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Integrated Approach for the Control of Hardy Weeds in Groundnut (*Arachis hypogaea* L.)

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ABSTRACT

An experiment was conducted during 2005 and 2006 at the Research Farm of the Department of Agronomy, Agrometeorology and Forestry, PAU, Ludhiana in order to control some hardy weeds like *Acrachne racemosa*, *Commelina benghalensis*, etc. in groundnut. Crop treated with pre-plant application of fluchloralin 0.675 kg and pre-emergence application of pendimethalin 0.75 kg, oxyflourfen 0.25 kg and alachlor 1.25 kg/ha each f. b. one hand weeding as well as oxyflourfen 0.50 kg/ha alone produced significantly higher pod yield and significantly less weed dry matter accumulation as compared to the recommended treatment i. e. fluchloralin 0.675 kg/ha during both the years. However, during second year pre-plant application of trifluralin 0.75 kg/ha f. b. one HW, trifluralin 1.0 kg , oxyflourfen 0.25 kg+pendimethalin 0.5 kg, oxyflourfen 0.25 kg+trifluralin 0.75 kg/ha and two hand weedings treatments also resulted in significantly higher pod yield and significantly less weed dry matter accumulation than recommended treatment. On the basis of average of two years, all the herbicidal treatments except alone application of fluchloralin 0.675 kg and pendimethalin 1.0 kg/ha produced significantly higher pod yield than unweeded control treatment. Integration of hand weeding with pre-plant application of fluchloralin 0.675 kg and trifluralin 0.75 kg as well as pre-emergence application of pendimethalin 0.75 kg , oxyflourfen 0.25 kg and alachlor 1.25 kg/ha increased pod yield by 39.1, 43.0, 54.6, 54.5 and 55.9% than unweeded control and 14.7, 17.9, 27.5, 27.4 and 28.4% than alone application of fluchloralin 0.675 kg/ha (recommended).

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is very important oilseed crop and it contributes 67% of total edible oil produced in India. The demand for edible oils is rising at about 6% per year. Therefore, concerted efforts are now being made to stabilize and increase oilseed production. Groundnut was the major **kharif** crop of the Punjab state about 3-4 decades back but with the popularization of rice, the area under this crop had decreased drastically. These days, this crop is grown in pockets of Sangrur, Barnala, Patiala and Ludhiana districts. Among the various factors responsible for deplorably low yield of groundnut, severe infestation of weeds is one of the major constraints. Due to slow initial growth and coincidence of this crop with monsoon season, the problem of weeds is also very serious and if left uncontrolled, these may reduce the groundnut yield upto 76% (Gnanamurthy and Balasubramanian, 1998).

At present pre-plant application of fluchloralin 0.675 kg/ha or pre-emergence application of alachlor 2.5 kg/ha are recommended and due to high temperature, rapid degradation of these herbicide takes place. Hardy weeds, namely, *Acrachne racemosa*, *Commelina benghalensis*, *Cucumis trigonus*, etc. are not controlled with these recommended herbicides. So, in order to control these hardy weeds, research trials were conducted during the *kharif* seasons of 2005 and 2006.

MATERIALS AND METHODS

An experiment was conducted at Research Farm, Department of Agronomy, Agrometeorology and Forestry, PAU, Ludhiana during **kharif** season of 2005 and 2006 in order to develop some integrated approach for the control of hardy weeds in groundnut and to find out the interactive effects of tank mix herbicides. The experimental field with enough natural weed population was selected for conducting trial. Sowing of groundnut variety M 522 was done on 05.06.2005 and 09.06.2006 in rows spaced 30 cm keeping plant to plant spacing of 22.5 cm. A seed rate of 95 kg/ha was used during both the years. The experimental field was loamy sand in texture with was low available N and medium available P and K. Crop was raised by applying 15 kg N, 20 kg P_2O_5 and 25 kg K_2O/ha at the time of sowing. Economics was calculated by taking MSP of groundnut as Rs. 1520 per quintal and straw prices at the rate of Rs. 40 per quintal. Cost of cultivation excluding the herbicides was taken as Rs. 15770 per hectare. Herbicide prices used

