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Short communication

Evaluation of pre- and post-emergence herbicides in groundnut

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Groundnut is the most prominent and important crop among all oil seed crops. It is one of the chief foreign exchange earning crops for India. However, owing to lack of appropriate management practices, production and area under cultivation of groundnut have remained low. It is grown on 4.70 million ha area with a total production of 6.60 million tonnes and an average productivity of 1400 kg/ha in our country. (Department of Agriculture, Cooperation and Farmers Welfare, 2014-15). Currently used tillage practices common to groundnut production favor germination, growth, and development of weeds. Weeds compete with crop plants for nutrients and remove 30 to 40% of applied nutrients resulting in significant yield reductions (Dryden and Krishnamurthy 1977). Reduction in groundnut crop yield due to weed alone is estimated to be 16-42% depending on crop and location (Rangasamy *et al.* 1993). In *Kharif* season, weeds cause greater loss compared to insects or other plant diseases. Depending on weed intensity, the yield reduction in groundnut ranged between 40-50% (Mishra 1997). Successful production of groundnuts demands that maximum economic yields be harvested from each field. Because of the growth habits of groundnut, weed removal is extremely difficult once weeds become established between the rows. Mechanical removal by tractor mounted cultivators becomes impossible. Manual weeding requires huge labour force and accounts for about 25% of total labour requirement of about 900-1200 man hours/ha (Nag and Dutt 1979). Concequently, it is obvious to accept chemical weed control practices in groundnut to control annual and perennial weeds. In this view, this experiment was conducted to evaluate suitable herbicides and herbicide combinations for *Kharif g*roundnut.

A field experiment was carried out at research farm of Zonal Agricultural Research Station Khargone, JNKVV, Jabalpur during *Kharif* (rainy season June-October) of 2007 and 2008. The site of the experimental field having clayey loam texture with the pH of 7.7. The soil had 0.42% organic carbon content, high available N (258 kg/ha), medium available P (14.2 kg/ha) and high K (375 kg/ha), respectively. The recommended dose of NPK and Zn for groundnut crop was 25:50:30:05:N:P:K:Zn kg/ha. The experiment had seven treatments, set in a randomized complete block design with 3 replications in fixed plots. Treatments comprised unweeded control, weed free check, pendimethalin 1.0 kg/ha as pre-emergence (PE) + 1 hand weeding at 30 DAS, post-emergence quizalofop-ethyl 50 g/ha at 20 DAS, post-emergence imazathypyr 75 g/ha at 20 DAS, pre-emergence pendimethalin 1.0 kg/ha + post-emergence quizalofop-ethyl 50 g/ha (750 ml/ha) at 20 DAS and pre-emergence pendimethalin 1.0 kg/ha + post-emergence imazathypyr 75 g/ha at 20 DAS. The crop variety '*JGN*-3' was sown during first week of July with spacing of 30 x 10 cm with seed rate of 100 kg/ha. Agronomic practices other than treatments were performed evenly to all the plots as per-recommended package of practices. Different observations were recorded during the course of investigation. Net return and B C Ratio was computed on the basis of cost of cultivation and pod yield at prevailing market prices. Statistical analysis of the data was carried out using analysis of variance technique as applicable to RCBD.

Effect on haulm and pod yield

The total plant population at harvest was not significantly influenced under different weed control treatments (Table 1). The maximum plant population was observed with application of pre-emergence pendimethalin 1.0 kg/ha + post-emergence quizalofop-ethyl 50 g/ha (750 ml/ha) at 20 DAS (289/ m^2), which was followed by weed free check (283/ m^2); whereas lowest plant population was observed in unweeded check (264/m^2). Dry haulms yield was observed significantly higher in all the treatments compared to unweeded check. The highest dry haulms yield was recorded under influence of treatment where pre-emergence pendimethalin 1.0 kg/ha + post-emergence imazathypyr 75 g/ha was applied at 20 DAS (2.40 t/ha) followed by weed free

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check (2.35 t/ha) and post-emergence imazathypyr 75 g/ha (750 ml/ha) at 20 DAS (2.09 t/ha). Pre-emergence pendimethalin 1.0 kg/ha + post-emergence imazathypyr 75 g/ha at 20 DAS, weed free check and post-emergence imazathypyr 75 g/ha at 20 DAS were at par to each other but were significantly superior to other treatments in reference to dry haulms yield. Pre-emergence application of pendimethalin 1.0 kg/ha recorded lower weed population, higher pod and haulm yields due to control of weeds at early stage (Bhatt *et al.* 2008).

In groundnut nodule formation, weed control index and pod yield were maximum with pre-emergence application of pendimethalin 1.0 kg/ha (Deshmuk and Dev 1995). Jain *et al*. (2000) confirmed that pre-emergence application of pendimethalin 1.5 kg/ha reduced the weed density, weed biomass and increased the weed control efficiency as well as number of pods/plant and weight of pods in groundnut crop. Whereas, Nayak *et al*. (2000) reported that the higher weed control efficiency was found in pendimethalin 1.0 kg/ha, which was at par with two hand weeding at 25 and 40 DAS.

