg/ha, fluochloralin 0.5 kg/ha), preemergence (nitrofen 1.5 kg/ha; methabenzthiazuron 0.6 kg/ha; isoproturon 1.5 kg/ha metoxuron 1 kg/ha; terbutryn 0.75 kg/ha) and pre-emergence + post emergence (methabenzthiazuron 0.6 pre + terbutryn 0.75 post; terbutryn 0.75 kg pre + terbutryn 0.75 kg post; nitrofen 1.5 kg pre + 2,4-D E.E. 0.5 post; metoxuron 1.0 kg pre + methabenzthiazuron 0.6 kg post emergence pre ha) were studied on ear and grain growth in wheat var Sonalika.

The post emergence application of terbutryn (0.75 kg/ha) and methabenzthiazuron (0.6 kg/ha) reduced the grain growth as evidenced from dry weight increment at different intervals. However, it was noted that the ear and grain weight reduction due to post emergence treatments of these

herbicides was similar to weedy check. The reduction in grain weight per ear was mainly due to reduction in seed size and not due to reduction in seed primordia as the number of seeds per ear did not reduce as compared to pre emergence treatments. The grain weight was also reduced due to post emergence application of 2,4-D E.E. (0.75 kg/ha). The ear and grain weight under pre emergence treatments were higher than weedy check as well as post emergence application. The reduction under weedy check was due to the competition stress. The deleterious effects on crop growth under post emergence application resulted in reduction in grain yield per hectare.

97. Weed Management in Wheat, Jitendra Pandey
Department of Agronomy, Rajendra Agril. University
T.C.A. Dholi, Muzaffarpur, Bihar, India.

Weed is a major pest of wheat and its infestation reduces crop yield by 30 to 50%. Orissa weeds are of serious problem in dwarf wheat in the recent past and their control with existing methods is not very effective. Application of 2,4-D (35 days after sowing) gives effective control of broad leaf weeds but is ineffective on grassy weeds. Pre or post emergence application of some herbicides give excellent control of these weeds. Amongst various herbicides, methabenzthiazuron, metoxuron, isoproturon, terbutryn, nitrogen, barban, triallate, diclofop, methyl and benzyl prop ethyl are very effective. This first four herbicides give effective control of grassy as well as broad leaved weeds, while the others are specific to grassy weeds only. Efficacy of these herbicides differ with dose, time and mode of application, soil moisture, temperature, soil types etc.

Grassy weeds remove about half of the nitrogen than that of wheat and broad leaved weeds approximately 30 kg N/ha if allowed to compete till harvest. Application of herbicides controls weeds and thereby results in a considerable saving of nitrogen for crop use. Their application also economizes the nitrogen dose by regulating the nitrification mechanism in soil. Some of the triazines and substituted urea compounds affect the nitrification process in soil. Metoxuron affects the CO₂ evolution as well as microbial population. Its application suppresses the fungal population in the soil. None of the herbicides which are used for controlling weeds in wheat persist for more than the crop period at normal rate of their application.

98. Weed Control in Maize through Herbicides.
B.Raju, V.C. Reddy and K. Krishnamurthy. All India Co-ordinated Research Programme on Weed Control, University of Agricultural Sciences, Gandhi Krishi Vignana Kendra, Bangalore-560065, Karnataka, India.

A field experiment was conducted on red sandy loam soils of Gandhi Krishi Vignana Kendra, Bangalore, during kharif 1978 to assess the efficacy of different herbicides for controlling weeds in maize (variety - Deccan hybrid) under rainfed conditions. Pre emergent application of alachlor (1.5 kg/ha), bifenox (1.0), fluchloralin (1.5), terbutryne (1.5) and EPTC (2.0) were compared with weed free, unweeded check and normal practice of hand weeding twice (on 20th and 40th) plus earthing up on 20th day. Major weed flora consisted of Digitaria marginata, Cleome monophylla, Eragrostis pilosa, Borreria, Stricta and Cyperus compestris.

Among the herbicides, pre emergent application of terbutryne gave the highest yields (3302 kg/ha), followed by EPTC (3048) which were comparable with weed free (3542) and normal practice (3248). Highest weed control efficiency was obtained by terbutryne application (81.9%) which was not toxic to the crop growth. Bifenox, dicamba, gave lower grain yields (1682 and 2554 kg/ha) which were comparable with check (2531), due to their toxic effect on the crop growth. Though fluchloralin was not toxic on the crop growth, its lower grain yield (2502 kg/ha) is attributed to its inefficiency to control the weeds (weed control efficiency below zero).

99. Screening of New Herbicides for Weed Control and Selectivity in Maize. N.T. Yaduraju, V.S. Mani and Bhagwan Das, Indian Agricultural Research Institute, New Delhi-110012, India.

In a preliminary herbicide screening trial carried out at Indian Agricultural Research Institute, New Delhi, new herbicides like methabenzthiozuron 1.4 kg/ha, metaxuron 0.8 kg/ha, isoproturon 0.5 kg/ha, patrran 1.0 kg/ha and metribuzin 0.35 kg/ha were compared with recommended herbicides like atrazine (1.0 kg/ha), alachlor (2.0 kg/ha) and linuron (0.25 kg/ha) in hybrid maize (EH-4000175) during kharif 1979. Weed free check and unweeded control were included for comparison.

The treatments were replicated three times. Maize sowing was done on 18th July, 1979 and spraying of the herbicides was made as preemergence application to weeds on 26th July, 1979, when the maize was 2-3 leaf stage. The dry matter production of weeds recorded 50 days after sowing indicated that all the herbicides tried decreased the dry matter production as compared to control. The lowest dry matter production was recorded in atrazine treatment, which was on par with all other herbicide treatments except linur on and isoproturon. The plant stand at harvest did not vary significantly amongst the treatments, so also the stover yield and grain yield of maize. Cob number however, differed significantly but only weed free check and atrazine had significantly more number of cobs/plot than unweeded control. The highest grain yield (23.5 q/ha) was obtained with weed free check and alachlor followed by atrazine and patoran. The lowest yield was in metribuzin (1520 kg/ha) closely followed by unweeded control (1680 kg/ha).

100. Effect of Levels of Atrazine and Alachlor on the yield of Seed maize. Jitendra Pandey, N.N.Sharma and C.P.Singh, Department of Agronomy, Rajendra Agril. University, T.C.A.Dholi Muzaffarpur, Bihar, India.

An experiment with composite variety Lakshmi was conducted during Kharif season to evolve suitable method of weed management in maize grown for seed. Results revealed that atrazine at 1.0 kg/ha and alachlor at 2.0 kg/ha were as effective as two hand weedings. The weed control efficiency of the atrazine at 1.0 kg/ha was the highest and weed index the lowest. Its application also proved economic as compared to other treatments.

101. Performance of Simazine Fluchloralin, 2,4-D and Penoxalin on Control of Weeds in Maize with Varying Levels of Nitrogen. J.K.Swain, G.K.Patro and G.C.Tosh Agronomy Division, OUAT, College of Agriculture, Bhubaneswar-3, Orissa, India.

The efficiency of pre emergence application of simazine, fluchloralin, 2,4-D and penoxalin at the same dosage of 1.0 kg/ha was compared with cultivator's practice (two hoeings, weeding and earthing up) and un-weeded check with 40, 80 and 120 kg N/ha in rabi maize during 1978-79 at Bhubaneswar.

The following conclusions were drawn from the study:

(1). None of the herbicides tried showed any deliterious effects in respect of germination of maize. (2) Amongst all treatments, pre emergence application of 2,4-D 1-0 kg/ha very efficiently controlled the dry matter accumulation of weeds 30, 60 & 90 days after sowing. In respect of weed population also 2,4-D was found to be promising, although it was preceded by penoxalin which recorded the minimum dry weight. (3). There was significant increase in weed population and dry matter accumulation of weeds with each increasing levels of nitrogen upto 120 kg N/ha at all stages of growth. (4) While considering the herbicide - nitrogen interactions, 2,4-D with 40 kg N/ha recorded the minimum dry matter accumulation of weeds at all stages growth. The weed population interactions were not significant at 30 & 60 days after sowing. At 90 days after sowing, however, penoxalin with 40 kg N/ha recorded the minimum weed population.

102. Pigment Concentration and Yield of Maize as affected by a few Herbicides. A.N.Rao, School of studies in Botany, Vikram University, Ujjain 456010, Madhya Pradesh presently ICRISAT, Patanchery 502324, Andhra Pradesh., India.

In the present investigation the response of maize against a monolinuron, atrazine, simazine 2,4-D and cyanazine as indicated by pigment concentration and final yield components was studied. When compared to unweeded control all the triazine herbicides at 1 kg/ha increased the total chlorophyll content. At atrazine at 2 and 5 kg/ha and cyanazine and simazine at 5 kg/ha were inhibitory in comparison to their lower rates. Data on grain yield indicated that monolinuron at 0.5 kg/ha was non-toxic to maize while higher dosages were highly toxic, 2,4-D atrazine and simazine caused an increase in grain yield with the increase in concentration upto 2 kg/ha while 5 kg/ha rate was toxic and Cyanazine caused increase in grain yield at 0.5 and 1 kg/ha while 5 kg/ha rates were highly toxic in reduction in grain yield.

103. Weed Control Experiment in Maize M.L.Malla, Miss J.D.Ranjit, B.D.Pathak & K.M.Basnet. Agronomy Division, Agronomy Experimental farm, Khumaltar, Nepal.

The present investigation includes six treatments and was carried out to assess the right dose of herbicides controlling the weeds in maize under upland condition of Khumaltar Agronomy Experimental Farm.

The herbicide atrazine was used in different doses. The main weeds were cynodon dactylon panicum sp. Echinochloa crusgalli Ageratum conizoides and Cyperus rotundus etc. The pre-emergence spray of atrazine 6 kg/ha gave highest grain yield (4010 kg/ha) and lowest weed population and lowest dry and fresh weight of weeds.

Economically the pre-emergence spray of atrazine at the rate of 3 kg/ha gave more profit (i.e Rs.5733) as compared to other treatments which are superior to no weeding. (Atrazine rate: kg total formulation/ha.)

104. Comparative Weed Control Efficiency of Various Herbicides in Grain Sorghum. S.P.SINGH, Division of Agronomy, Indian Agricultural Research Institute (I.A.R.I), New Delhi-110012, India.

Field experiments were conducted under rainfed conditions at Indian Agricultural Research Institute, New Delhi to study the most sensitive stage of sorghum crop for weed competition and to study the relative efficiency of different herbicides. The variations in yield of sorghum were not marked in 1975 but in 1978, weeds caused considerable reduction in sorghum yield when not controlled in early stages of crop growth, i.e upto 30 days after sowing. Maximum grain yield (3290 kg/ha) was recorded in treatment having two hand weedings at 15 and 30 days crop stages. Among the herbicides tested, atrazine @ 0.5 kg/ha pre emergence proved the best. This treatment was statistically at par with hand weeding twice at 15 and 30 day stages. Tribunil 1.0 kg/ha pre emergence proved the next best followed by alachlor 0.5 kg/ha. Combined application of atrazine (0.25 kg/ha) and alachlor (0.5 kg/ha) and atrazine (0.25 kg/ha) and tribunil (0.5 kg/ha) also gave encouraging results.

105. Chemical Weed Control in Sorghum Based Mixed Crops. B.S.Goud Reddy, M.M.Hosmani and T.K. Prabhakara Setty. Department of Agronomy, College of Agriculture, Dharwad, Karnataka, 580005, India.

Effect of three herbicides (alachlor, atrazine and nitrofen) applied each in two concentrations on control of weeds in sorghum based mixed crops (greengram, soybean, blackgram, cowpea, horsegram and redgram) was studied at Dharwad during kharif 1979-80 on black clay loam soils under rainfed conditions.

Alachlor and Nitrofen had no effect on germination of all the mixed crops at 1 kg/ha but at 2 kg/ha alachlor drastically affected the germination of sorghum. Atrazine reduced the germination of all mixed crops to 50% at 1 kg/ha and the effect was more severe at 2 kg/ha, while sorghum was not affected at both levels. Visual observations on crop injury ratings also reveal that all the mixed crops were susceptible to atrazine and sorghum to alachlor. Nitrofen was not injurious to both sorghum and mixed crops. Alachlor was more effective ; control of grassy weeds as compared to nitrofen and atrazine but nitrofen was most effective in control of broad leaved weeds. Dry weight of weeds per 0.25 m² was lowest in Atrazine followed by alachlor and Nitrofen. Grain yield data of sorghum based mixed crops reveal that alachlor was better for mixed crops like blackgram, cowpea and redgram while nitrofen was better for greengram, soybean and horsegram and atrazine was not suitable for any of the sorghum based mixed crops. However, lower doses of herbicides were found to be better in intercropping systems.

106. Control of Sorghum halepense(L.) Pers. in spring
Planted Sugarcane. Govindra Singh and P.C.Pant.
Department of Agronomy, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Nainital 263145, Uttar Pradesh.

Studies were conducted to find out the effect of dalapon, MSMA, paraquat, asulam and their methods of application on the control of Sorghum halepense and the yield of sugarcane. The field was naturally infested with S. halepense (on an average 96 plants/m² counted 30 days after planting of sugarcane). On an average, infestation with S. halepense caused 96.8% reduction in the yield of millable canes. Three applications of dalapon (3 kg/ha) as directed spray without spray shield) and asulam (3 kg/ha as blanket spray) at an interval of 20 days caused significant reduction in the population of S. halepense and millable cane yields in these two treatments were comparable with that of weedfree treatment. Dalapon applied as directed spray with spray shield could not bring down the population of S. halepense appreciably. MSMA and paraquat were not effective in controlling S. halepense. Treatment of manual hoeing (three at an interval of 40 days) could give millable cane yield only 71% of that obtained in weedfree treatment.

107. ✓ Weed Control in Forage Sorghum. Govindra Singh, V.M.Bhan, Ram Prasad and N.C.Paliwal. Department of Agronomy, Govindra Ballabh Pant University of Agriculture and Technology, Pantnagar, Nainital, 263145, Uttar Pradesh, India.

Experiments were carried out to study the effects of weed competition, emergence of weeds in forage sorghum (var. rio) sown on different dates during rainy season and methods of weed control on the forage yield of sorghum. On an average, competition with weeds caused 53.1% reduction in the green forage yield. Competition with the weeds for the first 15 days after sowing had no adverse effect on forage yield. Competition with weeds for the first 30 days after sowing and beyond caused significant loss in forage yield. Total population of weeds was found to be more in later dates of sowing as compared to early dates of sowing which resulted in reduced forage yield. Pre emergence application of atrazine at 1 kg/ha rate controlled weeds satisfactorily and forage yield obtained with this treatment was comparable with the yield in weedfree treatment.

108. ✓ Weed Control studies in hybrid pearl millet.
S.K. Kaushik and R.C. Gautam. Division of Agronomy,
Indian Agricultural Research Institute, New Delhi
110012, India.

Field studies were carried out to determine the most effective method of weed control in hybrid pearl millet (*Pennisetum typhoides* (Burm f.) Stapf. & C.E. Hubb.) under dry conditions. Atrazine at 0.5 and 0.25 kg/ha applied pre emergence with and without one hoeing at weeks 1 and 2, 4-D at 0.5 kg/ha applied post emergence (6 weeks after planting) with and without one hoeing 3 weeks constituted herbicidal treatments. One or two weeding and hoeings in combination or alone and hand weeding twice at 3 and 6 weeks were the other treatments. *Echinochloa crusgalli* (L.) Beauv., *Cynodon dactylon* Pers. and *Trianthema monogyna* L. were the most predominant weed species infesting experimental area. Atrazine at both doses (0.5 and 0.25 kg/ha) with and without one hoeing at 6 weeks, one or two weeding and hoeings or hand weeding twice at 3 and 6 weeks were the most efficient treatments in bringing down weed infestation. These treatments stepped up grain production significantly over unweeded check. 2,4-D did not prove a superior herbicide for pearl millet.

109. ✓ Comparative Efficiency of Herbicides for Weed Control in Finger Millet. B.K. Ling Gowda, Univ. of Agricultural Sciences, Gandhi Krishi Vignana Kendra, Bangalore 560065, Karnataka, India.

Field experiments were conducted during kharif 1974 and 1975 at the Main Research Station, Hebbal under irrigated conditions.

Among the herbicides, neburon at 1.0 kg/ha and 2,4-D Na salt 1.5 kg/ha gave higher grain yields (2,4-D Na salt 1.5 kg/ha gave higher grain yields (2471 and 2369 kg/ha respectively). Then MCPA amine salt at 0.75 kg/ha, 2,4-D ethyl ester at 1.5 kg/ha, 2,4-D slow release at 1.5 kg/ha, picloram at 0.75 kg/ha benthocarb at 2.0 kg/ha and penoxalin at 1.0 kg/ha, owing to their better control of weeds. Weed dry matter recorded at harvest was lowest in 2,4-D Na salt, normal practice (14.3 g/0.5 m²), followed by neburon (16.7 g). The grain yield of neburon and 2,4-D Na salt were comparable with normal practice (2978 kg/ha). The lower yield in other herbicides treatment (429 to 1745 kg/ha) was due to their toxic effect on the germination of the crop.

111. ✓ Evaluation of Herbicides for Control of Weeds in Forage Teosente (Euclaena maxicana). V.M. Bhan, N.C. Paliwal and Ram Parsad. Department of Agronomy, G.B. Pant University of Agriculture and Technology, Pantnagar 263145, Uttar Pradesh, India.

Field experiments were conducted to evaluate the performance of cynazine (2-(4-chloro-6-(ethylamino)-s-triazin-2-yl amino)-methylpropionitrile); alachlor (2-chloro-2', 6'-diethyl-N-(methoxymethyl) acetanilide); nitrofen (2,4-dichlorophenyl p-nitrophenyl ether); simazine (2-chloro-4,6-bis(ethylamino)-s-triazine) and atrazine (2-chloro-4-(ethylamino)-6-(isopropylamino)-s-triazine) along with weed-free and weedy check on the yield of teosente forage and dry matter produced by weeds. Alachlor and simazine were applied at 1, 2 and 3 kg/ha, atrazine 1 and 2 kg/ha, nitrofen 0.5 kg/ha and 2 kg/ha and cynazine 0.75, 1.5 and 2.25 kg/ha as pre emergence spray. Application of cynazine, alachlor, simazine and atrazine increased teosente fodder yield significantly over weedy check. Alachlor at 2 kg/ha increased fodder yield significantly over 1 kg/ha dose during both the years. Similarly cynazine at 2.25 kg/ha gave significantly higher fodder yield over 0.75 kg/ha. Dry matter of weeds was also reduced with application of cynazine, alachlor, simazine and atrazine significantly over weedy check. Nitrofen could not control weeds which resulted in decrease in fodder yield.

112. ✓ Minimization of Preparatory Tillage with the use of Chemical Weed Control in Fodder production of M.P. Chari, R.K. Pandey and Fateh Singh Indian Grassland and Fodder Research Institute, Jhansi-284003, Uttar Pradesh, India.

Experiment was conducted on medium soil during the monsoon season of 1977 and 1978 at I.G.F.R.I., Jhansi. Eight

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treatments viz. direct drilling on untilled land with and without pre sowing foliar spray of gramoxone 2 q/ha, pre emergence application of atrazine 0.75 kg/ha with a cross ploughing (country plough) and a single ploughing (Meston plough) + a cross ploughing (country plough) + a single ploughing (blade harrow) in line sown crop; the above treatment of atrazine with a single ploughing (country plough) + a cross ploughing (country plough) and, a single ploughing (blade harrow) in broadcast sown crop and, manual weeding (4 week crop stage) with a tillage operation consisted of a single ploughing (country ploughing) + a single harrowing (blade-harrow) + a cross ploughing (country plough) in broadcast sown crop were studied. All the tillage operations were employed in randomized block design with 4 replications and plot size 8 x 5 sq.m (gross) and 7 x 4 sq.m (nets). crop was sown in 3rd and 2nd weeks of July during previous and final years, respectively.