for calculating economics were Treflan Rs. 380 per litre, Stomp Rs. 390 per litre, Lasso Rs. 260 per litre, Basalin Rs. 530 per litre and Goal Rs. 1760 per litre. Cost of had weeding was taken as Rs. 2000 per hectare for first hand weeding and Rs. 1250 per hectare for second or followed by treatment of hand weeding by considering Rs. 100 per day as wages of farm labour. Net returns were worked out as follows :

Net returns (Rs.)=Gross returns (Rs.)–Common cost of cultivations excluding weed control-Cost on weed control in a particular treatment.

B : C ratio=Gross returns/Cost of cultivation

The experiment was laid out in randomized block design with 16 treatments (Table 1) and four replications. Spray of different herbicidal treatments was done before sowing (pre-plant) or within two days of sowing (pre-emergence) as per treatment with knap-sack sprayer with discharge rate of 500 litres/ha. Weed dry matter at harvest was recorded by using the quadrate measuring 50 x 50 cm, randomly from two locations per plot.

RESULTS AND DISCUSSION

Effect on Weeds

The experimental field had sufficient population of hardy weeds such as *Commelina benghalensis* (Kaon makki), *Acrachne racemosa* (Gha) and *Cucumis trigonus* (Chibber bel), etc. Apart from these weeds, enough population of *Eleusine aegyptiacum* (Makkra), *Eleusine indica* (Madhana), *Eragrostris* spp. (Chirian da dana), *Digera arvensis* (Tandala), *Leucas aspera* (Gumma) and *Rhyncosia capitata* (Patasa bel) was also present in the field. During both the years, all the herbicidal treatments produced significantly less weed dry matter as compared to unweeded control treatment (Table 1). Integration of hand weeding with pre-plant application of fluchloralin 0.675 kg and trifluralin 0.75 kg/ha and pre-emergence application of pendimethalin 0.75 kg, oxyflourfen 0.25 kg and alachlor 1.25 kg/ha resulted in significant reduction in dry matter accumulation by weeds as compared to the recommended treatment i. e. pre-plant application of fluchloralin 0.675 kg/ha. Similar findings were earlier reported by Kumar *et al.* (2004) and Solanki *et al.* (2005). Performance of pre-emergence application of oxyflourfen 0.50 kg/ha was found to be comparatively better than

Table 1. Dry matter of weeds and yield attributes of groundnut as influenced by different weed control treatments

Treatment	Dose (kg/ha)	Final dry matter of weeds (kg/ha)		Plant height (cm)		No. of branches/ plant		No. of pods/ plant	
		2005	2006	2005	2006	2005	2006	2005	2006
T_1–Fluchloralin, pre-plant (Standard)	0.675	1745	1267	61.5	51.5	16.4	13.2	29.8	18.1
T_2–Fluchloralin, pre-plant f. b. HW	0.675	1475	975	62.2	48.6	16.2	11.1	31.1	17.1
T_3–Trifluralin, pre-plant. f. b. HW	0.75	1041	682	59.4	56.2	15.5	15.7	32.7	23.4
T_4–Trifluralin, pre-plant	1.25	1212	863	57.0	46.9	14.8	10.7	33.7	21.0
T_5–Pendimethalin, pre-em f. b. HW	0.75	985	698	60.3	56.6	16.1	14.8	33.0	20.0
T_6–Pendimethalin, pre-em.	1.0	1987	1185	58.8	50.4	17.0	11.7	28.3	18.6
T_7–Pendimethalin, pre-em.	1.25	1341	1072	60.7	48.9	15.2	11.3	30.1	19.6
T_8–Oxyflourfen, pre-em. f. b. HW	0.25	1049	709	59.2	61.7	14.5	16.0	33.5	17.2
T_9–Oxyflourfen, pre-em.	0.37	1719	1198	61.8	54.2	15.5	13.0	28.8	12.5
T_{10}–Oxyflourfen, pre-em.	0.50	1284	904	61.5	52.6	17.0	12.9	32.9	20.9
T_{11}–Alachlor, pre-em. f. b. HW	1.25	1041	694	60.5	59.4	16.2	15.0	32.6	15.9
T_{12}–Alachlor, pre-em.	2.50	1225	823	62.2	50.3	15.8	13.4	30.1	18.2
T_{13}–Oxyflourfen+pendimethalin	0.25+0.50	1182	739	62.7	55.7	15.4	13.4	30.9	15.7
T_{14}–Oxyflourfen+trifluralin	0.25+0.75	1297	980	60.9	51.5	15.2	12.4	29.3	16.2
T_{15}–Two hand weedings	-	1207	714	59.2	55.4	15.4	13.7	29.7	21.0
T_{16}–Control (unweeded)	-	2761	2439	60.5	40.5	15.4	9.8	27.2	16.8
LSD (P=0.05)		564	480	NS	5.3	NS	1.4	4.5	4.5