Dry pod yield was recorded maximum in weed free check (1.52 t/ha) followed by application of pre-emergence pendimethalin 1.0 kg/ha + post-emergence imazathypyr 75 g/ha at 20 DAS (1.21 t/ ha) and was minimum in un-weeded check (0.61 t/ ha). This might be due to minimized competition of weeds with main crop for resources, *viz*. space, light, nutrients and moisture due to effective weed control**.** Singh and Giri (2001) have also concluded that proper weed control was responsible for increase in plant height and dry matter production in groundnut. Weed free environment in crop also facilitated better peg initiation and development at the critical growth stages of groundnut which tends to increase in number of pods/plant and pod yield/ha. Higher profitable pod yield of summer groundnut was also reported by Raj *et al.* (2008) with keeping the crop in weed free condition.

All the treatments produced significantly higher dry pod yield in comparison to un-weeded control, while yields of pre-emegence pendimethalin 1.0 kg/ha + post-emergence imazathypyr 75 g/ha at 20 DAS, post-emergence imazathypyr 75 g/ha at 20 DAS and pre-emegence pendimethalin 1.0 kg/ha + post-emergence quizalofop-ethyle 50 g/ha at 20 DAS were found to be at par with each other. These results are generally in agreement with those obtained by Kumar *et al.* (2003a) and Kumar *et al.* (2003b). Gnanamurthy and Balasubramaniyan (1998) have also stated that the uncontrolled weed reduce groundnut yield up to 75%.

Economics

Economic evaluation of different weed control treatments showed maximum net return in weed free check (`16712/ha) followed by pre-emergence pendimethalin 1.0 kg/ha + post-emergence imazathypyr 75 g/ha (750 ml/ha) at 20 DAS (` 16270/ ha). While maximum B:C ratio was observed in pre-emergence pendimethalin 1 kg/ha + post-emergence imazathypyr 75 g/ha at 20 DAS (2.2) followed by post-emergence imazathypyr 75 g/ha at 20 DAS (2.1) and post-emergence quizalofop-ethyl 50 g/ha at 20 DAS (1.9). This might be due to the cost of cultivation of groundnut crop was increased in treatment weed free check because of the higher involvement of labours and their higher wages. This cost was reduced in treatment pendimethalin 1.0 kg/ ha as pre-emergence + imazethapyr 0.15 kg/ha as post-emergence by using herbicides to effective control of weeds with less number of labors. Sasikala *et al.* (2004), Tomar *et al*. (2009) and Rao *et al.* (2011) have also reported higher net return and B:C

Table 1. Evaluation of post-emergence herbicide in groundnut crop (mean of 2007-08 and 2008-09)

Treatment	Final Plant population/m^2	Dry haulum yield (t/ha)	Dry pod yield (t/ha)	Cost of cultivation (x10^3 `/ha)	Net income (x10^3 `/ha)	B:C ratio
Pre-emergence pendimethalin 1.0 kg/ha + one hand weeding at 30 DAS	259	1.78	1.10	14.02	10.43	1.7
Post-emergence quizalofop-ethyle 50 g/ha at 20 DAS	279	1.89	0.90	12.02	10.70	1.9
Post-emergence imazathypyr 75 g/ha at 20 DAS	283	2.09	1.11	12.50	14.96	2.1
Pre-emergence pendimethalin 1.0 kg/ha + post-emergence quizalofop-ethyle 50 g/ha at 20 DAS	289	1.64	1.15	12.52	10.53	1.8
Pre-emergence pendimethalin 1.0 kg/ha + post-emergence imazathypyr 75 g/ha at 20 DAS	277	2.40	1.21	13.87	16.27	2.2
Unweeded check	264	1.15	0.61	10.52	4.50	1.4
Weed free check	283	2.35	1.52	19.52	16.71	1.8
LSD (P=0.05)	NS	0.33	0.17	-	-	-

ratio with integration of pre- and post-emergence application of herbicides with hand weeding in groundnut.

It could be concluded that application of pre-emergence pendimethalin 1.0 kg/ha + post-emergence application of imazathypyr 75 g/ha at 20 DAS gave higher pod and haulm yields and maximum net return on per rupee invested. The results confined that use of herbicides to weed control is a cheaper and economical method of weed control. It is also a best option to reduce the constraints of labour scarcity in Indian agriculture.

SUMMARY

The experiment comprised 7 treatments *i.e*. un weeded control, weed free check, pendimethalin 1.0 kg/ha (PE) + 1 hand weeding at 30 DAS, post emergence quizalofop-ethyl 50 g/ha at 20 DAS, post-emergence imazathypyr 75 g/ha at 20 DAS pre-emergence pendimethalin 1.0 kg/ha + post-emergence quizalofop-ethyl 50 g/ha at 20 DAS and pre emergence pendimethalin 1.0 kg/ha + post emergence imazathypyr 75 g/ha at 20 DAS. The experiment was set in a randomized-complete block design (RCBD) with 3 replications, in fixed plots and the crop variety '*JGN-3'* was sown 100 kg/ha during first week of July with spacing of 30 x 10 cm. Application of pendimethalin 1.0 kg/ha + imazathypyr 75 g/ha (750 ml/ha) at 20 DAS gave comparable pod yield (1.21 t/ha) and maximum net returns on per rupee invested. The results confined that the use of pre and post emergence herbicides in combination to groundnut crop is a practically efficient and economically feasible method to control weeds and fetch higher returns.

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