In linesown crop of M.P.Chari, pre-em application of atrazine 0.75 kg/ha appeared promising with a tillage operation of a cross ploughing by country plough. This treatment caused a marked reduction in the intensity of annual weeds (broadleaves, grasses and Cyperus irca) and facilitated a establishment of crop which consequently yielded 37 q/ha (d.m.). This treatment proved comparable to the same set of treatment including additional tillage of one ploughing by meston plough + one ploughing by blade harrow and thus saved these two operations. The traditional method of manual weeding with a intensive tillage of single ploughing (country plough) + single harrowing (blade harrow) + a cross ploughing (country plough) in the broadcast sown crop did not prove more efficient over the above mentioned promising treatment inspite of two extra operations. Pre-em. atrazine with a cross ploughing by country plough showed an increasing trend of dry-matter production in row cropping over that of broadcasting. Direct seed-drilling with pre-sowing foliar spray of gramoxone 2 l/ha followed this treatment and marked superior over direct drilling without preparatory tillage and weed control method in fodder production. (Herbicide rate: liters or kg total formulation/ha).

113. ✓ Studies with pre and post emergence Herbicides as well as their Combination for Weed Control in Cotton (*Gossypium hirsutum* L.). H.S.Brar and H.S.Gill Department of Agronomy, Punjab Agricultural University, Ludhiana, Punjab, India.

Present investigations were carried out at the Punjab Agricultural University, Ludhiana during 1973-74 and 1974-75. Studies on pre and post emergence application of herbicides in cotton for controlling weeds reveal that pre-emergence application of trifluralin (0.8 kg/ha), fluchloralin (1.2 kg/ha) and diuron (0.8 kg/ha) were quite effective in controlling annual weeds but failed to control sedges. However, post emergence application of diuron (0.4 kg/ha) and paraquat (0.3 + 0.3 kg/ha) alone failed to control weeds. Similarly the yield under these treatments was at par with unweeded crop. Moreover, supplemental application of diuron/paraquat after pre emergence application of trifluralin, fluchloralin and diuron did not improve weed control efficacy as well as growth and seed cotton yield under these treatments; much of the weed control efficacy in these combinations was conferred by the pre emergence treatments. Even one hand weeding after pre emergence application of herbicides failed to increase the yield significantly over the pre emergence herbicides treatments it was observed that pre emergence application of diuron was phytotoxic to crop plants and hence weed control efficacy of this herbicides was counteracted by the poor plant stand under this treatment. Average seed cotton yield of both years under trifluralin and fluchloralin were 1072 and 1036 kg/ha respectively which was quite comparable with hand weeded crop (1058 kg/ha) and was significantly higher than unweeded crop (629 kg/ha).

114. ✓ Effect of Weed management and Nitrogen Levels on the Yield of Cotton (*Gossypium hirsutum*) K.T.Nagre and M.B.Patil. Panjabrao Krishi Vidyapeeth, Akola, Maharashtra, India.

Studies on the efficiency of chemical weed control and nitrogen management in *Gossypium hirsutum* cotton were undertaken with normal hand weeding, pre emergence spray of diuron 0.75 kg/ha. Pre + Post emergence spray of diuron 0.75 kg/ha, pre emergence spray of diuron 0.75 kg/ha plus post emergence spray of MSMA 3 L/ha and five levels of nitrogen, 0, 20, 40, 60 and 80 kg N/ha, against no weeding control.

Results indicated that weeds reduced the yield of cotton by 85%. Pooled data indicated that normal hand weeding and pre + post emergence spray of diuron 0.75 kg/ha were at par and both recorded significantly more yield than no weeding and Pre-emergence spray of diuron. The weed control efficiency achieved under pre + post emergence application of diuron was 74.4% as against 88.2% with repeated hand weeding. The normal hand weeding is convenient method of weed control but when labourers are scarce and not available, chemical weeding with pre + post emergence spray of diuron is better alternative. Application of 60 kg N/ha was at par with 80 kg N/ha and recorded significantly more yield than 40 kg N/ha.

115. Effect of Methods and Time of Weed Management on the Yield of Deshi Cotton (Gossypium arborum). K.T.Nagre and M.B.Patil Central Research Station, Punjabrao Krishi Vidyapeeth, Akola-444041, Maharashtra, India.

Studies on the methods and time of weed management in Gossypium arborum cotton, variety AKH-4, were undertaken with the combinations of two methods, hand weeding and hoeing and five timings i.e weeding and hoeing after 3 weeks, 6 weeks, 9 weeks, 3 + 6 weeks 3+6+9 weeks from sowing. Results indicated that even though hand weeding had slightly better than hoeing, both methods are equally suitable for weed control in cotton. Yield of cotton was significantly influenced by timing of weed control. On the basis of data of three years, it is indicated that for AKH-4 cotton the critical period of weed competition is between 3 and 9 weeks from sowing and cotton yield was significantly higher due to three hand weedings/hoeings, given at 3, 6 and 9 weeks from sowing than any single operation and also two hand weedings/hoeings given at 3 and 6 weeks.

116. Chemical Weed Control in Cotton with Bifenox and MSMA Herbicides. T.P.Mustafee and Bibhas Ray. R and D Section, Farm Chemicals Ltd., Bombay 400001, India.

Investigations on weed control in cotton (Gossypium spp. variety - "Váralaxmi") under irrigated and rainfed conditions were carried out during Kharif seasons of 1977-79 with bifenox (Methyl 5-(2',4' -dichloropenoxy)-2-nitrobenzoate) and MSMA (mono-sodium methanearsonate) at three locations of Karnataka. Bifenox as pre-and Post-emergence, MSMA as post emergence (one and two applications) and bifenox as pre-emergence followed by MSMA or bifenox as post-emergence were tested in the trials.

In trial No.1, effective weed control (51-75%) with production of 10.9-15.6 q/ha of seed cotton was obtained by pre and post-emergence application of bifenox at 1.0-2.0 kg/ha under rainfed condition. Hand weeding thrice at 25, 50 and 80 days after sowing gave maximum yield (17.4 q/ha). In trial No.2, one post-emergence spray of MSMA at 1.7-3.4 kg/ha showed 53-69% weed control with 14.8-17.0 kg/ha of yield under irrigation, but two sprays rendered 66-85% weed control with 17.7-20.5 q/ha of crop. In trial No.3, bifenox at 0.5-1.0 kg/ha as pre-emergence followed by MSMA at 1.7 kg/ha or bifenox at 0.5-1.0 kg/ha as post-emergence offered 70-92% weed control with 17.7-21.2 q/ha of yield under irrigated condition. Here, hand weeding twice at 25 and 50 days recorded 87% weed control with 19.2 q/ha of cotton.

117. Chemical weed control and its Economics in Rainfed H-4 Cotton (Gossypium hirsutum). V.G.Kurlekar and V. Khuspe. Marathwada Agricultural University, Parbhani 431402, Maharashtra, India.

As the hybrid cotton is widely spaced and cultivated under high status of soil fertility, the weed problem is serious, due to which the seed cotton yield losses are estimated to 30 to 60 per cent. It was, therefore, though worthwhile to study the weed control by chemical and cultural methods, workout the economics and give handy recommendations to growers on weed control in cotton. An agronomic investigation was undertaken in 1975-76 and 1976-77 at Marathwada Agricultural University, parbhani. The treatment were six concentrations of fluchloralin and three times of application alongwith additional treatments, replicated three times in randomized block design. Growth of H-4 cotton, in terms of plant height, leaf area and dry matter per plant and seed cotton yield per hectare, was favourably influenced by presowing and pre emergence application of fluchloralin 2.0 to 3.0 l/ha. Similarly, it could also substantially reduce the weed population, dry weight of weeds and weed index. Post emergence application of fluchloralin proved most ineffective in controlling the weeds. Chemical control of weeds with fluchloralin 2.5 l/ha and diazinon 1.0 kg/ha was economical, although not superior to weeding and interculturing (WI) method, as the gain in yield and net profits with these treatments were fairly high and considerably. Functional analysis of the pooled data indicated that fluchloralin application above 2.345 l/ha was not advisable as it reduced the total yield. Similarly the minimum advisable rate of fluchloralin application was found to be 0.66 l/ha. (Herbicides rates: 1 or kg total formulation/ha).

118. Evaluation of Integrated Methods of Weed Control in Cotton (*Gossypium hirsutum* L.) in Chambal Region of Madhya Pradesh. S.C.Jain, G.S.Bhardwaj and P.C.Jain. All India Cotton Co-ordinated Improvement Project (AICCIP), Jawaharlal Nehru Krishi Vishwa Vidyalaya, Indore M.P., India.

Field studies were carried out to compare the compatibility of integrated methods with conventional methods of weed control (*Gossypium hirsutum* L.) in Chambal region of Madhya Pradesh. Four herbicides, diuron (3-(3,4-dichlorophenyl)-1, 1-dimethyl alachlor (2-chloro-2, '6'-diethyl-N-(methoxymethyl) acetanilide), Fluometuron (1,1-dimethyl-3-(3,3,3-trifluoro-m-lolyl) urea and MSMA (monosodium methanearsonate) were tried alone and in combination. They were also tried in combination with interculture. Imposing one interculture with herbicides applied either at pre or postemergence had an edge both over the singular herbicides as well as the conventional methods, pushing up the mean seed cotton yield from 30 to 158 percent in the former and 1 to 46 percent in the latter. When combined with interculture, the highest yields of 1220 and 690 preemergence in 1973-74 and 1974-75 respectively and 396 kg/ha in MSMA + diuron (1.5 + 0.5) in 1975-76. Amongst the herbicides applied diuron followed by fluometuron at preemergence and MSMA + diuron followed by MSMA and diuron at postemergence were outstanding, giving comparable yields with the conventional methods in two of the three years. Seed cotton yields were reduced to the tune of 942, 628 and 312 kg/ha due to weed competition in 1973-74, 1974-75 and 1975-76 respectively.

119. Chemical Weed Control in Varalaxmi Hybrid Cotton. V.S.Gidhavar and V.R.Koraddi, Department of Agronomy, University of Agricultural Sciences, Agricultural Research Station, Arabhavi, Belgaum Dist:Karnataka, India.

The studies on the effect of herbicides for varalaxmi hybrid cotton under irrigation were made at Agricultural Research Station, Siraguppa, during 1976-77 season. Of the herbicides tried at preemergence, flucloralin 2 kg/ha and diuron 1 kg/ha were found very effective in controlling several weed species and increasing the yield of seed cotton.

120. Effect of Pre-emergent Herbicides on Weed Control and Fibre yield of Jute (*Corchorus capsularis* L.). G.C.Tosh and P.R.Patnaik, Weed Research Scheme, Orissa University of Agriculture & Technology, Bhubaneswar 751003, Orissa, India.

The comparative efficiency of new herbicides (pronamido, butachlor, benthocarb, fluchloralin and chloroxuron) were examined with traditional method of manual weeding in low land.

during kharif 1973 and 1979 at Bhubaneswar. All the herbicides were tried at 1.0 and 1.5 kg/ha applied at pre emergence day after sowing. The predominant weeds were grasses and sedges. The germination and crop stand were little affected by high doses of butachlor, chloroxuron and fluchloralin during both the years. Butachlor at 1.0 and 1.5 kg/ha caused significant reduction in the population of grasses and sedges. Benthicarb at 1.5 kg/ha and fluchloralin at 1.0 and 1.5 kg/ha were next in order and were at par in respect of weed control. Maximum fibre yield was recorded in butachlor at 1.0 kg/ha (3262 kg/ha) Benthicarb at 1.5 kg/ha (3014 kg/ha) and fluchloralin at 1.0 kg/ha (2852 kg/ha) were next in order. The fibre yield in traditional manual weeding treatment was 2740 kg/ha and the best yield 706 kg/ha in un-weeded control treatment.

121. Preliminary studies on the control of Orobanche
Tobacco. G.V.G. Krishnamurty, Ramjilal and K. Nagaraj
Central Tobacco Research Institute, Rajahmundry-
533104, Andhra Pradesh, India.

Thirtynine pesticides were screened in pots to control Orobanche cernua, a serious root-parasite on tobacco. Among 17 were fungicides, 11 nematocides and 11 insecticides. They were tried @ 0.5 ml or 0.5 g/pot as per the type of pesticide formulations. Fifteen days after pesticide application, tobacco seedlings CV CTRI Special were planted in orobanche sick plots. Counts on emerged and underground orobanche shoots were taken 2 months after planting. Among the 17 fungicides, Calixin, Karathene LC-48 and Vitavax-75 WP were highly promising in reducing orobanche emergence. Among the nematocides, Basal 99 G, Lannate 90 W, Nemagon 60 EC and Vapam 40 EC were very effective in orobanche control. None of the 11 insecticides controlled the parasite. Future tests in field with the above 7 pesticides may throw more light on the multiple advantages in controlling soil-borne diseases including orobanche.

In order to select field tolerant cultivars, 40 promising tobacco varieties comprising 39 FCW and 10 air-cured types were screened in field under heavy infestation level. Observations on disease incidence and intensity were taken 75 days after planting. None of the varieties was found tolerant to Orobanche.

122. Effect of Herbicides on Nitrogen uptake by Crop, Weeds and Orobanche, (Orobanche Cernua Loeft.) in irrigated Bidi Tobacco, (Nicotiana tabacum L.).
Y.B. Palled, Y.C. Panchal and V.S. Patil, University of Agricultural Sciences, Dharwad Campus-580005. Karnataka, India.

Four herbicides viz., alachlor, fluchloralin, pebulate, diphenamid and combinations of diphenamid, with chloramben.

EPTC were applied as pre planting sprays to test their efficacy on control of weeds and orobanche in irrigated bidi tobacco (var. S-20) during khari and rabi of 1978-79 at Agricultural Research Station, Nippani. Nitrogen uptake by the crop was maximum 336 kg/ha) in weed free check. Fluchloralin at 1.0 kg/ha and 3.0 kg/ha and diphenamid at 2.0 kg/ha had appreciably higher nitrogen uptake by the crop and were superior to hoeing and other herbicidal treatments. They also reduced nitrogen uptake by weeds, considerably as compared to other treatments. Lowest nitrogen uptake by orobanche was found in pebulate at 1.0 kg/ha closely followed by fluchloralin at 1.0 kg and 1.5 kg/ha.

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WEED CONTROL IN OIL
SEEDS

123. Chemical Weed Control in Groundnut. V.C.Reddy, B.Raju, K.Kenchaiah and K.Krishnamurthy, All India Co-ordinated Research Programme on Weed Control, University of Agricultural Sciences, Gandhi Krishi Vignana Kendra, Bangalore-560065, Karnataka, India.

Studies were conducted with TMV-2 variety on red sandy loam soil, under rainfed conditions during kharif 1978, at Gandhi Krishi Vignana Kendra, Bangalore, to find out the efficacy of different herbicides for controlling weeds in groundnut. Pre-emergent application of nitrofen(2.0 kg/ha), dinitramine(0.5), napropamide(1.0), EPTC(4.0), alachlor(1.0), fluchloralin(1.5), trifluralin(0.5) and oxadiazon (0.75) (granular and EC formulations) were compared with weed-free treatment throughout and normal practice(followed by hand weeding on 30th day) alongwith unweeded check. Major weed flora were Acanthospermum hispidum, Amaranthus viridis, Celosia argentia and Panicum repens. Among the herbicides dinitramine gave the highest yield (1554 kg/ha) followed by alachlor(1255), and nitrofen(1176) which were on par with normal practice(1333) and weed free treatments(1447) due to better control of weeds. The lowest yield was obtained in weedy check(431). Herbicides differed in controlling monocot and dicot weeds. Dinitramine at 0.5 kg, napropamide at 1.0 kg and oxadiazon(EC) 0.75 kg controlled both monocots and dicots while others were more effective in dicots. Nitrofen at 2.0 kg and oxadiazon(EC) 0.75 kg/ha caused toxic symptoms initially and later recovered.

124. Evaluation of Herbicides for Weed Control in Groundnut Var. MH-2. S.P.Singh, S.K.Yadav, (Miss) K.Gupta and V.M.Bhan, Department of Agronomy, Haryana Agricultural University, Hissa 125004, Haryana, India.

Groundnut crop suffers badly if the weeds are not controlled well. In a field trial conducted during 1979-80, seven herbicides viz., prometyne, simazine, nitrofen, fluchloralin, bentazon, oxyfluorfen and pendimethalin were evaluated for weed control in groundnut var. MH-2. This variety is dwarf and bunch type, and has high yielding potential. Fluchloralin was applied as pre plant soil incorporation and bentazon as postemergence spray. Other herbicides were applied as preemergence spray. Weed population at crop harvest was 8.3/m² in plots hand weeded twice which was statistically at par with simazine 1.0 kg/ha and fluchloralin and pendimethalin at 1.0 and 1.5 kg/ha. The weeds were not

controlled effectively by prometryne 1.0 kg, nitrofen 2.0 kg, and bentazon 1.0 and 1.5 kg/ha. Pod yield was maximum (3790/ha) in case of fluchlorolin 1.5 kg/ha which was closely followed by its lower dose of 1.0 kg/ha, hand weeding twice, weed-free treatment and pendimethalin 1.5 kg/ha.

125. Effect of Certain, Herbicides and their Levels on the Control of Weeds as well as Growth and yield of Groundnut. Under Intensive Irrigated Area of Middle Gurarat. C.B. Shah., H.M. Mehta and T.G. Meisheri. Department of Agronomy, Gurarat Agricultural University, Anand, 388110, Gurarat, India.

A field experiment was conducted in kharif 1979 on Agronomy Farm of Anand Campus, on sandy loam soil for the control of weeds as well as to ascertain the effects on yield on groundnut (Arachis hypogaea L.) Var., TG-17. The treatments were: unweeded check, weeded control, (1.5 and 2.5/ha), dalapan (1.0 and 2.0 kg/ha) chloramben (Amiben) (3.0 and 6.0 l/ha). All the herbicides were applied at pre-emergence in 500 l/ha of spray solutions. The data on weed control efficiency was calculated on the basis of dry matter produced. The results indicated that the weed control efficiency of fluchloralin, paraquat and nitrofen were 44, 24 and 20% respectively. The data on the yield of groundnut pods indicated that the application of fluchloralin, nitrofen and paraquat increased the pod yield by 50.7, 46.8 and 46.6% respectively as compared to unweeded control. The yield obtained from weeded control was 57.4% higher as compared to unweeded control. However, this was at par with the herbicidal application. The data on the dry matter production of groundnut indicated that higher yield was obtained from weed control, but this was at par with fluchloralin, nitrofen and paraquat 2.5, 10.0 and 6.0 l/ha. (Herbicide rate: liters total formulation/ha).

126. Weed Control Sunflower in an Integrated Approach, K.T. Krishnegowda, T.V. Muniyappa, B.S. Siddegowda and M.N. Venkataramu, AICRP on Sunflower, G.K.V.K. Campus, U.S.A. Bangalore-560065, Karnataka.

A study was conducted in Kharif 1977, 1978 and 1979 at the Gandhi Krishi Vignana Kendra Campus, University of Agricultural Sciences, Bangalore to know the impact of weed free periods, herbicides and cultural practices on yield of sunflower and weed growth. The treatments were

weed free for first 15, 30, 45 and 60 days after sowing, alachlor, nitrofen (both at 1.5 and 2.0 kg/ha), dichlormate (2.0 and 4.0 kg/ha) (all as preemergent herbicides); hoeing (twice) and unweeded control. Plots kept weed-free for first 45 days gave higher seed yield (1046 kg/ha) than other periods of weeding indicating the critical period of crop weed competition. Of the herbicides, dichlormate at 4.0 kg/ha gave higher seed yield (1067 kg/ha) than other herbicides (929 to 969 kg/ha) which are comparable to hoeing (985 kg/ha). This differential response in yield reflected the differential herbicidal effect on number and growth of weeds. Increase in dosage of dichlormate decreased both number and growth of weeds, while in others only weed number showed a decrease.

127. Weed Control Studies In Sunflower (*Helianthus annuus* L.)
J.S. Sawhney and A.B. Deepak, Department of Agronomy,
Punjab Agricultural University, Ludhiana, Punjab, India.