f. b.–Followed by, NS–Not Significant.

other tried herbicides.

Effect on Crop

During 2005, the difference in plant height and number of branches/plant among different treatments were found to be non-significant (Table 1). During 2006, the plant height of unweeded control plot was found to be significantly less as compared to all weed control treatments. The highest plant height during second year was recorded in pre-emergence application of oxyflourfen 0.25 kg (f. b.) one hand weeding which was at par with pre-emergence application of pendimethalin 0.75 kg/ha f. b. one hand weeding and alachlor 1.25 kg/ha f. b. one hand weeding. The integration of one hand weeding with pre-emergence application of oxyflourfen 0.25 kg/ha produced the highest number of branches/plant which was at par with pre-plant application of fluchloralin 0.675 kg, pre-emergence application of pendimethalin 0.75 kg and alachlor 1.25 kg/ha each f. b. one hand weeding. The difference in number of pods/plant during both the years was also found to be significant. During 2005, pre-plant application of fluchloralin 0.675 kg and trifluralin 0.75 kg/ha and pre-emergence application of pendimethalin 0.75 kg, oxyflourfen 0.25 kg, alachlor 1.25 kg/ha each f. b. one hand weeding and pre-emergence application of oxyflourfen 0.50 kg/ha produced significantly higher number of pods/plant as compared to unweeded control. However, during 2006, only trifluralin 0.75 (pre-plant) f. b. one hand weeding produced significantly more number of pods/plant as compared to unweeded control treatment.

During both the years, all the herbicidal treatments except pre-emergence application of pendimethalin 1.0 kg/ha produced significantly higher pod yield as compared to unweeded control treatment (Table 2). Crop treated with pre-plant application of fluchloralin 0.675 kg and pre-emergence application of pendimethalin 0.75 kg, oxyflourfen 0.25 kg, alachlor 1.25 kg/ha each f. b. one hand weeding and oxyflourfen 0.50 kg/ha alone produced significantly higher pod yield as compared to the recommended treatment i. e. fluchloralin 0.675 kg/ha during both the years. However, during second year pre-plant application of trifluralin 0.75 kg f. b. one hand weeding and trifluralin 1.0 kg, oxyflourfen 0.25 kg+pendimethalin 0.5 kg, oxyflourfen 0.25 kg+trifluralin 0.75 kg/ha and two hand weedings treatments also resulted in significantly higher pod yield than recommended treatment i. e. pre-plant application of fluchloralin 0.675 kg/ha. On an average of two years, all the herbicidal treatments except alone application of

Table 2. Pod and stover yield, economics and benefit : cost ratio of groundnut as influenced by different weed control treatments