The present studies were conducted in the spring crop sunflower succeeding autumn potato on light soil at the Punjab Agricultural University, Ludhiana. Alachlor, fluchloralin, methabenzthiazuron and terbutryn applied at 3 levels each were effective to reduce significantly the weed dry matter and at the same time did not show adverse effect on emergence of crop seedlings. Application of the herbicides resulted in significant increases in grain yield in both the years. In 1978, alachlor, fluchloralin and hand weeding with yields of 16.20 to 16.70 kg/ha differed significantly from terbutryn and methabenzthiazuron which had yields of about 1170 kg/ha and all the herbicides proved superior to control (yield 980 kg/ha). The medium level of alachlor (1.25 l/ha) showed maximum yield (1930 kg/ha). However, unlike 1978, the effects of herbicides and their levels were at par in 1979 though significantly superior to that of unweeded control, which was probably due to interference of rains soon after sowing. Percent oil content of sunflower seed was not affected by the herbicides (Herbicide rate: liters total formulation/ha).

128. Differential Response of Safflower Genotypes to Herbicides V.S. Veeranna, T.K. Prabhakara Setty and Y.C. Panchal. University of Agricultural Science, Dharwad Campus, 580005, Karnataka, India.

A field experiment involving five safflower genotypes (A-1, S-144, 168, 83 and 673) and three herbicides (alachlor, nitrofen and trifluralin) along with unweeded check was conducted at Water Management and Salinity Centre

Navalgund, Karnataka on deep black clayey soils during rabi 1976-77 under irrigated conditions. Among the varieties higher yields were obtained from cvs. 83 (13.4 q/ha) and A-1 (13.3 q/ha) as compared to S-144 (8.7 q/ha). Alachlor at 1.25 a.e kg/ha was most effective in controlling weeds (23.4 weeds/6 m²) as against unweeded check (94.3 weeds/6 m²) and gave highest seed yield of safflower (13.6 q/ha) and this was followed by nitrofen at 1.25 a.e kg/ha (11.6 q/ha). Differential response of varieties to herbicides has been noticed. Alachlor has enhanced the seed yields in all the genotypes tested except cv. S-144, while nitrofen had an adverse effect on cvs. 168 and 83. Trifluralin (1.0 a.e kg/ha) had beneficial effect on cv. A-1 and deleterious effect on cv. S-144. The differential response in yield to herbicides were due to variations in yield attributing characters such as number of primary branches per plant, number of capsules per plant, number of seeds per capsule and hundred seed weight.

129. Weeds and Weed Control in Sesame. D.C.Ghosh and S.K.Mukhopadhyay. College of Agriculture (Palli Siksha Sadana), Visva-Bharati University, Sriniketan-731236, Birbhum, West Bengal, India.

Field experiment conducted during kharif 1979 at the College of Agriculture Farm, Sriniketan, Visva-Bharati University showed that pre-emergence application of fluchloralin 0.72 kg/ha at one day after sowing effectively controlled the weeds in sesame fields from the very germination stage of the crop, checked the removal of nutrients by weeds markedly, recorded lower dry weight of weeds than that of other chemical treatments and finally higher seed yield of sesame which was at par with continuous weeding, handweeding twice, wheelhoeing followed by handweeding and fluchloralin 0.72 kg/ha followed by handweeding treatments. Fluchloralin 0.72 kg/ha alone as pre-emergence spray also proved superior in increasing number of capsules per plant, number of seeds per capsule and test weight of seeds. Higher dose of fluchloralin (0.96 kg/ha), however, showed reduction of sesame seed yield due to mortality of sesame plants and stunted growth of plants with fewer capsules in their axils. Pre-emergence application of nitrofen at all doses (1.0 to 2.0 kg/ha) although effectively controlled the weeds but resulted in very poor stand, stunted growth of the crop and ultimately very low seed yield of sesame. Addition of a handweeding treatment 30 days after application of fluchloralin 0.72 kg/ha did not have any advantage over the application of fluchloralin 0.72 kg/ha alone. Therefore, pre-emergence application of fluchloralin 0.72 kg/ha alone at one day after sowing may be used as an effective chemical method of weed control in sesame crop.

130. Screening of Herbicides for Weed Control in Raya.
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Haryana, India.

130. Raya (*Brassica juncea* L.) was sown in a field laid in randomised block design with four replications. Plots were treated with fluchloralin (0.25, 0.5 and 0.75 kg/ha) and with nitrofen and fluoro-difen (0.5, 0.75 and 1.0 kg/ha) one day after sowing. Hand weeding twice and no weeding were kept in addition to herbicide treatments. All treatments of herbicides increased the yield of Raya over unweeded control. Among the herbicides fluoro-difen gave highest yields. The yields obtained with fluchloralin ranged from 1450 to 1710 kg/ha and with nitrofen it was 1510 to 1660 kg/ha, while with fluoro-difen it was 1720 to 1820 kg/ha. Yields obtained with fluoro-difen 0.75 kg/ha (1825 kg/ha) and 1.0 kg/ha (1787 kg/ha) dose were superior to a hand weeded plots (1762 kg/ha).

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131. Screening of Herbicides to Control Weeds in Kharif Crops

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A preliminary herbicide screening trial on Kharif crops grown at Jabalpur was conducted in 1979. The objective ~~was to~~ determine the crop tolerance and weed control efficacy of 9 herbicides on soybeans (Glycin max), urid (Phaseolus munge), mung (Vigna radiata), pigeon pea (Cajanus cajan), groundnut (Arachis hypogaea), niger (Guizotia obýssimia), Sorghum (Sorghum vulgare), maize (Zea mays), ragi (Eleusine coracana) and Kodon (Paspalum scrobiculatum). The herbicides screened consisted of nitrofen 1.0 kg/ha, alachlor 1.0 kg/ha, metribuzin 0.25 kg/ha, oxadiazon 1.5 kg/ha, 2,4-D 0.75 kg/ha, and benthocarb 1.0 kg/ha as pre emergence; fluchloralin 0.5 kg/ha, trifluralin 1.0 kg/ha and penoxalin 1.0 kg/ha as preplant in 500 litres water, along with hand weeding once, ~~hand weeding twice~~ and a weedy check. Weed control efficiency was the highest in oxadiazon followed by alachlor, metribuzin, penoxalin, fluchloralin and trifluralin. Both dicotyledonous and graminaceous weeds were controlled while weeds belonging to cyperaceae emerged later on in all these treatments except oxadiazon. The weed biomass recorded at final stage was the lowest in oxadiazon, followed by penoxalin, fluchloralin, alachlor and trifluralin.

Based on data on crop germination, phytotoxicity and weed control efficiency, penoxalin, fluchloralin, oxadiazon, trifluralin and alachlor were promising for soybeans, urid, mung, pigeon pea, niger and maize. Metribuzin was effective in pigeon pea, kodon, maize and soybeans. Ragi was resistant to nitrofen and 2,4-D only; other herbicides inhibited seed germination. For sorghum, metribuzin was fairly good. Alachlor and nitrofen were promising for groundnut.

132. Screening of Preemergence Herbicides in Soybean and Herbicidal Impact on Weeds.

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A study was undertaken during Kharif 1974 and 1975 at the Agronomy Field Unit, University of Agricultural Sciences, Bangalore with 6 preemergence herbicides viz., methabenzthiazuron (1.0 and 2.0 kg/ha), fluchloralin (1.5 and 2.5 kg/ha), bentazon (1.0 and 2.0 kg/ha), alachlor (1.5 and 2.5 kg/ha), chloramben (1.0 and 2.0 kg/ha) and

in controlling weeds
soybean.

Among the herbicides, methabenzthiazuron (1 to 2 kg/ha) caused slight injury to soybean by causing seedling mortality and suppressing growth, but gave effective control of weeds. The grain yields obtained in fluchloralin (1.5 to 2.5 kg/ha), alachlor (2.5 kg/ha), chloramben (1.0 kg/ha) and nitrofen (1.0 kg/ha) were comparable to hand weeding in view of better control of weeds without injurious effect on crop. This enabled plants to express better growth. While bentazon gave lower seed yield due to nodule suppression in crop and less control of weeds specially monocots. Herbicides differed considerably in controlling weed species. Generally, alachlor was effective against both monocots and dicots, followed by methabenzthiazuron, fluchloralin and chloramben.

133. Effect of Herbicides on Growth and Yield of Lentil (*Lens culinaris* L.)

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Lentil cv. L 9-12 was sown in a field laid in Randomised Block Design with four replications. It was treated with prometryne (0.5, 1.0 and 1.5 kg/ha) and diallate (0.75, 1.0 and 1.25 kg/ha) one day after sowing. Control treatments were no weeding and hand hoeing. Length, fresh and dry weights of shoots and roots of plants were recorded from 15th day to 115th day after sowing at an interval of 25 days. Yield was recorded after harvest. Length of plants from prometryne (0.5 and 1.0 kg/ha) and diallate (0.75 kg/ha) treated plots were more upto 40th day. Thereafter the plants were longer in unweeded plots. Fresh and dry weights of shoots of treated plants were invariably higher at all stages in all the treatments. Roots were slightly shorter in earlier stages in treatments which increased the shoot length in comparison to control but later they have grown longer. Diallate was toxic to crop. Prometryne at all doses and diallate at 0.75 kg/ha gave higher yield over no weeding. In comparison to hand hoeing (18.56 q/ha) only prometryne applied at 1.5 (22.47 kg/ha) and 2.0 kg/ha (20.95 kg/ha) was found superior.

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than one weeding plus one hoeing and chemical weed control through alachlor and diuron. Alachlor and diuron were not found useful because of their adverse phytotoxic effect on crop stand. The most critical period of crop weed competition was between 3 to 5 weeks from sowing.

136.

Chemical Weed Control in Gram (*Cicer arietinum*)

C.R. Bisen and J.P. Tiwari, Deptt. of Agronomy, J.N. Krishi Vishwa Vidyalaya, Jabalpur-482 004, M.P., India.

Field studies were conducted to find out suitable chemical for weed control in gram. Gram, variety J.G.221, was sown under rainfed condition. The dominant weeds were Phalaris minor, Chenopodium album, Melilotus spp. and Vicia spp. Terbutryn 0.75 kg/ha as preemergence showed good control of Phalaris minor and other broad leaved weeds and had no adverse effect on gram crop. Alachlor 0.75 kg/ha and nitrogen 0.75 kg/ha gave control of broad leaved weeds but population of Phalaris minor remained unaffected. Gram showed tolerance to alachlor, nitrofen and methabenzthiazuron used as preemergence. Metribuzone 0.75 kg/ha gave effective control of all the weeds but had adverse effect on gram crop. Terbutryn 0.75 kg/ha as preemergence showed improvement in in yield attributing characters of gram and showed significantly higher yield (8688kg/ha) than other treatments except one hand weeding at 28 days after hoeing (760 kg/ha). Control (weedy check) produced lowest gram yield of 220 kg/ha.

137.

Effect of Chemical and Mechanical Methods on Control of Kharif Weeds in Moong:

M.R. Bajpai, V.D. Apte and G.C. Trivedi, Deptt. of Agronomy, S.K.N. College of Agriculture, JOBNER 303 329, Rajasthan, India.

A field experiment was conducted during Kharif 1979, to compare effect of herbicides and mechanical methods on dry matter production of weeds. Application of two herbicides fluchloralin and nitrofen was done prior to weed emergence at four doses (fluchloralin at 0.4, 0.8, 1.1 and 1.4 kg/ha and nitrofen 0.5, 1.0, 1.5 and 2.0 kg/ha). In mechanical methods one weeding (15 days after weed emergence) two weedings (15, 30 days after weed emergence) and continuous weeding (every week) were included. Continuous weeding proved best among all treatments by giving lowest dry weight of weeds i.e. 21, 35 and 57 kg/ha at 15, 30 and 40 days after weed emergence respectively. Fluchloralin 1.4 kg/ha and nitrofen 2 kg/ha were better than other lower doses of herbicides and one weeding and two weedings as

well in controlling weeds. One weeding and two weedings were inferior than the lowest doses of herbicides in controlling weeds. However, because of extreme drought, crop failed completely and could not be harvested.

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138. ✓ Comparative Efficiency of Different Herbicides for Control of Weeds in Urid: Indu Mehta and D.S. Boonlia, Soil & Water Management Research Station, Nanta Farm, Kota, Rajasthan, India.

Heavy losses in yield due to many flushes of weeds viz., Echinochloa spp., Cyperus rotundus, Dinebra sp, Justicia Quincueangularis, Merremia emarginata, Digera muricata, Cichorium intybus phyllanthus spp and many other monocot and dicot weeds have been recorded in Chambal Command Area, Kota. The study was therefore, initiated to control these weeds through preemergence application of chloramben, nitrofen and alachlor 0.5, 1.0, 1.5 and 2.0 kg/ha and trifluralin 0.25, 0.5, 1.0 and 1.5 kg/ha in comparison to one weeding as well as weedy check. Chloramben and nitrofen 2.0, alachlor 1.0 and 2.0 kg/ha and trifluralin at all the doses tried reduced the weed infested area significantly. The dry weight of weeds (after 40 days of sowing) was less in all the treatments compared to control but significant reduction was observed by all the doses of alachlor, trifluralin and high doses of chloramben. The herbicidal activity of all the chemicals (except that of trifluralin), though persisted, but gradually decreased by harvest time. In case of trifluralin, there was about 67 % reduction in dry weight of weeds as compared to control even at the time of harvest. Trifluralin and alachlor at higher doses could efficiently check the growth of almost all the weeds but satisfactory control of M. emarginata, C. intybus and C. rotundus could not be achieved by trifluralin and of Echinochloa, Dinebra and M. emarginata with alachlor. Chloramben and alachlor 1.0 - 2.0, nitrofen 0.5, trifluralin 0.5-1.5 kg/ha gave higher yield over control but extra ordinary increase (100 and 85 %) in yield was noticed only with trifluralin 1.0 and 1.5 kg/ha respectively.

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139. ✓ Studies on Chemical Weed Control in Black Gram (Vigna mungo L.) O.P. Vats and J.S. Sawhney, Department of Agronomy, Punjab Agricultural University, Ludhiana, Punjab, India.

Studies for finding suitable herbicides and their doses for weed control in an erect growing variety, T-9 of black gram were conducted during Kharif 1973 and 1974 on loamy sand soil at the Punjab Agricultural University, Ludhiana. Three levels each of alachlor (1.5, 2.5 and 3.5

kg/ha), nitrofen (1.25, 1.5 and 2.0 kg/ha) and their three combinations at one half the three dose were included in the study. To these were added, three other treatments, unweeded control, weed-free condition and hand weeding.

In 1973 when the preemergence spray of the herbicides was followed immediately by heavy rains, the highest doses of nitrofen and alachlor were found toxic to crop plants; the latter treatment resulted in a grain yield much lower than that of unweeded control. Mixture of alachlor 0.75 + nitrofen 0.625 kg/ha gave grain yields similar to those obtained in nitrofen at 1.5 kg/ha, weed-free plots and weeding 30 days post-sowing. All the four treatments were superior to unweeded control. In 1974, the lowest doses of alachlor and nitrofen did not prove very effective and recorded grain yields at par with that from unweeded control. The herbicide combinations which maintained their superiority over control in the second year also, gave grain yields comparable with those from weed-free condition and weeding 30 days after sowing. The results indicate that the pre-emergence spray of mixture of alachlor 0.75 + nitrofen 0.625 kg/ha is safe and effective for weed control in black gram.

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140. Herbicides and Rhizobium Culture Studies in Black gram (Vigna mungo L.) and Green gram (Vigna radiata L.) Wilczek, O.P. Vats and J.S. Sawhney, Deptt. of Agronomy, Punjab Agricultural University, Ludhiana, Punjab, India.

The present studies were conducted with black gram (Var. T.9) and green gram (var. ML-1) at Punjab Agricultural University, Ludhiana in 1973 and 1974. Weed control treatments comprised of preemergence spray of alachlor 3.5 l/ha, weed-free check and unweeded control. The inoculation treatments were that of treating the seed with and without rhizobium culture. In 1974, both the herbicides and their combination proved superior in yield over unweeded control. In 1973, only the alachlor-nitrofen mixture was found superior over control. Alachlor applied alone, drastically reduced the yield due to its phytotoxic effect. The grain yields were 1270, 1100, 970 and 770 kg/ha respectively in weed free check, alachlor-nitrofen mixture, nitrofen and alachlor as against 790 kg/ha from the control treatment. Dry matter accumulation of weeds in two years were 1000 to 2000 kg/ha in herbicide treated plots and 10000 kg/ha in the control. In both crops, neither the rhizobium culture effects nor the inoculation effects between rhizobium culture x herbicidal treatments were significant in respect of crop yields, number of nodules and their dry weight. This indicated that nodulation process in these crops was independent of rhizobium culture, herbicidal treatments and their interaction. Herbicidal mixture at the above rate was safe and effective for weed control in black and green gram.

141. WEED CONTROL IN PLANTATION AND ORCHARD CROPS
(TEA, GRAPES, POTIEGRANATE CARDAMUM AND APPLES
AND SUGARCANE.

Effect of some Premiergence Herbicides for Weed Control in Tea. B.Kotoky and V.S.Rao. Tocklai Experimental Station, Jorhat-785008, Assam, India.

Field and pot experiments were conducted in 1979 to study the preemergence activity of several new herbicide on weeds occuring in tea. The weed infestation comprised mo of Borreira hispida (80%), Saccharum spontaneum (10%), Imper cylindrica (5%) and other species (5%). All the new herbicide were applied at 0.5, 1.0 and 2.0 and their effects were compared with those of simazine and diuron, the two preemergence herbicides surrently used in tea, applied at 1.0 and 2.0. The results indicated that at equal rates, oxyfluorfen (Gon) showed greater activity and it persisted for a much longer time than simazine and diuron did. Metribuzin (Sencor) and oxadiazon (Ronstar) also showed promise. Other herbicides, alachlor (Lasso), butachlor (Machete), bentazon (Basagran), fluchloralin (Basalin), ethoufumesate (Nortron) and bifenox (Modown) were found to be less effective.

In other experiments where combinations of preemergence herbicides were applied, tank mixing of 0.5 and 1.0 kg/ha of oxyfluorfen with 1 kg/ha (one half of the recommended rate) of simazine or diuron resulted in much greater weed control activity than when simazine and diuron were applied alone.

142. Control of Perennial Grasses in Tea. S.N.Sarmah, B.Kotoky and V.S.Rao, Tocklai Experimental Station, Jorhat-785008, Assam, India.

Several pot and field experiments were conducted with different herbicides and herbicide combinations for control of Paspalum conjugatum, Axonopus compressus and Imperata cylindrica, the most persistent perennial grasses in tea. For field experiments, weed nurseries of individual weed species were grown. The experiments on Paspalum indicated that glyphosate at 0.3 kg/ha, solubilized glyphosate at 0.3 kg/ha and paraquat + diuron at 0.4 + 0.5 kg/ha and 0.4 + 1.0 kg/ha were most effective. Diuron alone had very little postemergence activity, but when it was tank mixed with paraquat 80% of Paspalum infestation was controlled.

In experiments on Axonopus, glyphosate (0.8 kg/ha) and solubilized glyphosate (0.4 kg/ha) completely eliminated the grass weed infestation. The paraquatdiuron (0.4 + 1.0 kg/ha) tank mix gave effective control both initially and later i. five weeks after application. Diuron alone at 1 kg/ha also controlled 88% of Axonopus infestation. The combination of dalapon-MSMA (3.0+1.0 kg/ha) also showed good activity on this weed.

At the higher rate, 0.8 kg/ha, glyphosate was very effective on Imperata. But at 0.4 kg/ha, it showed only a moderate effect. Tank mixing of 2,4-D sodium salt (0.8 kg/ha), MSMA (0.5 and 1.0 kg/ha) diuron (0.5 kg/ha) or oxyfluorfen (0.38 and 0.75 kg/ha), with the lower rate of glyphosate showed no enhancement in the control of this perennial weed. But when fertilizers like ammonium sulphate, urea and diammonium phosphate were tank mixed at 0.5% with the lower rate (0.4 kg/ha) of glyphosate, Imperata control was similar to that obtained at the higher rate (0.8 kg/ha) of glyphosate.

These results showed that glyphosate, diuron, and paraquat + diuron can give very effective control of these perennial grasses in tea.

143. Conceptual Considerations of Weed Management in Tea Plantations, S.R.Nene . The Alkali and Chemical Corporation of India Ltd., 34, Chowringhee Road, Calcutta 700071, West Bengal, India.

Current reckoning indicates that the rate of development of new chemicals from the Industry is likely to be much greater than the rate witnessed during the last two decades owing to a variety of factors. Even when the new chemicals are discovered, the time required for completion of the elaborate approval procedures will be much longer in future. The availability of a new chemical in India will therefore depend upon several other factors. One major condition viz. establishment of local manufacture has all along proved to be the most difficult to fulfil. It would, therefore be necessary to apply effort on fuller optimisation of the herbicides which are freely available in India. Fortunately Indian Scientists at the TRA and the UPASI who have already proved their competence in meeting the challenges in field research in the past will, no doubt, be able to deal with the new challenges.

144. Effect of Oxyfluorfen on Some Important Weed Species in Tea Plantation. M.S.Ghosh and L.Ramakrishnan. Indofil Chemicals Limited, Bombay-400025, Maharashtra, India.

Oxyflurofen, a new herbicide developed by Rohm and Haas Company as GOAL EC has been tried as preemergence herbicide in young tea in four different agro-climatic zones in North East India i.e Dibrugarh, Jorhat Tezpur and Terrai regions.

Oxyflurofen was evaluated at 0.12, 0.24, 0.36 and 0.48 kg/ha with 3 replications. The experiment was laid out in May 1979 and observations were taken upto October 1979 at an interval of 25, 40, 75, 100, 135 and 165 days after first spray. The herbicide was applied with Aspee Backpack Sprayer with WFN 40 nozzle after cheeling of the plots. Oxyflurofen at all the 4 concentrations was found non injurious to young tea and very effective in controlling 6 obnoxious weeds viz Borreria hispida, Imperata cylindrica, Paspalum conjugatum, Ageratum conyzoides, Cynodon dactylon and Digitaria sanguinalis. Besides other less important weeds like Commelina, Oxalis, Pteridium, Datura, Setaria and Polygonum sps. The initial control of weeds and regeneration of weed varied from 40 to 75 days. Another spray after 75 days with Oxyflurofen (0.06 kg/ha) in combination with paraquat (0.2 kg/ha) gave total control of weeds upto 165 days. Oxyflurofen (0.06 kg/ha) in combination with 2,4-D (0.8 kg) 40 days after first application showed very promising weed control of Borreria sp up to 100 days.

Findings of this experiment revealed that Oxyflurofen can be used at 0.12 kg/ha in young tea even from the year of planting as preemergence herbicide after cheeling followed by postemergence application either at the same or lower concentration (0.06 kg/ha) in combination with Paraquat or 2,4-D as and when necessary can solve the problem of weeds in young tea economically.

145. Effect of Different Herbicides in the Control of *Cyperus rotundus* in the Grape vine. S.M.Kondap, M.R.Reddi, K.Rama Krishna, & G.Satyanarayana and S.N.Reddy. Department of Agronomy, Agricultural College (APAU), Rajendranagar, Hyderabad-500030, Andhra Pradesh, India.

An experiment was conducted in the grape garden of Agricultural College, Rajendranagar, Hyderabad during Kharif 1979 to study the effect of different herbicides in the control of *Cyperus rotundus* which is a major noxious weed in this crop. The herbicides were MSMA (0.875 kg/ha), 2,4-D (2 kg/ha) and glyphosate (1.10 kg/ha). The herbicide 2,4-D was sprayed alone and also in combination with 5% jaggery solution. The treatment 2,4-D + 5% jaggery solution was found to be the most effective treatment in controlling this weed with the mortality percentage of 43.2, 25.7 and 94.3 in first, second and third weed spraying. Whereas in others it was 86.9, 68.2 and 38.2 for treatments MSMA, 2,4-D alone and glyphosate respectively. The mortality percentage due to 2,4-D + Jaggery solution spraying was statistically significant over 2,4-D alone as well as glyphosate. Increased translocation may be the reason for this. No toxic effects were found on the grape vine growth as well as on the production of grapes. This reveals the possibility of chemical weed control of *Cyperus rotundus* in the grape vine.

146. Comparison of 2,4-D Formulations for Weed Control in Pomegranate N.H.Sanghavi, A.V. Patil and J.R.Patil. Mahatma Phule Krishi Vidyapeeth, Rahuri-413722, Maharashtra, India.

The efficacy of slow release 2,4-D recently developed by National Chemical laboratory, Pune was compared with sodium salt of 2,4-D against weeds in pomegranate under Rahuri conditions. The slow release 2,4-D was tried at 10, 15, 20 and 25 kg/ha while 2,4-D (Na-salt) 2.5 kg/ha. The herbicides were applied during dry period i.e. from September to November 1978. It was observed that parthenium (*Parthenium hysterophorus* L) was effectively controlled by all the 2,4-D treatments. Another dicot weed *Punthariphulli* (*Logsea mollis*) was also controlled by all the herbicidal treatments. In general, the application of 20 kg/ha of slow release 2,4-D was found more effective. Further, it was observed that slow release 2,4-D was also effective against monocot weed waghnaakhi (*Digibaria sanguinalis*). However, the herbicides were found ineffective against the ekdandi (*Tridax procumbens*) and the Harali (*Cynodone dactylon*).

147. Problematic Dicot Weeds and Their Control in Sugarcane. B.S.Nadagoudar, G.V.Lokeshwarappa, N.Dwarakanath, C.C. nnaiah and N.A.Janardhanagowda, University of Agricultural Sciences, Regional Research Station, V.C.Farm, Mandi Karnataka, India.

In red sandy loams of South-Karnataka, dicot weeds are more problematic than monocots in sugarcane. Of the six herbicides tested under field conditions for a period of 3 years (1976-77, 77-78 and 1978-79) metribuzin was found to be more effective in controlling all types of weeds. At 1½ months after planting sugarcane dicot weed population was 2 to 3 in 1 m² area where metribuzin was sprayed once at 1 kg/ha as preemergent spray. While at higher concentration of 2 kg/ha with one half at preemergence and remaining half at postemergence dicot weed population was negligible. In unweeded plots the weed population ranged from 86 to 194/m². Weed population continued to be at low even up to 5½ months after planting. Higher dose of metribuzin was toxic to the crop resulting in lower cane yield. With proper weed control using different there was significant improvement in number of tillers per shoot and millable canes harvest.

148. Studies on the Rate of Application of Terbacil, Asulam and Atril-D in Autumn planted Sugarcane. Govindra S. and P.C.Pant. Department of Agronomy, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Nainital-263145, Uttar Pradesh, India.

Studies were conducted to find out the effect of different rates of application of terbacil (1.0, 1.5 and 2.0 kg/ha), asulam (2.0, 3.0 and 4.0 kg/ha) and atril-D (0.5, 1.0 and 1.5 kg/ha) on autumn planted sugarcane and associated weeds. Terbacil was applied as preemergence and asulam and atril-D were applied as postemergence treatments. On an average, millable cane yield was reduced by 52.7% due to the infestation of weeds. Millable cane yields obtained in terbacil and atril-D treated plots were significantly higher than the yields in weedy check plot No. consistent results were obtained with asulam. Terbacil at 2.0 kg/ha and atril-D at 1.5 kg/ha rate of application produced millable cane yields at par with that of weedfree treatment. The major weed population consisted of annual broad leaf weeds and Cyperus rotundus. Asulam was not effective on these weeds.

149. Asulam for weed control in sugarcane. A.K. Ghosh, P. Sarkar and R.D. Singh Department of Agronomy, Allahabad Agricultural Institute, Allahabad-211007, Uttar Pradesh, India.

The effectiveness of asulam for the control of Johnson grass (*Sorghum halpense* (L) Pers.) and other weeds in Sugarcane (*Saccharum officinarum* L.) was investigated during 1977-78 at the Allahabad Agricultural Institute. Single application of asulam at 8.5 and 10 l/ha, 6 weeks after planting (WAP) were compared with repeat application, at 6 and 11 WAP and at each of the two rates of herbicides. Asulam gave effective control of *Sorghum halpense*, *Paspalum sanguinalis* L. and Bermuda grass (*Cynodon dactylon*). Repeat application was more effective than single application for Johnson grass control. Highest sugarcane yield (36.6 tons/ha) was obtained from plot treated with 10 l/ha asulam 6 WAP and the lowest (21.3 tons/ha) from unweeded control.

150. Studies on Chemical Weed Control in Sugarcane (*Saccharum officinarum*). K. Narayana Rao, K. Narayana Gupta, P. Nageswara Rao and S. Bhaskaran, A.P. Agricultural University Agricultural College, Bapatla and Regional Agricultural Research Station, A.P. Agricultural University, Rudrur-503188, Andhra Pradesh, India.

A field trial in sugarcane was conducted at the Regional Agricultural Research Station, Rudrur during 75-76 season with atrazine, terbacil, dichlormate, metoxuron, asulam + iso-octyl ester, asulam + ioxynil + 2,4-D ester, metribuzin and paraquat + 2,4-D. Weed control was good up to 90 days with atrazine, terbacil and asulam + ioxynil + 2,4-D ester and on 120 day none of the herbicides was better than hand weeding in controlling weeds. Maximum cane population was obtained with asulam 3.4 (twice) kg/ha, asulam 3.4 + iso-octyl ester 0.74 kg/ha. Sucrose content was highest in the treatment with asulam 3.4 + ioxynil + 2,4-D ester 0.50 kg/ha followed by paraquat 0.50 + 2,4-D 3.0 kg/ha (twice). Cane yield was maximum under asulam 3.4 kg/ha (twice) followed by asulam 3.4 + iso-octyl ester 0.74 kg/ha. The yields obtained in hand weeding were comparable with under metoxuron 6.8 kg/ha, dicamba 3.0 kg/ha, asulam 3.4 kg/ha (Pre), paraquat 0.50 + 2,4-D 3.0 kg/ha, iso-octyl ester 1.34 + asulam 3.4 kg/ha, iso-octyl ester 0.74 + asulam 3.4 kg/ha. Atrazine, terbacil, dichlormate, metribuzin, metribuzin though controlled weeds gave much reduced yields which could be due to their sub-lethal toxic effects on sugarcane. Among the herbicides asulam 3.4 + iso-octyl ester 0.74 kg/ha and asulam 3.4 kg/ha (twice) can be recommended.

151. Weed Control in Sugarcane. V.S.Khandal, May & Baker (India) Limited, Bombay-400025, India.

Weed flora of sugarcane in Nera valley (Deccan) was noted. Two locations, Sakharwali and Haregaon were selected for this trial. Both the locations have specific flora. Sakharwari farm was predominately infested with dicot weeds, Haregaon was mainly infested with monocot weeds. Asulam and Isooctyl Easter of 2,4-D were tried alone and in combination, with the aim to note the efficacy in controlling weeds in sugarcane. Combination of ASULAM 4 kg. per hectare and ISOCTYL EASTER of 2,4-D @ 0.75 kg per hectare were tried in 2 ways: a single delayed spray programme (5 week after planting) and double spray programmes (Pre emergence spray followed by post emergence spray 7 weeks after first spray). It was noted that at Haregaon double spray programme has given significantly superior results, compared to single delayed application, when at Sakharwari that difference between single spray programme and double spray programme) was not significant. At Haregaon ASULAM alone gave significantly superior weed control, compared to ISOCTYL EASTER of 2,4-D, when at Sakharwari this difference was not significant. Weed flora of above locations mainly comprises of: MONOCOTS:- COMMELINA, BENGHALENSIS; CYNOTIS ARISTATE; CYNDON DACTYLON; P. RAPENS; SETARIA ITATICA. CYPRUS ROTUNDUS DICOTS:- AMRANTHUS V. A. SPINOUS; ACHYRANTHUS ASPERA; SCLANUM XANTH-OCARPUM; DATURA (THORN APPT); IEMOEA SP; CONOVOLULUS ARVENSIS; TRIDAX SP; VIOLEA SP; ARGEMONE MAXICANA; MELILOTUS SP; EUPHORBIA HERTA; E. MICRO EHELIOSCIPIA; PHYLLANTHUS NIRURI ETC.

To note the efficacy of different 2,4-D formulations in a field trial, 2,4-D sodium salt, AMINE & ETYLESTER AND ISOCTYL EASTER were tried. It was found that 2,4-D ISOCTYL EASTER provides better weed control compared to other 2,4-D formulations in Sugarcane.

152. Control of Weeds in Sugarcane through Herbicides Rakesh Mohan and Mosood Alam, Indian Institute of Sugarcane Research, Lucknow-226002, Uttar Pradesh, India.

A series of experiments were conducted to determine the most effective dose singly and in combination of paraquat (gramoxone) and 2,4-D sodium salt (Fernoxone) as also the status of soil moisture for required weed control in sugarcane, were conducted at Indian Institute of Sugarcane Research Lucknow, during the tenure of the Fellowship from ACCI. The mean yield of the two seasons both on spring as well as on winter planted sugarcane revealed the economic dose of 2.5 lt/ha., each when used singly and a tank mixture of the same

strength when used once during the formative phase of sugarcane. The necessity of including a cultural weeding within the frame work of developing herbicide was also evident. The soil moisture status for the effective control through these herbicides was 15 percent total soil moisture. The results were constant in both the years of trials.

153. Dicotyledonous Weeds of Cardamom Estates.
V.S.Korikanthimath and M.N.Venugopal
 Central Plantation Crops Research Institute,
 Research Centre, Appangala, Mercara-5712001
 Karnataka, India.

Cardamom (Elettaria cardamom L.Maton) tracts generally receive heavy rainfall. Sufficient moisture available during most part of the year encourages growth of a rich herbaceous cover. Weed growth is accentuated in the initial years of establishment of cardamom estates and in the open areas. With a view to planning effective control of weeds, list of weeds with special reference to dicotyledonous weeds in cardamom estates is presented in this paper. This paper covers field data regarding the extent of occurrence of weeds, growth characteristics, flowering and fruiting period, dispersal mechanism of the fruits and seeds. Amongst the weeds recorded the members of Asteraceae constitute a major weed flora. Most common weeds encountered are - Ageratum conyzoides, Stemima lavenia, Bidens biternata, Spilanthes paniculata, Strobilanthes urceolaris.

154. Survey and Identification of Weed Flora in Apple Orchards. L.P.Misra and M.K.Seth. Regional Fruit Research Station, Himachal Pradesh, Krishi Vishwavidyalaya, Mashobra, Simla-171007, Himachal Pradesh, India.

The weeds growing in the apple orchards of the Regional Fruit Research Station, Mashobra spread over an area of 23 hectares were surveyed and identified. Most of the weeds belonged to the family Compositae followed by family Gramineae. In all 53 species of weeds belonging to 49 genera and 26 families were identified. The physioclimatic conditions of the research station in which weeds grew are also presented.

WEED CONTROL IN VEGETABLE CROPS

- 155: Control of Weeds in Potato Crop. A.K.Singh and S.S.Saini,
Central Potato Research Institute (CPRI) Simla 171 001,
H.P., India.

Field experiments were carried out for control of Weeds in Potato crop with pre- and post-emergence herbicides at Central Potato Research Station, Jullundur. Application of Alachlor 3.0 Kg/ha, Simazine 0.5 Kg/ha, tribanal 2.0 Kg/ha, metribuzin (Sencor) 1.0 Kg/ha at pre-emergence and propenil 2.5 Kg/ha and paraquat 2.0 Kg/ha at postemergence gave effective control of weeds. Full covering of potatoes at the time of planting and application of suitable herbicides as pre- or postemergence treatment gave similar yields as obtained when normal cultural practices were followed. Thus the hoeing and second earthing up in potato crop could be dispensed with as cultural operations in standing seed crop help in spread of contact viruses like PVX & PVS through man and machine.

- 156: Efficacy of some pre-plant, pre-emergence and post-emergence herbicides for weed control in autumn crop of Potato.
K.S.Randhawa and K.S.Sandhu, Department of Vegetable Crops, Landscaping and Floriculture, Punjab Agricultural University, Ludhiana-141 004, Punjab, India.

Autumn crop of potato is encountered with numerous monocot and dicot weeds which become a great hinderance for its successful cultivation. The traditional methods of mechanical weed control has always vexed the farmers as labour for weeding is increasingly becoming unavailable especially at times when it is needed most.

Field studies were conducted during 1978-79 and 1979-80 to determine the efficacy of fluchloralin at 0.96 kg/ha (preplant), nitrofen at 1.00 kg/ha (preem), dichlormate at 1.35 kg/ha (preem), linuron at 0.25 kg/ha (preem) propanil at 0.85 kg/ha (postem) alachlor at 1.50 kg/ha (preem), paraquat at 0.60 kg/ha (postem), metribuzin at 0.52 and 0.70 kg/ha (preem), and methabenzthiazuron at 1.4 kg, 1.75 kg and 2.10 kg/ha (preem).

These herbicidal treatments were compared with an unweeded control (no weeding), weeded control (weed free), and one weeding and one earthing up. No herbicidal treatment showed any type of phytotoxic effect to the crop. All the herbicidal treatments gave statistically better weed control and yield than the unweeded control. But fluchloralin at 0.96 kg/ha, alachlor at 1.50 kg/ha metribuzin at 0.70 kg/ha and paraquat at 0.60 kg/ha were superior in controlling the weeds and significantly increasing the yield. However these treatments were comparable to weeded control and one weeding + one earthing up contro.

157: Effect of Different Herbicides on Control of Weeds and Yield of Potato (*Solanum tuberosum*). V.M.Bhan, S.S.Tripathi and Govindra Singh. Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, 263145, Uttar Pradesh, India.

Field experiments were conducted to study the relative performance of nitrofen (4-nitro-2, 4-dichloro diphenyl ether), alachlor (N-methoxy methyl-L chloroaceto-2, 6-diethyl anilide), dichlormate (3,4-dichlorobenzyl N-methyl carbamate and 2,3-dichloro-benzyl methyl carbamate), Metribuzin-(4-amino-6-t-butyl-3-(methylthio)-as-Triazin-5(4H)-one), linuron (3-(3,4-dichlorophenyl-1-methoxy-1-methyl urea), propanil (3,4-dichloropropionanilide),

paraquat (1,1-dimethyl-4, 4-bipyridilum dicloride) and fluchloralin (N-propyl-N (2-chloroethyl)-2,6-dinitro-n-trifluoromethyl aniline) for control of weeds and on the yield of potatoes. Weeds reduced potato yields up to an extent of 28.5 to 40.8%. One weeding followed by earthing was found to be insufficient for effective control of weeds in potato planted on ridges. Application of nitrofen, alachlor, dichlormate, metribuzin, linuron and paraquat increased potato yield significantly over untreated check during both the years and over one weeding followed by earthing in 1976-77. During 1975-76 metribuzin, paraquat and linuron each at 0.5 kg/ha significantly increased tuber yield over one weeding followed by earthing. Application of paraquat at 0.5 kg/ha applied 20 days after planting (5 to 10% sprouting) gave maximum tuber yield during both the years. Increase in yield was due to significant reduction in weed population and dry matter per unit area due to various herbicide treatments. Preplant incorporation of fluchloralin at 2 kg/ha delayed the sprouting of tubers.

- ✓ 158: Herbicidal and Cultural Control of Weeds in Potato
 B.B.Mandal, G.Bhattacharyya, P.K.Jana & S.P.Bhattacharyya,
 Department of Agronomy, Bidhan Chandra Krishi Viswa
 Vidyalaya, Kalyani, Nadia, West Bengal, India.

Sirmate at both the rates (5.0 and 2.5 l/ha) of application at one day after sowing effectively controlled the weeds and reduced the total dry weight of weed per unit area and gave comparable tuber yield to that of weed free check. One hand weeding given on the 15th day after sowing reduced the weed population per unit area at the early stage of crop growth but

was comparable to that unweeded control at the time of harvest in respect of both dry weight of weeds per unit area and yield of tuber.

159: Weed Control Studies in Potato (*Solanum tuberosum* L.)

M.L.Pandita, R.S.Hooda and A.S.Sidhu, Department of Vegetable Crops, Haryana Agricultural University, Hissar, Haryana, India.

The field investigations were conducted to study the efficacy of different herbicides on weed control and tuber yield in potato at the Vegetable Research Farm, Haryana Agricultural University, Hissar during 1977-78, 1978-79 and 1979-80.