Treatment	Dose (kg/ha)	Pod yield (kg/ha)		Stover yield (kg/ha)		Net return (Rs./ha)		B : C ratio	
		2005	2006	2005	2006	2005	2006	2005	2006
T_1–Fluchloralin, pre-plant (Standard)	0.675	2840	1630	8270	6820	26934	23936	2.63	1.51
T_3–Fluchloralin, pre-plant f. b. HW	0.675	3142	1986	8610	7012	46058	27605	2.70	1.71
T_3–Trifluralin, pre-plant f. b. HW	0.75	3257	2016	8540	7029	48028	28376	2.83	1.76
T_4–Trifluralin, pre-plant	1.25	3762	2138	8550	7113	56574	31452	3.44	1.96
T_5–Pendimethalin, pre-em f. b. HW	0.75	3589	2111	8870	7082	53933	31005	3.28	1.93
T_6–Pendimethalin, pre-em.	1.0	2605	1547	8010	6689	38616	21962	2.34	1.39
T_7–Pendimethalin, pre-em.	1.25	3214	1732	8450	6891	47566	24327	2.83	1.53
T_8–Oxyflourfen, pre-em. f. b. HW	0.25	3607	2088	8540	6912	54106	30527	3.28	1.90
T_9–Oxyflourfen, pre-em.	0.37	2887	1716	8040	6719	42629	24147	2.55	1.52
T_{10}–Oxyflourfen, pre-em.	0.50	3690	2096	8710	6998	54309	29161	3.15	1.80
T_{11}–Alachlor, pre-em. f. b. HW	1.25	3595	2152	8540	6829	53086	30324	3.11	1.87
T_{12}–Alachlor, pre-em.	2.50	2951	1832	8070	6722	42628	24545	2.47	1.53
T_{13}–Oxyflourfen+pendimethalin	0.25+0.50	3196	2127	8150	6869	47193	30208	2.80	1.87
T_{14}–Oxyflourfen+trifluralin	0.25+0.75	2907	2072	8210	6853	42883	29484	2.56	1.83
T_{15}–Two hand weedings	-	3042	2082	8320	6870	43321	27371	2.45	1.68
T_{16}–Control (unweeded)	-	2388	1298	7440	5989	36595	19969	2.32	1.27
LSD (P=0.05)		445	326	612	483	-	-	-	-

MSP of groundnut was taken as Rs. 1520/q and straw prices @ Rs. 40/q and cost of cultivation excluding herbicide was taken as Rs. 15770/ ha.

fluchloralin 0.675 kg and pendimethalin 1.0 kg/ha produced significantly higher pod yield than unweeded treatment. The difference in pod yield among pre-plant application of fluchloralin 0.675 kg, pendimethalin 1.0 kg/ha and unweeded control were found to be non-significant. Integration of hand weeding with pre-plant application of fluchloralin 0.675 kg and trifluralin 0.75 kg as well as pre-emergence application of pendimethalin 0.75 kg, oxyflourfen 0.25 kg and alachlor 1.25 kg/ha increase pod yield by 39.1, 43.0, 54.6, 54.5 and 55.9% than unweeded control and 14.7, 17.9, 27.5, 27.4 and 28.4% than fluchloralin 0.675 kg/ha. Improvement in pod yield of groundnut by integration of hand weeding with herbicide has also been reported by Tiwari and Dhakar (1997), Kumar *et al* (2004) and Solanki *et al.* (2005). All the weed control treatments (except alone application at pendimethalin 1.0 kg/ha and oxyflourfen 0.375 kg/ha during 2005) resulted in significantly higher stover yield than weedy check during both the years.

The highest net returns as well as cost : benefit ratio during both the years were obtained in the treatment of pre-plant application of trifluralin 1.25 kg/ha and it was followed by pre-emergence application of oxyflourfen 0.50 kg/ha, oxyflourfen 0.50 kg/ha (pre-emergence) followed by one hand weeding and pre-emergence application of pendimethalin 0.75 kg/ha followed by one hand weeding.

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