Five herbicides, nitrofen 1.0, fluchloralin 1.0 kg/ha, metribuzin 0.75 kg/ha, paraquat 2.0 kg/ha and propanil 0.87 kg/ha were tried alongwith weedy check and repeated weeding during 1977-78 and 1978-79. In 1979-80, three doses of pendimethalin (0.5, 1 and 2 kg/ha) and nitrofen + simazain were added to the treatments. Nitrofen 1 kg/ha was most effective in controlling the weeds in potato crop and gave tuber yield which was at par with the yield in weed-free treatment during first two years. Similarly, the dry matter production by weeds was minimum under weed-free and nitrofen treatments, whereas it was maximum under weedy check treatment. During 1979-80 pendimethalin 2 kg/ha was found to be the most effective in controlling the weeds and increasing the yield of potato over weed-free treatments followed by nitrofen + simazine 0.75 kg + 0.125 kg/ha. The lowest yield was recorded in the weedy check treatment and this was almost half of the yield in pendimethalin (2 kg/ha) and weed free treatments.

- 160: Effect of Herbicides Alone and in Combination with Hand Weeding on the yield of Tomato and Associated Weeds.
V.M.Bhan, S.S.Tripathi and Govindra Singh, Department of Agronomy, G.B.Pant University of Agriculture and Technology, Pantnagar 263145, Uttar Pradesh, India.

Metribuzin (4-amino-6-t-butyl-3(methylthio) 1,2,4-triazin-5 (4+1)-one, alachlor (N-methoxymethyl-L-chloroaceto-2,6-diethyl anilide) and nitrofen (4-nitro-2,4-dichloro diphenyl ether) were compared alone and in combination with one hand weeding (45 days after transplanting) for control of weeds in Tomato. On an average, weedy condition reduced tomato yield by 50%. All the herbicide treatments significantly increased the crop yield when compared to weedy check but, yields in herbicide treatments were significantly lower when compared to that obtained under weed free check. Superimposition of one hand weeding treatment over herbicide application increased yields significantly over weedy check and were at par with the weed free treatment.

- ✓ 161: Investigation on the Chemical Weed Control on Tomato (*Lycopersicon esculentum* Mill.) P.L. Bhalla and D.Tiwari
 Department of Horticulture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, India.

Fourteen weed species were found associated with tomato crop. Of these Cyperus rotundus, Lagascea mollis, Ageratum, Cynyzoides and Chenopodium album were the predominant weeds. Alachlor 2 kg/ha + one hand weeding was quite effective in reducing the weed intensity. All the herbicidal treatments reduced the fresh and dry weight of weeds significantly over unweeded control. There was reduction in yield by 40.2% in unweeded control due to crop-weed competition. Metribuzin 0.525 kg/ha Preplant and

metribuzin 0.33 kg/ha postemergence, linuron 0.5 kg/ha and

methabenzthiazuron 2.1 kg/ha exhibited phytotoxic effect and reduced

the yield. Among the herbicidal treatments, alachlor 2 kg/ha + one

hand weeding was the most promising one which gave significantly

more yield (343.05 kg/ha) but was at par with fluchloralin

0.72 kg/ha. Herbicides may also improve the quality characteri-

stics of tomato fruit and may help in controlling the diseases.

✓ 162: Chemical Weed Control Studies in Tomato.

M.L.Pandita and J.S.Sandyan, Department of Vegetable Crops,
Haryana Agricultural University, Hissar 125004, Haryana, India.

Field investigations were conducted to study the efficiency of

different herbicides on weed control and yield in tomato, cultivar

HS-102. Three levels each ~~day~~ dalapon, alachlor, nitrofen,

3,4-dichlorobenzoic acid (at 1.5, 2 and 2.5 kg/ha each), prometryne

(0.5, 1 and 1.5 kg) dinitramine (0.3, 0.6 and 0.9 kg/ha),

fluch-poralin (0.75, 1 and 1.25 kg/ha) were tried alongwith weedy

check and hand weeding in randomized block design in four

replications at the Vegetable Research Farm of Haryana Agricultural

University, Hissar. / Fluchloralin 1.25 kg/ha alachlor 2.5 kg/ha and

nitrofen 2.5 kg/ha were the most effective in improving growth,

flowering, fruiting and early and total yield in tomatoes.

They were also very effective in controlling weeds and improving

the quality of harvested fruits.

- ✓163: Effect of Herbicides and Hand Weeding on Growth, Yield and Quality of Onion (*Allium Cepa* L.) R. Singh, A.P. Sinha and S.P. Singh, Agricultural Research Institute and Hihar Agriculture College, Sebour, Bhagalpur, Hihar, India.

Field experiment was conducted to study the herbicidal efficiency and selectivity of chemical method of weed control in onion (Variety Nasik red) during Rabi 1976-77 at the Horticulture Garden of Bihar Agriculture College, Sabour. The treatments consisted of two preplanting application of herbicides, alachlor 2,5 kg/ha and nitrofen 4.0 kg/ha, two postemergence application of tenoran 3.0 kg/ha and 2,4-D 1.0 kg/ha, and hand weeding given twice at 20 and 40 days after transplanting, thrice at 20, 40 and 60 days after transplanting and four times at 20, 40, 60 and 80 days after transplanting. An unweeded control was also included to evaluate the extent of weed competition.

The result indicated that the application of nitrofen and tenoran at preplanting and postemergence respectively, increased the bulb development with respect to diameter perimeter and weight of bulbs as well as bulb quality in respect of total soluble solids(T.S.S.) . The influence of herbicides was at par with hand weeding. The treatments which received four hand weeding gave the highest yield of onion bulb. Increase in yield in hand weeding treatment given 2,3 and 4 ~~given~~ times were found to be 47, 57 and 60% over that of control respectively. Thus the weed competition was more critical at the early stage upto 40 days after transplanting. Preplanting application of nitrofen and

postemergence application of tenoran increased the bulb yield by 46 and 34% respectively over control. The yield obtained from plots treated with nitrofen was found at par with two hand weeding treatment but lower than treatments which received three or four times hand weeding.

- ✓ 164: Study on the Effect of Certain Herbicides on Onion
 (Allium cepa L.) P.K.R.Nair, Hariwallabh and P.L.Bhalla.
 ✓ Department of Horticulture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur 482004, M.P. India.

All herbicides increased the height of onion plants over unweeded control except linuron 0.50 kg/ha which exhibited phytotoxic effect to reduce the crop stand. Oxadiazon 1.44 kg/ha gave the maximum bulb yield (31,259 kg/ha) than all other treatments. It recorded 12.82 percent increase over weeded control. Alachlor 2 kg/ha (preplant) & propanil 1.3 kg/ha (postemergence) was the second best herbicidal treatment. Of the fifteen weed species, the most noxious species were Chenopodium album and Daucus carota. Presence of weeds reduced crop stand and the size of bulb, resulting in loss in yield by 41.21 per cent over the most effective herbicide treatment, oxadiazon 1.44 kg/ha (postplant). Highest net return (Rs.1379/ha) was given by oxadiazon 1.44 kg/ha over weeded control. There was no effect of herbicides on quality of onion. It can be concluded that the use of herbicides is beneficial and economical in onion than the normal practice of handweeding.

Presence

- ✓ 165: Weed Management Studies in Onion (*Allium cepa* L.)
U.C. Upadhyay, Naserulla Khan and V.R. Chakrawar, Marathwada
Agricultural University, Parbhani-431 402, Maharashtra, India.

A field trial to study the weed management in onion was conducted in 1979-80 at the Central Farm of the Marathwada Agricultural University, Parbhani. Seven treatments, no weeding (control), fluchloralin (Basalin 48%) 1 kg/ha at preplanting, liuron 1 kg/ha at preplanting, fluchloralin at preplanting followed by one hand weeding after one month, liuron at preplanting followed by one hand weeding after one month, 2 weedings (first weeding one month after planting followed by another weeding one month after the first weeding) and weed-free condition, were tested in a randomised block design, with replications.

Acalypha indica, *Euphorbia* spp, *Xanthium strumarium*, *Cassia* spp and *Ipomoea reniformis* were the important weeds found in the experimental area. Maximum yield of 464.93 kg/ha of green onion was obtained in 9 weed-free treatment which was at par with the treatments T2, T4. To keep the land free from weeds is not a practical position and hence T4 treatment, fluchloralin spray at preplanting followed by one weeding after one month appeared to be the effective method of weed management in Onion. Economics of production revealed that Mis treatment gave the maximum net profit of Rs. 7440/ha.

- ✓166: Evaluation of Effective, Selective and Economical Herbicides for garlic (*Allium sativum* L.) A.B.Sharma, S.M.Asfar and P.L.Bhalla, Department of Horticulture, Jawaharlal Nehru Krishi Vidyalaya, Jabalpur 482004, Madhya Pradesh, India.

Experiment was conducted with 16 treatments and 4 replications in a randomized block design during rabi 1978-79. All herbicides affected the sprouting of garlic except fluchloralin 0.96 kg/ha and penoxalin 1.50 kg/ha + linuron 0.25 kg/ha preplanting. Maximum economical yield was obtained with alachlor 2.0 kg/ha (preem) + one hand-weeding. The presence of weeds under control reduced the crop stand, number of bulbs, size of ~~rub~~ bulb and yield by 56.42%. Twenty weed species were observed under control plots. The most noxious weeds were Daucus carota, chenopodium album and Euphorbia geniculata. Oxadiazon 1 kg/ha., (postem) gave satisfactory weed control. Methabenzthiazuron 2.1 kg/ha (postem) was quite effective to keep the weeds under check but reduced the bulb size and yield. Highest return (Rs.1358/ha) was obtained with alachlor 2.0 kg/ha (preem) + one hand-weeding ~~followed~~ followed by weed-free (Rs.922/ha) and methabenzthiazuron 2.0 kg/ha (preem) (Rs.622/ha) treatments. Increased dry matter content of garlic was observed in penoxalin 1.50 kg/ha. Alachlor 2.0 kg/ha + one hand weeding increased the protein content of garlic.

- 167: Effect of Herbicides on Yield of Cauliflower and Associated weeds
V.M.Bhan, S.S.Tripathi and Govindra Singh, Department of
Agronomy, G.B.Pant University of Agriculture and Technology,
Pantnagar-263145, Uttar Pradesh, India.

* Field studies were conducted to evaluate the performance of alachlor (N-methoxymethyl-L-chloroaceto-2,6-diethyl anilide) and nitrofen (4-nitro-2,4-dichlorodiphenyl ether) at 1 and 2 kg/ha alone and in combination with one hand weeding (given 60 days after ~~trans~~ transplanting) on weed control and yield of cauliflower. Application of herbicides increased the yield significantly over weedy check. Superimposition of one hand weeding in addition to herbicide treatment increased crop yield significantly over herbicide alone. Maximum yield of cauliflower was obtained when the field was sprayed with alachlor at 2 kg/ha followed by one hand weeding given 60 days after transplanting. Increase in yield was associated with decrease in population and dry matter of weeds per unit area.

- 168: Studies on the Chemical Weed Control in Seed Crop of Radish
(Raphanus sativus L.) K.S.Randhawa, K.S.Sandhu, Hari Singh
and S.S.Gill, Department of Vegetable Crops, Landscaping &
Floriculture, Punjab Agricultural University, Ludhiana-
141004, Punjab, India.

Adequate supply of high quality seeds free from mixtures is the basic need for stepping up vegetable production. Radish is one of the most important seed crops in Punjab which is invaded by a wide spectrum of broad leaved and grassy weeds. The farmers are to face great problems for weeding the crop for a number of times with manual labour which is not economical. So keeping this in view, investigations were conducted during 1978-79 and 1979-80 to

ascertain the efficacy of herbicides like nitrofen at 1.40 kg and 2.0 kg/ha (preem) alachlor at 1.75 and 2.50 kg/ha (preem), fluchloralin at 0.48 kg/ha (preplant) + atrazine at 0.12 kg/ha (preem), fluchloralin at 0.84 and 1.20 kg/ha (preplant), fluchloralin at 1.20 kg/ha (preem), metoxuron at 1.39 and 1.60 kg/ha (preem) and metribuzin at 0.52 and 0.70 kg/ha (preem). These herbicidal treatments decreased the weed population as compared to unweeded control. Metoxuron at 1.39 and 1.60 kg/ha and metribuzin at 0.52 and 0.70 kg/ha imparted phytotoxic effect to the crop showing yellowing, scorching and suppression of growth. From the remaining treatments alachlor at 2.50 kg/ha (preplant) and fluchloralin at 0.48 kg/ha (preplant) + atrazine at 0.12 kg/ha (preem) were superior in controlling the weeds.

- 169: Weed Control Studies in Okra. V.M.Bhan, S.S.Tripathi and Govindra Singh, Department of Agronomy, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar-263145, Uttar Pradesh, India.

Field experiments were conducted to study the requirement of weedfree period and the comparative effect of alachlor (N-methoxymethyl-L-chloroaceto-2,6-diethyl anilide), and fluchloralin (N-propyl-N(2-chloroethyl)-2,6-dinitro-n-trifluoromethyl aniline) alone and in combination with one hand weeding (45 days after sowing with khurpi) were carried out to develop package of practice for weed control in \pm Okra. It was observed that Okra crop requires 60 days of initial weed free maintenance and this increased the yield by 138% in 1977 and 109% in 1978. Application of alachlor at 1 and 2 kg/ha and fluchloralin at 0.5 and 1 kg/ha increased the crop yield significantly over weedy check. Superimposition of one hand weeding 45 days after sowing over each of

over herbicide alone. Alachlor and fluchloralin, at all doses, significantly reduced the density and dry matter production of dry weeds. Emergence and dry matter of weeds decreased with the increase in period of weed free maintenance and were minimum when plots were kept weed free for 60 days after sowing.

- ✓170: Study on the Effect of Herbicidal Treatments on Growth and Seed-yield of Garden Pea (*Pisum sativum* Subsp *Hortense* L.)
P.L.Bhalla and K.K.Chourasia, Department of Horticulture,
 Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur 482004,
 Madhya Pradesh, India.

This study was carried out during 1977-78 with 16 treatments and 3 replications in a randomized block design. It was found that the weed control efficiency of all the 16 treatments differed significantly. Prometryne 2.0 kg/ha controlled the weeds most efficaciously but it exhibited phytotoxic effect on the crop plants. Twenty nine weed species were associated with this crop. Amongst these, *Cyperus rotundus*, *Cynodon dactylon*, *Chenopodium album*, *Euphorbia geniculata*, *Phyllanthus niruri*, *Sonchus arvensis*, and *Phaseolus triobus* were the predominating ones, but could reduce the seed yield of pea by 2.74% only. Weed competition index indicated that fluchloralin 0.96 kg/ha recorded maximum increase in seed yield (30.38%) over control (one hand weeding) followed by fluchloralin 0.48 kg/ha and alachlor 1.0 kg/ha. Fluchloralin and alachlor which proved selective, effective and economical herbicides, increased the rhizobial population in the rhizosphere. The seeds obtained from herbicidal treatments were healthier, possessed higher germination and free from seed mycoflora.

- 171: Chemical Control of Weeds in Mustard. Y.C.Panchal, M.S.Ganesh Babu and V.S.Patil, University of Agricultural Sciences, Dharwad Campus-580005, Karnataka, India.

Control of weeds under irrigated farming for any crop or season is always a problem. A field experiment with four herbicides of three concentrations each was conducted on mustard (Brassica campestris L. CV. BR.40) at the Agricultural College, Dharwad during Rabi 1978-79. Results indicated that there was no significant yield difference among the herbicide treatments and that of weed free check. However, the unweeded check recorded lowest yield of 739 kg/ha as against 10.71 kg/ha of weed free check, 1032 kg/ha of fluchloralin (1.0 kg/ha), 1026 kg/ha of trifluralin (1.0 kg/ha), 972 kg/ha of ~~respecti~~ nitrofen (1.0 kg/ha) and 951 kg/ha of alachlor (1.0 kg/ha) respectively. Among the herbicides, fluchloralin (1.0 kg/ha) and trifluralin (1.0 kg/ha) gave effective control of weeds. Influence of the herbicides on the oil content of mustard was also studied.

WEED CONTROL IN CROPPING SYSTEMS.

- 172: Chemical weed Control in Rice-Wheat Rotation. S.P.Singh and V.S.Mani, Indian Agril. Research Institute, New Delhi-110 012, India.

Rice-wheat rotation is gaining importance in North-West non traditional rice growing India. Very little work has been done on weed management in rice-wheat rotation. Hence, field trials were conducted in Kharif 1978 and 1979 at Indian Agricultural Research Institute Farm, New Delhi, in split plot design having three replications. The treatments consisted of three methods of planting viz. direct seeding, puddled followed by transplanting and transplanting ~~via~~ without puddling. Paraquat was applied at 2 kg/ha 15 days in the last method before transplanting for killing the standing weeds. Herbicide treatment consisted of two preemergence herbicides butachlor (G) and benthocarb (G) each at 1 kg/ha and two postemergence herbicides, propanil and bentazon each at 2 kg/ha applied either alone or in combination. Results of experiments showed that among the different methods of planting puddled-transplanting method gave highest grain yield of 6600 kg/ha followed by transplanting in non-puddled soil by using paraquat (5300 kg/ha) and direct seeding (3100 kg/ha). Herbicide treatment significantly out yielded the unweeded control (4200 kg/ha) and were at par with hand weeding 5400 kg/ha). Weed competition was found to be very severe in direct seeded crop. However in transplanted crop the weed growth was less because of the puddling operation or use of paraquat. After

paddy crop was harvested weed growth in the succeeding wheat crop in rabi season was monitored. It appeared that the growth of predominant weeds like Chenopodium album and Mililotus spp. was less in herbicide treated plots. The herbicide used in paddy for weed control had no adverse effect on growth and yield of the following wheat crop. ~~How~~ However, intensive puddling used for paddy was found to give lower yield of succeeding wheat crop than that obtained when direct seeding of rice was done in Kharif.

- 173: Chemical Control of Weeds in Mixed Crop of Chilli & Cotton.
Y.C.Panchal, C.I.Nimbal and V.S.Patil, University of Agricultural Sciences, Dharwad Campus, 580005, Karnatak, India.

A field experiment was conducted with the object of controlling weeds in the mixed ~~cropped~~ cropping of chilli and cotton at Agricultural College, Dharwad during 1978-79, under assured rainfall conditions. Five herbicides (alachlor, nitrofen, fluchloralin, trifluralin and chloramben) were tried at rates each in a mixed crop of chilli and cotton. The herbicides were applied as preplant sprays at 15 days before planting. The results indicated that nitrofen at 1.5 kg/ha was not only effective in controlling weeds but also helps to obtain higher yields of chilli (1230 kg/ha) and cotton (1113 kg/ha) as against 1300 kg/ha check. While the ~~the~~ yields in unweeded check were reduced to one third of that in nitrofen treatment. The highest dry weight of weeds (399 kg/ha) was found in unweeded check treatment as against 58.6 kg/ha in nitrofen (1.5 kg/ha).

- 174: Crop Productivity and Weed Flora Shifts as Affected by Herbicides in Maize-Pulse Rotation. Raj Singh and V.S.Mani.
Division of Agronomy, Indian Agricultural Research Institute, New Delhi 110012, India.

A field experiment to study the effects of continued use of atrazine and alachlor on crop productivity of maize (cv. G-5) and shift in weed flora during Kharif and residual toxic effects on pulses (pea-T-163, gram, C-235, and lentil 19-12) during Rabi was carried out for three years, 1975-76, 1976-77, 1977-78 at the Indian Agricultural Research Institute, New Delhi. Preemergence application of atrazine, 1,2 and 4 kg/ha and alachlor at 1,2 and 4 l/ha was made to maize in each season. After harvesting maize the three pulses were raised on the same herbicide-treated plots. The data on grain yield and weed flora revealed that the use atrazine and alachlor at all their levels of application continuously for three years affected neither crop productivity nor resulted in shifts in weed flora. Atrazine at 1 kg/ha exerted some stimulatory effects on grain production when applied continuously for three years as evidenced by increased grain yield by 9.29 kg/ha over control in the last season. (Herbicide rate : Kg or litres total formulation/ha).

- 175: Studies on Weed Control in Sorghum Based Intercropping Systems. D.Boobathi Babu, S.Sankaran, and Y.B.Morachan. Department of Agronomy, Tamil Nadu Agril. University, Coimbatore 641003, Tamilnadu, India.

Experiments were conducted to evolve an effective and economic weed control programme for different sorghumbased intercropping systems. Application of preemergence herbicides (alachlor 1.5 kg/ha and dinitramine 0.5 kg/ha) supplemented by one hand hoeing at

30 days gave effective weed control and favourably influenced the growth, nutrient uptake and yield of sorghum (C.S.H.5) Higher yield of intercrops viz., blackgram (Co.3), cowpea (C.152) and lablab (Co.8) was achieved with either preemergence application of alachlor 1.0 kg/ha or dinitramine 0.5 kg/ha followed by a hand hoeing at 30 days. Increasing the rate of alachlor application from 1.0 to 1.5 kg/ha resulted in marginal yield reductions in intercrops. However, cost return analysis revealed preemergence application of alachlor 1.5 kg/ha hand hoeing at 30 days was found to be profitable for sorghum blackgram and sorghum cowpea intercrop system. In case of sorghum + lablab intercrop system, preemergence application of dinitramine 0.5 kg/ha + hand hoeing at 30 days seemed remunerative.

176. Chemical Weed Control in Crops of Southern Guinea Zone of Nigeria. D.J.Chandra Singh and S.T.O. Lagoke. Agric. Res.Station, Mokowa, and Institute for Agric.Research Ahmada Bello University, Zaria Nigeria.

Nigeria is agriculturally highly potential country growing variety of crops such as maize, sorghum, millet, rice, groundnut, gingelly, yam, cotton, venaf and vegetables. Southern guinea zone receives annual rainfall of 1,000 to 1,500 mm scored over a period of 150 to 200 days. All the above crops are rainfed and cropping season starts from last week of April and extends up to early November. So weeds are a serious problem until or unless they are controlled. Several herbicides were tried at different doses and field trials were conducted from 1976 onwards in crops like maize, sorghum, pearl millet, cotton, groundnut, yam, melon and cow-pea. The use of triazines, acetanilides, dinitramines, etc is encouraging in the crops. The results regarding degree of weed infestation, chemical control, grain yield etc. were presented and discussed.

177. Chemical Weed Control Studies in Pure and Intercropped Maize, N.T.Yaduraju, I.P.S.Ahlawat, Attar Singh and V.S.Mani, Indian Agricultural Research Institute, New Delhi 110012, India.

Intercropping in Maize particularly with grain legumes is becoming a common practice among the farmers for more profits and for conserving soil fertility. Recommendations of chemical weed control in such cropping systems require careful evaluation of herbicides for their selectivity to both main and intercrops besides their effect on weeds. A field

study was, therefore, initiated to assess the efficiency and selectivity of nitrofen (0.5 kg/ha), alachlor (1.0 kg/ha) and linuron (0.25 kg/ha) to maize and intercrops (used, moong and soybean). All the herbicides tested were effective in checking weed population and growth. Linuron was better than other herbicides in controlling weeds. There was no significant difference in the dry matter production of maize and grain legumes in the herbicide treated plots as compared to hand weeding. This indicated the selectivity of these three herbicides to maize and grain legumes tested. Intercrops did not have smothering effect on weeds emerging between two rows of maize on the contrary, their own growth was significantly reduced by over growth of weeds. Urd was better than moong or soybean. Despite the good weed control and selectivity to maize in the initial stages, the grain yield was significantly reduced by linuron as compared to hand weeding and nitrofen treatments. Alachlor gave yield comparable with hand weeding.

178. Growth and Development of *Trianthema monogyna* under variable Plant densities of Maize (*Zea mays*) and Cowpea (*Vigna unguiculata* L. walp) L.B.Brar and H.S.Gill, Department of Agronomy, Punjab Agricultural University, Ludhiana, Punjab, India.

Abstract

Field investigations were carried out in the Punjab Agricultural University, Ludhiana during kharif 1977 and 1978 to study the influence of variable plant densities of maize and cowpeas, alone and in mixture on the growth and development of *Trianthema monogyna* L. The treatments which had higher densities of crop plants asserted a strong smothering effect on this weed. A three fold reduction in the dry matter accumulation by *Trianthema* was recorded where maize alone and maize + cowpeas were sown with double the seed rate than their normal seed rate. Like reduction in the dry matter production, maize when grown with double the seed rate indicated 59 percent reduction in the number of secondary branches of *Trianthema* than control (*Trianthema* grown without competition) and about 43 percent reduction when grown in maize sown with normal seed rate (75 kg/ha). Similarly, maize + cowpeas mixture with double the seed rate (75 + 30 kg/ha) decreased the number of secondary branches, length of primary branch and number of nodes of this weed. Cowpea was inferior to maize in asserting the smothering effect on this weed. This weed produced minimum number of seeds per plant in maize alone sown with double seed rate (150 kg/ha) and it was about 10 and 6 times less

the seed prdduct on potential of Trianthema alone (with fertilizer) during 1977 and 1978, respectively.

*Assistant Agronomist and ** Sr. Agronomist (Weed Control) - cum-Head, Department of Agronomy, Punjab Agricultural University, Ludhiana.

179. Studies on Weed Management and Intercropping in Arhar under Dryland conditions. Masood Ali, R.K. Pandey and C.R. Rawat., Indian Grassland and Fodder Research Institute, Jhansi, Uttar Pradesh, India.

Experiments conducted on weed management in intercropping system of arhar (Hy 1) and short duration legumes (black gram and soybean) on red sandy loam soils of IGRI, Jhansi during kharif 1977 and 1978 revealed that alachlor applied in the form of granules or emulsifiable concentrate (EC) at preemergence 2 kg/ha was quite effective and economical. The grain yields in these two alachlor treatments were 1240 and 1290 kg/ha as against 1380 kg/ha under weed free conditions. Though hand weeding (done twice) was more effective in controlling weeds than alachlor, it was much costlier. Intercropping of black gram in normally planted arhar was more productive and profitable than arhar alone. Further, intercropping decreased weed population by 29% over arhar alone.

180. Control of Parthenium hysterophorus (Gajar Gavat) in Non-crop Area. R.V. Nalamwar, B.T. Chaudhari, P.K. Khedekar and C.S. Vaidya, Department of Agronomy, Punjabrao Krishi Vidyapeeth, Akola-444 041, Maharashtra, India.

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Since parthenium is now spreading to cultivated crops from non-crop areas, it has become very essential to control the weed even in non-crop areas for its eradication. Keeping this in view, a field experiment on the control of parthenium consisting of a few herbicide treatments along with hand pulling and control was conducted. Parthenium seeds were grown in the field for raising parthenium plants. Preemergence application of atrazine 1.5 kg/ha and terbutryn (Igran) 1.5/kg/ha did not allow a single seed of parthenium to germinate. Pulling of weeds by hand before flowering was found quite effective. Application of 2,4-D (Na salt) 5 kg/ha 20 days after emergence of the weed was nearly as effective as application of MSMA 5 l total product/ha.

181. Efficacy of Farm Chemicals to Control Parthenium (Parthenium hysterophorus): S.M. Suryawanshi, Agricultural College, Nagpur-10, Punjabrao Krishi Vidyapeeth, Akola-444 041, Maharashtra, India.

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Rapid dissemination, pernicious nature and nuisance value of parthenium weed calls for immediate control measures. Its control needs integrated approach wherein chemical, biological and social measures are to be involved. On cultivated land, tillage implements interfere with its propagation, but on non-cropped and waste-lands where no control measures are followed, it grows profusely, multiply tremendously and compete with natural useful vegetation suppressing its growth. Hence, present investigation was undertaken during monsoon of 1979-80 on uncultivated waste-land heavily infested in the previous season with parthenium to evaluate efficacy of different herbicides (as pre as well as postemergence) spray in the control of parthenium.

Among the various herbicides tried, atrazine gave best control of parthenium followed by oxadiazon, dalapon, simazine, fenuron and monuron. Atrazine, dalapon, oxadiazon, simazine, fenuron, monuron and tribenil were at par and they were significantly superior to fluchloralin, chlortoluron and control. Preemergence application of atrazine 2 kg, oxadiazon 1.25 kg, simazine 2 kg, pre + postemergence application of dalapon 5.8 kg, fenuron 1 kg, monuron 1.20 kg and tribenil 3.5 kg/ha gave control of parthenium to the extent of 100%, 97.7%, 96.30%, 96.12%, 92.60%, 91.67% and 83% over control respectively. Besides parthenium, other predominant weeds observed were Cyperus sp., Cynodon dactylon, Sida spinosa,

Achyranthus aspera, Corchorus sp. and Malchra capita. Atrazine, oxadiazon, tribenil, simazine, dalapon and fenuron gave good control of weeds like Sida spinosa, Achyranthus aspera, Chorchorus sp. and some grass weeds, while tribenil, atrazine and fenuron gave appreciable control of Malchra capita. Chemical dalapon followed by atrazine, oxadiazon, tribenil and fenuron provided significant control of weeds. Other herbicides such as monuron, simazine, basal and chlortoluron also gave good control of weeds. Partial control of nut-grass and other grasses was obtained with simazine, atrazine, basal and monuron.

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182. Parthenium - Its Hazards and Chemical Control Measures.
K. Narayana Rao and K. Mahadeva Gupta, Andhra Pradesh
Agricultural University, Agricultural College, Bapatla-
522101, Andhra Pradesh, India.

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In Kharif 1979, a field trial was conducted at Chinakondrupadu village of Guntur District to control Parthenium with 2,4-D alone, 2,4-D + paraquat and 2,4-D MSMA at different combinations. The results of the trial indicated that application of 2,4-D alone at 2.0 and 4.0 kg/ha was ineffective. However, combined application of 2,4-D 4.0 + paraquat 0.40 kg/ha or 2,4-D 5.0 + paraquat 0.50 kg/ha or 2,4-D 4.0 + MSMA 2.19 kg/ha proved to be very effective in controlling this weed, with 100 % control within 45 days after application. The other combinations controlled this weed to the extent of 70 to 90 %. Combination of 2,4-D 3.0 + MSMA 1.40 kg/ha which resulted in 95 % weed mortality and costed only Rs. 289/ha was found cheaper compared to the other herbicide combinations, hence it can be recommended for adoption.

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183. Relative Effectiveness of Selected Preemergent Herbicides and 2,4-D Slow Release Formulation on the Control of Parthenium hysterophorus L.
T.V. Muniyappa, T.V. Ramachandra Prasad and K. Krishnamurthy, Agronomy Department, University of Agricultural Sciences, Hebbal, Bangalore 560 024, Karnataka, India.

Seven preemergence herbicides viz., 2,4-D Na salt (2.8 and 4.0 kg/ha), 2,4-D amine salt (2.8 and 5.0 kg/ha), terbutryne (2.8 and 6.0 kg/ha), atrazine (1.25 and 1.40 kg/ha), RH 8817 (1.1 and 2.28 kg/ha) (in both seasons), simazine (1.25 and 1.4 kg/ha) and neburon (1 and 2 kg/ha) (in second season) were compared with 2,4-D slow release formulation (1.4, 2.8 and 4.2 kg/ha) for relative efficacy in minimising the emergence of Parthenium during Rabi 1977 and 1978 at Guttadahalli near Hebbal, Bangalore.

In both the seasons, RH 8817, atrazine, simazine, terbutryne and neburon (at both the doses) minimised the weed emergence considerably upto 150th day of spraying. Plots sprayed with 2,4-D Na salt and amine salt had moderate weed emergence. 2,4-D slow release at 4.2 kg/ha gave moderate weed emergence in comparison with other 2,4-D compounds. Lower rates of this herbicide was not effective. The trend was similar in both the seasons except weed counts being lower in 2nd season due to lower rainfall.

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184. Comparative Efficacy of Postemergence Application of Paraquat in Combination with 2,4-D Formulations on the Control of Parthenium hysterophorus L. T.V. Muniyappa, T.V. Ramachandra Prasad and K. Krishnamurthy, Department of Agronomy, University of Agricultural Sciences, Hebbal, Bangalore 560 024, Karnataka, India.

A study was undertaken at Guttadahalli, near Hebbal during Rabi 1977 and 1978 to determine the relative efficacy of selected combinations of paraquat (0.3 to 1.2 kg/ha) with 2,4-D Na salt (2 and 4 kg/ha), 2,4-D ethyl ester (1.8 to 3.6 kg/ha) and 2,4-D diethanol amine salt (2.31 kg/ha) in comparison with 2,4-D Na Salt and 2,4-D diethanol amine salt alone at blooming stage of Parthenium.

2,4-D diethanol amine salt (1.15 to 3.47 kg/ha) and 2,4-D Na salt (4.0 kg/ha) alone gave 100 % mortality of the weed by 35 to 40 days besides minimising the regeneration upto 120 days of spraying. Combinations of paraquat at 0.9 to 1.2 kg/ha with 2,4-D Na salt at 2 to 4 kg/ha and paraquat at 0.3 to 1.2 kg/ha with 2,4-D amine salt at 2 to 4 kg/ha gave 96 to 100 % top kill of the weed. Some regrowth was observed in these combinations specially at lower dosages. Besides regeneration of the weed was also relatively more in combinations, particularly at lower doses.

185. Studies on the Effect of Different Methods of Control of Parthenium hysterophorus L. J.R. Patil and N.K. Umrani, Department of Agronomy, Mahatma Phule Agricultural University, Rahuri, Ahmednagar Dist, Maharashtra, India.

Field trials involving different herbicides and hand pulling for the control of Parthenium weed were conducted for two years (1978-79) in Kharif season at the Instructional Farm, Rahuri to know the comparative effectiveness and economics of different control methods. The observations recorded on weed count at 120 days from weed emergence revealed that among preemergence herbicides, atrazine (1.5 kg/ha) and metribuzin (2.1 kg/ha) gave 100 % and 98 %

weed control respectively. The results with slow release 2,4-D (15, 20 and 25 kg product/ha) were not consistent. Among the postemergence herbicides, spraying of amine 2,4-D (1.45 kg/ha) gave 87 % and 98 % control in 1978 and 1979 respectively. The addition of paraquat (0.5 kg/ha) to 2,4-D treatment was not beneficial. The weed control efficiency obtained with pre- and postemergence herbicides (except 2,4-D slow release) were comparable with that of hand pulling. The other chemical methods viz., washing plus common salt (2 : 1) at 15 % and common salt at 10 % were not much effective. The results with 15 % common salt spraying were not consistent. Maximum weed control (98 %) was obtained during 1978. However, regrowth of affected plants was observed in the treatment during 1979.

The herbicides like 2,4-D amine at 1.45 kg/ha (cost Rs. 139.50/ha) and atrazine at 1.5 kg/ha (Rs. 247/ha) were not only effective but also cheaper than the mechanical method i.e. hand pulling (Rs. 250/ha).

186. Parthenium (parthenium hysterophorus L.) and Its Control: A Review: D.K. Shelke, Department of Agronomy, Marathwada Agricultural University, Parbhani-431 402, Maharashtra, India.

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Parthenium hysterophorus L. commonly known as 'Gavai' or 'Chatak chandni' is a deadly weed infesting both cropped and noncropped area throughout the country under varied agro-climatic and soil conditions. It exhausts the soil of essential elements. It has also a depressing effect on the human nervous system. Beside its danger to human beings and crops, it is useful for extracting leaf protein for human diet. Its prolific seeding ability, the extremely light weight of seeds armed with pappus and non-dormancy of seeds are some of the factors for extensive spread through natural agencies such as wind, water, birds and animals. In this paper efforts are made to review the information on parthenium relating to history, morphology, occurrence, ecology, mode of reproduction, dissemination and preventive and control measures.

187. Failure of Seed Formation in Parthenium hysterophorus L. with Chlorflurenol (EMD-7301 W) and Its Practical Implications: S.N. Khosla, S.N. Sobti and Kuldeep Singh, Regional Research Laboratory (CSIR), Canal Road, Jammu-Tawi - 180 001, Jammu & Kashmir, India.

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P. hysterophorus L. has been declared a National Health Hazard in view of its serious skin allergies to man and animals. It is a serious threat to agriculture.

as well. Till to date, no means are available which ensure complete control or eradication of this weed. The present study was undertaken to suppress flower and seed formation and induce sterility with chlorflurenol in order to check its secondary seed germination and infestation of the original or new sites. Thus uniform seedlings were transplanted in 12" pots with one seedling each and three such pots were sprayed to dripping with chlorflurenol 0.2, 0.5, 1.0, 2.0 and 3.0 mg/ml. Three unsprayed pots were kept as control. Teepol (0.1 %) was added in the spray solutions as wetting agent. After 24 hours of the spray, growth abnormalities typical of the auxin type herbicides were observed. Basal leaves in the treated plants were narrower, reduced and green. Flowering was delayed and adversely affected. After about three months, normal flowers were hardly seen at 0.2 and 1.0 mg/ml. At 1.0 mg/ml and above, mostly sterile flowers were produced besides fusion of inflorescences. These results show that 2.0 and 3.0 mg/ml concentrations of chlorflurenol can completely eliminate flowering and also cause sterility in the life cycle of P. hysterophorus and thereby contribute significantly towards effective control of its successive generations and making the environment of the infested site free of its health hazards to man and animals. It will also diminish the threat to agricultural land. Availability of chlorflurenol in India and its cost are, however, limiting factors at present.

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188. Effect of Preemergence Herbicides on Germination and Growth of Species of Hyptis, Argemone, Parthenium, Cleome, Datura and Eupatorium: T.V. Muniyappa, T.V. Ramachandra Prasad, M.M. Hosmani and D.N. Nagaraj, Department of Agronomy, University of Agricultural Sciences, Hebbal, Bangalore-560 024, Karnataka, India.

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The relative effectiveness of eight preemergence herbicides in inhibiting the emergence and growth of six weeds namely, Hyptis suaveolens Poit., Argemone mexicana Linn., Parthenium hysterophorus Linn., Cleome monophylla Linn., Datura stramonium Linn., and Eupatorium odoratum Linn. was compared in pots in summer 1977 at the Agronomy Field Unit, University of Agricultural Sciences, Bangalore. Of these weeds, Argemone and Eupatorium did not germinate upto 42nd day perhaps due to dormancy. While in others, germination and growth varied with application of different herbicides. Dicamba at 2.0 kg, atrazine at 1.25 kg, fluchloralin at 2.4 kg, terbutryne at 4.0 kg, diuron at 2.0 kg, alachlor at 2.5 kg, picloram at 1.08 kg and dichlormate at 2.2 kg/ha resulted in 0 to 20 % germination in Hyptis, Parthenium and Cleome. Besides, dry weight was also reduced in Hyptis by all herbicides.

except dicamba and picloram and Parthenium and Cleome by all herbicides. The emergence and growth of Datura was **inhibited considerably** by only terbutryne.

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189. Chemical Weed Control in Opium Poppy Through the Use of Crop Protectants: Raj Singh, B.B. Turkhede, V.S. Mani and Gita Kulshrestha, Division of Agronomy, Indian Agricultural Research Institute, New Delhi - 110 012, India.

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Since very little is known on the selectivity of herbicides to opium poppy crop, an experiment was started on chemical weed control in this crop through the use of some crop protectants during Rabi 1978-79 at the Indian Agricultural Research Institute, New Delhi. The experiment was conducted in a split plot design with three replications. The crop protectants were kept in main plots and weed control treatments in sub-plots. The crop protectants were F.Y.M. and activated charcoal. Two methods of application i.e. band placement and seed coating and one without crop protectant treatments were included. Herbicides used were alachlor and nitrofen each at the rate of 2 L/ha as pre-emergence treatments. Results revealed that in the absence of crop protectants the plant population and opium yield was significantly reduced by herbicide application while in the presence of crop protectant the plant population and opium yield were statistically at par with hand weeding thereby showing F.Y.M. and activated charcoal helped in reducing the plant injury from herbicides. All the weed control treatments were significantly superior to untreated check in reducing the dry weight of weeds. Hand weeding was the **best** treatment. Nitrofen and alachlor were statistically at par with each in reducing the dry matter accumulation in weeds.

(Herbicide rate: Litres total formulation/ha)

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190. Herbicidal and Selective Effect of Fluchloralin and Asulam in Opium Poppy: Raj Singh, B.B. Turkhede, V.S. Mani and Gita Kulshrestha, Division of Agronomy, Indian Agricultural Research Institute, New Delhi-110 012, India.

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A field experiment conducted during 1978-79 involved a comparative study of herbicidal and selective effects of fluchloralin (Basalin) and asulam (Asulox) in opium poppy. A preemergence application of three doses of Basalin (1, 1.5 and 2 L/ha) and three doses of Asulox (5, 6.5 and 8 L/ha) were given. Data on plant population, dry matter production by crop (g/plant), seed yield (g/ha) and opium yield (kg/ha at 70°) in Asulox treated plots

were found to be at par with hand weeding while all these characters suffered a reduction significantly at all the dosage levels of Basalin. It thus appeared that Asulox was highly selective to poppy. Weed population and dry weight were significantly reduced by the chemical treatments as compared to untreated check. Asulox was more effective against monocot annual weed species while Basalin was found effective against both dicot and monocot weed species.

(Herbicide rate: Litres total formulation/ha)

191. Effect of Certain Herbicides on Tuber Emergence of *Cyperus rotundus* L. P.K. Jha and D.N. Sen, Laboratory of Plant Ecology, P.O. Box 14, Botany Department, University of Jodhpur, Jodhpur 342 001, Rajasthan, India.

Some preemergence herbicides (diuron, EPTC, oxyfluorfen, glyphosate, penoxalin and vernolate) were used to study the suppression of tuber sprouting and perennation of world's most obnoxious weed *Cyperus rotundus* L. The suitability of the herbicides was also studied in relation to microbial activity and residual toxicity of the treated soil. Out of these six herbicides, EPTC and vernolate proved highly effective in controlling the sprouting of tubers in *C. rotundus*. Although oxyfluorfen suppressed the growth of this weed but it was found toxic to crops and microbial activity in soil. Other weedicides were not very effective in control of nutsedge.

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192. Studies on Control of *Cyperus rotundus*. K. Rama Krishna, S.M. Kondap and M.R. Reddi, Department of Agronomy, Agricultural College, (APAU), Rajendranagar, Hyderabad-500 030, Andhra Pradesh, India.

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A replicated field trial was conducted at the Agricultural College Farm, Rajendranagar, Hyderabad during Kharif 1979 to find out an effective control measure for *Cyperus rotundus* which is a major weed in the tropics and subtropics. Three chemicals namely, 2,4-D (2 kg/ha), MSMA (0.875 kg/ha) and glyphosate (1.10 kg/ha) were used. Spraying of MSMA and glyphosate was done at three different stages, 10th day, 20th and 30th day after emergence of the weed in combination with clipping or no-clipping of aerial parts. However 2,4-D was sprayed alone as well as in combination with 5 % jaggery solution on 20th day only. The 2,4-D + 5 % jaggery solution was found to be the most effective spray, with the mortality percentage of 47.3, 71.4 and 93.6 in the first second and third week after

some were controlled by diuron and oxyfluorfen. Amitrole killed the weeds through chlorosis in leaves, while silvex by wilting and drooping of plants. Difenzoquat, nitrofen and penoxalin seemed to be ineffective for the control of different weeds. Cyperus rotundus is found to be most resistant, while Indigofera cordifolia and Ipomoea pes-tigridis the most susceptible towards different weedicides. Almost all the weedicides tried were ineffective on grasses except amitrole.

195. ✓ Effect of Preemergence Herbicides on Control of Wild Garlic (Oxalis acetosella L.) : T.V. Ramachandra Prasad, T.V. Muniyappa, M.M. Hosmani and D.N. Nagaraj, Department of Agronomy, University of Agricultural Sciences, Hebbal, Bangalore 560 024, Karnataka, India.

A pot culture study was conducted to know the relative efficacy of 20 preemergence herbicides at two concentrations on emergence and growth of Oxalis acetosella L. during summer 1977 at the Agronomy Field Unit, University of Agricultural Sciences, Bangalore.

The emergence of Oxalis was delayed (from 19 days in picloram at 1 to 2 kg/ha to 81 days in RH 8817 at 2 kg/ha) in all herbicide sprayed plots as compared to water sprayed control (15 days). However, in fluchloralin at 2.4 to 4.8 kg/ha and penoxalin at 2.8 kg/ha prevented its emergence upto 100th day after spraying. Herbicides like oxadiazon at 0.9 to 1.8 kg, 2,4-D ethyl ester at 5.4 kg, alachlor at 2.5 to 5.0 kg, metribuzin at 3.5 kg, nitrofen at 1.88 to 3.75 kg, RH 8817 (coded product) at 1 to 2 kg and benthocarb at 2.5 to 5.0 kg/ha prevented the weed emergence beyond 40 days. Further, these herbicides differed in checking further multiplication of the weed. Diuron at 2.0 to 4.0 kg, metribuzin at 3.5 kg, nitrofen at 3.75 kg, 2,4-D sodium salt at 4.0 kg, RH 8817 at 2 kg and benthocarb at 2.5 to 5.0 kg/ha minimised the tuber and shoot production, and plant dry weight as compared to other herbicides. Fluchloralin at 2.4 to 4.8 kg and penoxalin at 2.8 kg/ha prevented weed emergence and its development upto 100th day of spraying. Thus the study brought out the utility of certain herbicides for a reasonable control of Oxalis to a relatively longer period.

196. Herbicidal Efficacy on the Sprouting Behaviour of Bulbs of Oxalis latifolia H.B. and K. : L.P. Misra, D.P. Sharma and H.S. Dhuria, Regional Fruit Research Station, Mashobra, Simla 171 007, Himachal Pradesh, India.

The effect of twelve herbicides on the sprouting behaviour of bulbs of Oxalis latifolia H.B. and K. was

tested under laboratory conditions. Pre-soaking with herbicides, dichlorprop, MSMA, butachlor, fluchloralin, fenoprop and paraquat completely killed in bulbs. Atrazine and terbutryne did not affect the sprouting of bulbs. Butachlor (500 and 1000 ppmw) did not kill the bulbs but inhibited their sprouting even upto 42 days after treatment.

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197. ✓ Marvel (*Dichanthium* sp.) a New Weed Host of *Sorghum* ergot
C.S. Sangitrao and P.G. Moghe, Sorghum Research Unit,
Punjabrao Krishi Vidyapeeth, Akola 444-041, Maharashtra,
India.

Sorghum (*Sorghum bicolor*) grown in Maharashtra has been suffering from ergot disease caused by *Sphacelia sorghi* Moench for several few years. Heavy losses were reported by this disease in seed production plots due to high degree of susceptibility of male sterile parent. A survey of affected areas in Maharashtra was undertaken in December 1979 to find out the role of grass weeds in the life cycle of *Sorghum* ergot fungus. The survey revealed that, besides *Ischaemum pilosum* (kunda grass) which has been already reported as collateral host (Sangitrao et al, Jan. 1978), *Dichanthium* sp. (Marvel grass) can also serve as a collateral host. Infection of ergot on Marvel grass was detected at Ner in Satara district in Maharashtra.

Dichanthium sp. is common in peninsular India. It grows as perennial herb and it flowers from August to April. Heavy dew stage of ergot with macro (triangular) and micro (oblong to oval) conidia were observed in December '79. The sclerotia, dirty white to black in colour and measuring 4 to 6 x 1 mm were also seen in some of the infected spikelets. Cross inoculation studies with the use of conidia from sorghum ergot and conidia from Marvel grass ergot revealed that sorghum and Marvel ergot were cross-inoculable. In addition it was found that Marvel ergot conidia could infect Bajra (*Pennisetum typhoides*), however the test with Bajra ergot infecting Marvel were inconclusive. Thus the role of this grass weed in spread and perpetuation of sorghum ergot cannot be neglected. It is possible that ergot fungus exists in strainal population, where the individual strains might differ in their infectivity and host range. Marvel grass also serves as feed for the cattle. Toxic effect due to ergot poisoning, if any, needs proper investigation. Further studies are in progress.

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198. Studies on Control of Nutgrass: *Cyperus*
C.B. Kurdikeri, V.S. Gidnavar,
M.M. Hosmani and T.K. Prabhakara Setty, Department of
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India.

Cyperus rotundus is a troublesome weed in irrigated areas. Studies on control of *Cyperus* were conducted for two years (1977-78 and 1978-79) at Agricultural Research Station Arabhavi (Belgaum, Karnataka). Effect of three herbicides

(glyphosate , bromocil and Na TCA) with two concentrations each were compared with un-sprayed control. The result indicated that bromocil and Glyphosate at 4 kg/ha controlled the Cyperus population significantly as judged on the basis of population ~~xx~~ and dry matter (weight) of bulbs. At lower doses, the herbicides ~~q~~ were not effective and Na TCA was totally ineffective in controlling Cyperus. Herbicide residues on succeeding crops (groundnut, maize, sunflower, gram, wheat, cotton and sorghum) had no harmful effect on germination and stand of the crop at 30 days after sowing.

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XIV. AQUATIC WEEDS AND THEIR CONTROL

199. The Problem of aquatic weeds in Kolloru lake- an appraisal
V.Seshavatharam and P.Venu, Department of Botany, Andhra University,
Waltair 530003, Andhra Pradesh.

The problem of aquatic weeds in Kolloru lake a large shallow eutrophic fresh water body extending over an area of 900sq.Km., in the district of Krishna and West Godavari in Andhra Pradesh was discussed. More than 18 species of aquatic macrophytes belonging to 14 families of the angiosperms have been recorded to occur in the lake with varying degrees of density and frequency. The seasonal maximum dry matter production estimated for some of the aquatic weeds of the lake varied from 24.4m.t per hectare in case of Ipomoea aquatica; 13.19 m.t per hectare in case of Ottelia alismoides and 0.15 m.t per hectare in case of Vallisneria spiralis, during the month of October 1977 from two localities Atapaka and Komatilanka, suggesting a very high potential for the organic matter production by the several weeds of the lake. In view of the low phytoplankton production, low oxygen concentration of the hypolimnion and of the high allochthonous inputs in to the lake in the form of agricultural run-off etc., it was suggested that any attempts to eradicate the aquatic weeds of the lake should be viewed with great restraint and caution, as their removal may result in greater harm, since these weeds are believed to be handling the problems of 'eutrophication' without devastating consequences though the extensive weed growth in the lake is hindrance for fish culture, navigation, sanitation etc.

200. Aquatic weeds Problem in Konkan Region (Western Maharashtra)
S.S.Wadje . Botany Department, Shri Panchm Khemraj Mahavidyalaya,
Savantwadi-416510, Maharashtra, India.

Studies carried out on aquatic weeds from lake of Savantwadi which is situated in coastal stretch of western Maharashtra, have revealed that Pseudoraphis spinescens, Hydrilla verticillata, Marsilea quadrifolia and Cynotis sp. were the dominant weeds of 12 observed. The lake is completely occupied by the noxious weeds. At the start of the rainy season (July to October), Pseudoraphis was found to be dominant in the lake followed by Hydrilla, Marsilea and Cynotis. But as the season progressed Hydrilla surpassed Pseudoraphis. In January-February, Pseudoraphis totally disappeared from the lake, almost all patches being occupied by Hydrilla which were previously occupied by Pseudoraphis. Finally Hydrilla is so dominant that a thick mat of 2-3 feet in thickness is noticed in the lake. The rapid and extensive growth of hydrilla in the lake is attributed to the excessive addition of nutrients to the lake. The lake is primarily enriched with the nitrates and phosphates from the sewage as well as phosphate detergents mixed during cloth washings. This has led to the heavy growth of Hydrilla (higher productivity) the lake eutrophication, which is a undesired type of pollution.

201. Herbicidal control of *Typha angustata*. K.Narayana Rao and P.Naraswara Rao, Andhra Pradesh Agricultural University, Agricultural College, Papatla-522 101, Andhra Pradesh, India.

A field trial was conducted during 1979 at the Agricultural College farm, Papatla, to study the effects of herbicidal combinations on *typha* with 2,4-D + paraquat, 2,4-D + diuron, glyphosate + paraquat + dalapon on actively growing plants. In another set of treatments reduced doses of the same combinations were included on the cut plants of *Typha*. Maximum weed control was observed with 2,4-D 10.0 + paraquat 2.5 kg/ha on whole plant spray. On the cut plants 2,4-D 4.0 + paraquat 0.5 + dalapon 4.25 kg/ha; 2,4-D 8.0 + paraquat 0.5 kg/ha and 2,4-D 4.0 + paraquat 0.5 kg/ha were good with minimum resprouts four months after spraying. It was indicated that cutting *Typha* plants to ground level and spraying reduced doses of herbicides were found to be best and economical as compared to whole plant spray.

202. Effect of seasonal sprays of Dalapon and Aminotriazole on the population fluctuations of *Typha angustata*. Mrs Indu Meheta and D.S.Boonlia, Soil and Water Management Research Station, Nanta Farm, Post Box No. 61, Kota, Rajasthan, India.

Due to varying modes of action, dalapon and aminotriazole show appreciably different herbicidal activities in different seasons and growth stages of the plants on account of variations in photoperiod, temperature and levels of carbohydrate reserves in the rhizomes of *Typha angustata*. An exhaustive study was therefore undertaken to find out the most suitable period for control of *Typha* by spraying these two herbicides in different seasons and to correlate the herbicidal activity with the mode of action and the physiology of the plants at different stages of growth. Dalapon and aminotriazole were sprayed at 8 kg/ha in July, September and November, 1975 and January, and June, 1976 on the plants (i) as such (Stage available in natural conditions) and (ii) having three months vegetative growth before spray. The monthly observations on the regrowth of the original population indicated that spraying of dalapon in July and of aminotriazole in September, November and January proved best, specially when the plants were sprayed after cutting. The population after these sprayings was almost nil throughout the year. Spray of dalapon on the plants as such in the month of July and September kept the regrowth less than 10% and 20% respectively upto six months and then it started increasing. When the plants were sprayed as such with aminotriazole the regrowth was less than 10% up to 10 months in case of September spraying and upto 7 months in case of November spraying. In general, spraying of aminotriazole after cutting proved better in all the seasons, while dalapon proved better, when sprayed on plants as such except in July and September when spraying preceded with cutting proved better.

203. Cultural and Chemical control of Hydrilla and Water Hyacinth
S.S.Pahuja and H.C.Sharma, Department of Agronomy, Haryana
Agricultural University, Hissar 125 004, Haryana, India.

To find out the suitable and effective cultural control for Hydrilla, the water was drained out from the pits for different periods and it was found that hydrilla required at least 5 days during April and only 2 days exposure during June for the complete sun drying of plants. Water hyacinth which is comparatively less sensitive to sun drying, required 12 days during April and 7 days during June for complete drying and killing of plants under moist soil conditions. Regarding the chemical control, all the herbicides viz., 2,4-D, diuron and paraquat at both the concentrations (2.5 and 5 ppm of 2,4-D and diuron, 0.5 and 1 ppm for paraquat) were found to be effective in controlling hydrilla plants during May as well as September (1978). All herbicides reduced drastically the chlorophyll content of the plants as well as the pH of treated water. No regeneration of hydrilla plants was observed. Water hyacinth could not be controlled by paraquat due to its low dose of 0.2 and 0.4 kg/ha. 2,4-D & diuron at both the doses of 1 and 2 kg/ha proved most phytotoxic as 100 percent mortality of plants was observed. Chlorophyll content of water hyacinth plants and pH of treated water decreased with the application of 2,4-D and diuron. Regeneration was observed only in paraquat treatment.

204. Response of Hybrid Bajara to water hyacinth manuring and Nitrogen fertilization. O.P.Nehra and S.P.Singh, Department of Agronomy, Haryana Agricultural University, Hissar-125 004.

One way to control weeds is to make use of them. Water hyacinth which is one of the world's worst weeds, was tried as manure in bajara crop in a field experiment conducted during the kharif season of 1977-78. Four levels of air dry water hyacinth (0, 1000, 2000 and 3000 kg/ha) and four levels of urea (0, 40, 80 and 120 kg N/ha) were tried in 16 treatments combinations. Water hyacinth was incorporated in to the soil one month before sowing of Bajara. Application of nitrogen through urea did not affect the plant height and test weight of bajara, but the dry weight of plants, number of tillers per plant, length of earheads and grain and stover yields per plant increased with the increase in nitrogen levels up to 120 kg/ha. Highest grain yield was obtained with 80 kg N/ha while the straw yield was maximum with 120 kg N/ha. A maximum net profit of Rs. 2000/- /ha was obtained with 80 kg N/ha. Different levels of water hyacinth manure did not affect plant height length of ear heads and test weight of Bajara. Water hyacinth manure at 2000 kg/ha produced maximum tillers per plant and also significantly dry weight and grain and stover yields per plant over control. This treatment also produced highest grain and stover yield per hectare but the differences were not significant. The interactions between nitrogen

fertilization and water hyacinth manuring regarding bajara yield was non-significant. Water hyacinth manuring not found to be economical.

205. Aquatic weed Problems of Andhra Pradesh and their control measures. K.Narayana Rao and K.Mahadeva Gupta and D.J.~~Sixx~~ Thandra Singh. Andhra Pradesh Agricultural University Agricultural College, Bapatla 522 101, Andhra Pradesh, India.

Problem concerning aquatic weeds found in Andhra Pradesh were discussed. The major floating aquatic weeds noticed were Eichhornia crassipes (Mart) Solms (Water hyacinth), Typha angustata Bory and Chaub., Ipomoea aquatica Forsk., Pistia Stratiotes, L., Nelumbo nucifera Gaertn., Nymphaea pubescens Willd., Monochoria vaginalis (Burn.f) C.Presl., Ottelia alismoides (Linn) Pers. and among algae Hydrilla verticillata, (L.f) Royle, Vallisneria spiralis, Cladophora sp., Ulothrix sp., Spirogyra and Chara. Measures to control these weeds and their limitations were described under mechanical, biological and chemical methods. Biological control consists of use of fish, duck, snails and manatee (mammal). The Chinese grass carp among fish seems to be a promising one to control Eichhornia crassipes, and Ipomoea aquatica can be controlled successfully by spraying sodium salt of 2,4-D @ 4.0 + paraquat @ 0.50 kg/ha on the actively growing weeds. Algae can be controlled by using copper sulphate @ 0.5 to 1.0 ppm, but periodical and repeated applications are necessary for a period of 5 to 7 days.

206. From Aesthetic to a Pest (Eichhornia crassipes (Mart) Solms). K.Narayana Rao and K.Mahadeva Gupta. Andhra Pradesh Agricultural University, Agricultural College, Bapatla-522101 Andhra Pradesh, India.

Water hyacinth (Eichhornia crassipes Mart) Solms., native to Brazil is now considered as a serious weed in 52 countries in the world. It propagates very rapidly and produces about 800 kg of dry matter per hectare in a day. The harmful effects and usefulness of water hyacinth are discussed. Mechanical, biological and chemical methods of control have been described. A combination of paraquat 0.50 + 2,4-D 4.0 kg/ha sprayed on the actively growing weeds was found to be the most effective method of chemical control of this weed.

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207. Yield Response of Some Fruit Vegetables to Zinc and NAA as Foliar Spray: T.P. Mustafee and Bibhas Ray, R and D Section, Farm Chemicals Ltd., Bombay 400 001, India.

Field studies were conducted with zinc, NAA and NAA-zinc combinations on tomato (Lycopersicon esculentum), brinjal (Solanum melongena) and chillies (Capsicum annuum) at various locations of West Bengal and Karnataka States during 1975-78. Three rates of NAA (10, 15 and 20 ppm) each with one and two applications and two rates of zinc (550 and 1100 ppm) with and without 10 ppm of NAA were used in the study on tomato. In case of brinjal and chillies, one application of zinc (550 and 1100 ppm) with and without 10 ppm of NAA and two applications of only NAA (7.5, 10, 15 and 20 ppm) were made at 5 and 7 weeks after transplantation of the seedlings. While spraying of zinc at 550-1100 ppm increased the yield to the extent of 5-8, 14-16 and 18-24 % in tomato, brinjal and chillies respectively, combination treatments of zinc at 550-1100 ppm with NAA at 10 ppm, in that place, recorded 25-27, 24-29 and 36-39 % more over control. Application of NAA alone also produced more crop with an average increase of 19 % in tomato, 23 % in brinjal and 21 % in chillies.

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208. Effect of Certain Plant Growth Regulators in Association with Nitrogen and Phosphorus on Growth Development and Yield of Groundnut: C.B. Shah, H.M. Mehta and J.J. Patel, Agronomy Department, Gujarat Agricultural University, Anand-388 110, Gujarat, India.

A study was conducted to investigate the effect of 2, naphthylacetic acid (NAA) and Indole butyric acid (IBA) each of two levels, 5 and 25 ppm respectively with 0 and 25 kg/ha nitrogen as well as 0 and 25 kg/ha phosphorus on sandy loam soil of Middle Gujarat. The soil had pH 7.2 with 0.47 % organic matter, 0.030 % total nitrogen, 50 kg/ha 5 M NaHCO₃ soluble phosphorus and 350 kg/ha exchangeable potash. The result of the experiment indicated that the differences due to treatments were significant in pod as well as straw yields. The application of nitrogen and phosphorus alone or in combination was not beneficial in increasing the economical yield of the crop. However, phosphorus application 25 kg/ha in association with any of the two hormones increased the pod yield significantly as compared to other treatments. The application of hormones in association with phosphorus increased the pod yield by 19.3 % and 22.6 % as compared to only nitrogen 25 kg/ha and only phosphorus 25 kg/ha respectively. Among the two hormones IBA increased the pod yield by 15.1 % as

compared to NAA, however, the difference between the hormones was not statistically significant.

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209. Response of Groundnut to Presowing Treatments with Phyto-hormones: R.K.Gupta and S.S. Singh, Department of Agronomy, Allahabad Agricultural Institute, Allahabad- 211 007, Uttar Pradesh, India.

Seeds of groundnut variety T64 were treated with 5, 10 and 25 ppm at GA, IAA, IBA, -NAA and TIBA for 24 hr. All the treatments showed favourable effects on dry matter production, nodul count, average number of pods per plant, average weight of pods per plant, pod yield, shelling percentage, seed index and fat and protein percentage. However, treatments did not show any effect on the date of first flowering. Response of crop to all auxin treatments was more pronounced, than GA and TIBA. Seeds treated with -NAA at 5 ppm gave the highest pod yield followed by IBA 10 and 25 ppm and IAA 5 ppm.

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210. Study on the Efficiency of Different Concentrations of Hydrazide in Inducing Dormancy in Groundnut: R.K. Gupta and S.S. Singh, Department of Agronomy, Allahabad Agricultural Institute, Allahabad-211 007, Uttar Pradesh, India.

In a trial with groundnut variety T64 the foliar application of MH at 5,000, 10,000, 15,000 and 20,000 ppm was made at 70 and 90 days after sowing with an object to induce dormancy in resulting seeds. It was observed that the dormancy was found to be more when the chemicals were sprayed at 90 days after sowing with a concentration of 15,000 and 20,000 ppm. The yield and yield components, viz., pod yield, shelling percentage, seed index, fat and protein percentage, were adversely affected by MH spraying as compared to control.

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211. Effect of Growth Regulators on Plant Growth, Yield and Quality of Groundnut: R.K. Gupta and S.S. Singh, Department of Agronomy, Allahabad Agricultural Institute, Allahabad-211 007, Uttar Pradesh, India.

In a field trial with groundnut variety TMV-7 the growth regulators viz., GA, IAA, IBA, -NAA and TIBA were

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used for seed treatment alone and seed treatment + foliar application 40 days after sowing (except GA) and performance of the crop was compared with control (seeds soaked in water only). The seeds treated with IAA and IBA gave highest percentage of germination while germination of seeds was found to be affected adversely when they were treated with TIBA. Plant growth, number of pods/plant, wt of pods/plant, pod yield, shelling percentage and seed index were found to be higher when seeds were treated with IAA + its foliar application which was followed by -NAA seed treatment alone. IAA seed treatment + foliar application and TIBA seed treatment gave highest value of seed oil content, while highest protein percentage was recorded in IPA seed treatment + foliar application.

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212. Effect of IAA and NAA on Growth and Nicotine Content of Tobacco: O.K.Garg, B.P.Singh and N.C.Sinha, Department of Plant Physiology, Banaras Hindu University, Varanasi, 221 005, Uttar Pradesh; Haryana Agricultural University, Hissar, Haryana and Indian Grassland and Fodder Research Institute, Jhansi 284 003, Rajasthan, India.

In a pot culture experiment, foliar spraying of IAA and NAA (5, 10, and 20 ppm) on tobacco plants were done 30 days after transplanting. IAA and NAA were not identical in their effects which may be accounted for their different molecular structures. Lower concentration (5 and 10 ppm) of both the growth substances were stimulatory, and high concentration (20 ppm) was inhibitory, of growth and flowering behaviour of tobacco plants.

Treatment with 10 ppm of IAA and NAA was most effective in elevating the nicotine content in tobacco leaves. Among the two hormones, NAA was superior to IAA.

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213. Induction of Wilt in Weeds by Fungal Metabolites: K.S. Deshpande and Ila Pappu, Botany Department, Science College, Nanded 431 602, Maharashtra, India.

Use of specific substances to influence particular plant function has been a recent development in agriculture and in India it is in the introduction phase. Toxins and growth regulators produced by phytopathogens provide a tool for effective weed control through induction of wilt, defoliation and preemergence-killing. Toxins synthesized by selected species of Helminthosporium, Alternaria induced rapid wilting in Parthenium hysterocarpus, Xanthium strumarium and Striga densiflora. The weeds were differentially sensitive to toxins though the toxins did not exhibit specificity. The differential responses of weeds appeared to be related to leaf surface waxes.

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214. Interaction of Parthenin with Gibberellic Acid on Growth Responses: Kuldeep Singh, S.N. Khosla and S.N. Sobti, Regional Research Laboratory (CSIR), Canal Road, Jammu Tawi-180 001, Jammu and Kashmir, India.

Parthenin has been reported to inhibit the seedlings' growth and seed germination whereas, gibberellic acid (GA_3) generally promotes these effects. Therefore, interaction of parthenin with GA_3 was studied to determine parthenin as an inhibitor. Five seedlings and 20 seeds each of Achyranthes aspera L. and Hordeum vulgare L. var. 'Ratna' were treated with different concentrations of parthenin, GA_3 and parthenin plus GA_3 for 24 hours in three replications each. Thereafter, they were washed thoroughly with tapwater and kept on moist filter papers for the next 72 hours to watch the subsequent growth of seedlings and seed germination. Same number of seedlings and seeds treated with different concentrations of parthenin and GA_3 separately for twenty four hours were washed with tapwater and treated again with GA_3 and parthenin respectively for another 24 hours. They were washed again and kept on moist filter papers for 72 hours to watch their growth responses. A similar set of seedlings and seeds treated with tapwater only was kept along with to serve as control. Significant inhibition of seed germination and of radical/root with parthenin treatment was observed at lower concentrations as compared to inhibition of plumule/coleoptile growth at higher concentrations. Lower concentrations of GA_3 significantly increased the plumule/coleoptile length whereas, no such results with radical/root and seed germination were observed over control. However, higher concentrations of GA_3 decreased the length of seedlings and seed germination rate. The GA_3 -induced growth of seedlings and seed germination was suppressed by parthenin when applied in combination with GA_3 or after the GA_3 treatment. However, GA_3 reduced the inhibitory effects of parthenin when the latter was applied prior to GA_3 but could not completely reverse the inhibition induced by parthenin. Therefore, these observations prove that parthenin is a growth inhibitor.

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215. Effect of Gibberellic acid, Abscissic acid and Phosphonate on the Germination and Seedling Growth of Melilotus parviflora Desf. S. Sarma, Department of Agricultural Botany, Gauhati University, Gauhati - 781 014, Assam, India.

Germination of seeds of Melilotus parviflora Desf. stored at 10°C was promoted by GA_3 . Highest germination percentage of 92.66 was obtained at 100 ppm

216. Controlled-release Herbicide for Crops: K.C. Das,
National Chemical Laboratory, Pune - 411 008,
Maharashtra, India.

Development of controlled-release pesticide formulations is one of the major objectives of current international pesticide research. From a controlled-release formulation the active ingredient is released at a fairly constant rate for a pre-determined period at a minimum effective dose at which pollution hazards to the non-target objects and to the environment are minimal. Chemical control of weeds by employing suitable herbicides is a more reliable method and many persistent and short life herbicides are effective. 2,4-D which is the cheapest herbicide causes drift hazards, translocation and run-off which are undesirable. The National Chemical Laboratory has developed a new and novel controlled-release, selective, preemergent herbicide granular 2,4-D formulation for effectively controlling many dicotyledenous and some monocotyledenous weeds in rice, wheat, jowar, bajra and sugarcane. The novelty of the present formulation is that the herbicide is chemically combined with an inert cheap naturally occurring polymer. The active ingredient is slowly released in the soil in desired minimal dose which is toxic to weeds and not to the main crop. Repeated multilocal large scale field trials carried out in India and abroad on crops during the last three years have confirmed the efficacy of the formulation. The formulation also controls parthenium hysterophorus. Data on dose, time of application, phytotoxicity to crops, types of weeds, controlled, toxicity and soil residues have been collected. The product is being registered by the Central Insecticide Board. The know-how is available from the National Research and Development Corporation, New Delhi.

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217. Wick Wiper Weeder for Row Crops: V.C.S. Sastry and
M. Lall, Central Plant Protection Training Institute,
Hyderabad 500 030, Andhra Pradesh, India.

Unsatisfactory weed control and damage to the crops are not uncommon due to improper application of herbicides. In order to have a suitable herbicide applicator a 'Wick Wiper Weeder' was designed by attaching a spray tank (an ordinary tin) with wicks to the wheel hoe. The unit consists of a tank with several holes in its bottom in which a number of wicks, similar to those used in stoves are fitted. When the applicator is in use

the herbicide percolates through these wicks and wipes over the weed foliage. With this applicator even non-selective herbicides can be applied in row crops, comparatively at low water volume and lower dosage of herbicides. In row crops like sunflower, safflower, brinjal, green gram, cow pea, etc., where directed application is not possible this wiper can be used safely. The height of the applicator can be adjusted according to the height of the weeds and application can be done at early growth stage of the crop. The unit can be fabricated easily by a village artisan and attached to the wheel hoe commonly used by the farmers at a nominal cost.

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218. Instrumental Methods for Herbicide Quality Control and Residue Analyses: The Alkali & Chemical Corporation of India Ltd., Ennore Express Highway, Ennavoor, Ennore P.O., Madras - 600 057.

In the field of crop protection chemicals, rigid quality control has assumed paramount importance in view of the scientific awareness and knowledge and the consequent regulatory requirements on safety and efficacy in use. The experience over several years have revealed that undesirable by-products arising from poor manufacturing techniques have deleterious effects, and so even in the field of crop protection chemicals it has become customary to talk of impurity levels rather than of purity as with drugs. The proper assessment of these impurities during manufacture requires the use of sophisticated analytical instrumentation.

In recent years there has been greater realisation of the harmful effects of chemical residues that can build to hazardous levels. Research and regulation have done much to limit the use of ecologically unsafe materials that cause irreparable damage to the soil and microorganisms. The revolution in analytical methodology has fulfilled the demands to detect parts per billion levels of chemical residues and has completely replaced the "bucket chemistry" of yester years.

A brief description of modern instruments available for this purpose highlighting their capabilities and limitations, and some of the special analytical methods developed in this field, are presented in the paper.

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219. Weeds and Weed Identification:

David N. Sen, Plant Ecology Laboratory, P.O.Box 14, Botany Department, University of Jodhpur, Jodhpur-342 001, Rajasthan, India.

The proper identification of any weed is a prerequisite for its effective control. Weeds show remarkable variations throughout the length and breadth of this country, mainly controlled by habitat and climatic conditions. This may lead to confusion with regard to their identification, more so when some of the weeds enlengthen their life-cycle by becoming 'off-season'. Polymorphism is another feature which creates difficulty in weed identification. Besides polymorphism in the habit of the weed, dimorphic and polymorphic seeds have been noted in several weeds. The diversity in the sizes, weight and germination of fruits and seeds has been termed 'ecological individuality'; this may empower weeds to face the onslaught of harsh environment, and render their control, still more difficult. There are adaptations in weeds with regard to their seed viability, germination, production of inhibitors in the seed coat, seedling growth, and dispersal mechanism. Almost all weed seeds possess morphological adaptations for long and short distance dispersal. Large quantities of seeds are maintained as a reserve in the soil for several years and still viable. High viability of seeds enables them to withstand uncongenial ecological conditions. The ability of seeds to germinate in different environmental conditions is of immense importance for their survival and remaining a perpetual source of nuisance to different crops. Additional means of multiplication, besides seeds, like tubers, rhizomes, stolons, runners, etc., give them sustained potentiality for activity. Even roots have been noted to help in the perennation of certain weeds. Production of inhibitors in the plant biomass or in the seed is of great consequence. In contrast some weeds may be helpful to the soil and crop, and not always harmful.

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220. Weed Research Methodologies for Multiple Cropping Systems with Particular Reference to Rainfed Farming: S.V.R. Shetty and A.N. Rao, Farming Systems Research Program, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, P.O. 502 324, Andhra Pradesh, India.

The broad strategy for weed research in cropping systems should involve study and evaluation of existing weed problems and weeding systems and the development and evaluation of alternate, improved weed management systems.

It is recommended that the research should involve three basic activities of biological and socio-economic surveys, research station studies and on 'on-farm' studies. The methodology and the techniques involved in these three activities are described with particular emphasis on the cropping systems of the semi-arid tropics. Detailed methodologies for eco-physiological and agronomic studies under small plot and large operational scale field trials are discussed. It is advocated that the meaningful understanding of the implications of multiple cropping on weeds can only be achieved if systematic research on weed ecology is included. Methods and techniques to monitor the weed growth to assess the critical period of crop weed competition and predict future problems in different systems are described. It is emphasized that the research should be aimed at improving the productivity on an 'year-round' basis with recognition of and focus towards the interdependencies and interrelationships that exist among different components of the cropping systems. The problems encountered in weed research techniques and the collection and analysis of data in different cropping systems are described. The philosophy and approaches to better understanding weed problems and to developing more stable integrated approach to weed management are described with a few examples from rainfed farming situations.

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221. Techniques of Herbicide Screening and Evaluation: V.S. Rao,
Tocklai Experimental Station, Tea Research Association,
Jorhat 785 008, Assam, India.

Herbicide screening, very crucial for successful weed research programme, includes field trials at different levels of experimentation with experimental herbicides, commercial herbicides already proven effective in other crops and elsewhere, and combinations of herbicides. There are: (1) Primary screening trials, (2) secondary screening trials, (3) regional and demonstration trials, and (4) special study trials. For all these trials, uniformity of weed growth and population should be the main concern in selecting an experimental site. This can be achieved by arranging blocks and plots across the weed population/growth gradient or in various configurations within the experimental site and also by seeding or planting weeds in the trials area or by raising special weed nurseries. Plot size should be such that would give the desired information without excess variability and plot numbering should be in a way which would avoid unnecessary confusion. The herbicide application should be done by using a proper sprayer in accurately calibrated quantities.

(either on area basis or volume basis) and by adopting appropriate spraying techniques.

Evaluation of treatments, the most vital part of experimentation, should be done at appropriate intervals to elicit valuable information on weeds and crop by qualitative and/or quantitative methods. Rating of weed control and crop injury at different scales constitute qualitative method mostly used for primary screening trials. The quantitative methods like weed counts, plant height and height and crop yield on selective or whole area are more useful for secondary screening, regional and demonstration and special study trials.

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222. Comparative Efficiency of Different Methods to Evaluate Weed Control Treatments in Field Crop Experiment:
M.S. Soundara Rajan, T. Sessaiah and G.H. Sankara Reddi,
Department of Agronomy, Andhra Pradesh Agricultural University, Tirupati, Andhra Pradesh, India.

Different methods to assess the efficiency of herbicidal treatments in groundnut crop were compared. Weed control efficiency which indicates the extent of reduction of weed competition was calculated separately for cumulative weed population and dry weight. Weed index another method to evaluate efficiency gives the extent of reduction in economic yield in a treatment compared to that in the weed-free treatment. Herbicidal efficiency index integrates both these aspects. However, a more reliable index now suggested is the weed control index which is the ratio of economic yield index to weed yield index as both the indices are calculated taking the weed and crop yield from unweeded control as the standard.

Data from a weed control field experiment in irrigated groundnut was used to calculate weed control efficiency, weed index, herbicidal efficiency index and the weed control index now suggested. The weed control efficiency was better reflected with cumulative weed dry weight than with cumulative weed population. Highest weed control efficiency with population or dry weight of weeds in this experiment was obtained with preemergence treatment of 2 kg/ha of alachlor supplemented with hand weeding at 45 days. However, preemergence treatment of 4 kg/ha of alachlor was found to be the most efficient with least weed index, highest herbicidal efficiency index and weed control index. Weed control index is more appropriate for evaluating efficiency of weed control treatments as it integrates the effect of the treatments

on weed dry matter and economic yield with a common base value for both from unweeded control.

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223. Field Weed Research Methodology in Integrated Weed Control Approach in Cotton Crop: S.C. Jain, All India Coordinated Cotton Improvement Project (AICCIP), Jawaharlal Nehru Krishi Vishwa Vidyalaya (JNKVV), Campus Indore 452 001, Madhya Pradesh, India.

Combination of cultural and chemical methods of weed control often increases the efficacy of the treatments. The increase in yield is not uniform. Consecutively following formula is evolved to express the 'Yield Index' (YI) in terms of percentage increase in yield:-

$$YI = \frac{I - H}{I} \times 100$$

Where I is the yield due to integrated weed control system and H is the yield due to the treatment for which YI is to be estimated. This formula will help to assess the effectivity of integrated methods of weed control over the chemical or conventional methods employed for weed control.

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224. Utilization of Weeds for Human Benefits: G. Thyagarajan, J.N. Baruah and H.D. Singh, Biochemistry Division, Regional Research Laboratory, Jorhat 785 006, Assam, India.

The highly prolific growth of the aquatic weed Water Hyacinth (Eichhornia crassipes syn. Pontedaria crassipes) is an increasingly serious environmental problem facing many parts of the world today. By its prolific growth this weed competes with other aquatic lives and brings about destruction of the ecosystem of inland water. It impedes drainage of cultivable land rendering it unproductive. Other damaging effects of water hyacinth includes: incubation of insects and disease vectors, hindrance to navigation, interference with fishing, increased loss of water by plant transpiration, restriction of desirable aquatic plant growth, depletion of oxygen in water and destruction of recreational value of inland waters. The various control measures involving chemical, biological and mechanical devices suggested from time to time to combat this infestation and the various uses of the plant for manure, biogas generation are discussed in this paper. An integrated approach to the problem of management of this weed for the benefit of mankind is being tried under the auspices of the UNEP - Commonwealth Science Council inter-country collaborative project on "Management of Water Hyacinth". The paper describes in detail the approach being made under this project to find out economic ways to utilize this aquatic weed.

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225. Weed Problems in NEH Region and Suitable Strategy for their Control: G.B. Singh and R.D. Singh, ICAR Research Complex for NEH Region, Shillong 793 003, India.

Favourable climatic conditions prevailing in the NEH Region induces profuse growth of undesirable weed species along with the cultivated ones. They are responsible for causing great decline in yield beside other adverse effects. Studies conducted on this aspect with the main objective of suggesting suitable control measures revealed that Eupatorium and Mikania are the two noxious weed species, which have assumed an alarming situation specially under uncultivated waste land, airfields, tea gardens and roadside areas etc. Under jhum system of cultivation, one of the reasons advocated for abandoning the jhum land is the prolific growth of weeds. Some efforts by the Scientists

of ICAR Research Complex were made from different angles under such situations and to find out a feasible solution for the same. According to the study made, loss in rice yield were found to vary from 40 - 60 %. Eupatorium and Mikania were found to be susceptible to the application of 2,4-D amine salt and 2,4,5-T whereas propanil (Stam F-34) was found good in controlling the weeds in paddy. Application of 2,4-D sodium salt and butachlor (Machete) granules were also found to have suppressive effect on weeds growth in paddy fields.

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