

Effective Control of Weeds in Chickpea (*Cicer arietinum*)

Surjit Singh, U. S. Walia and Buta Singh

Department of Agronomy
Punjab Agricultural University, Ludhiana-141 004 (Punjab), India

ABSTRACT

Field experiments were conducted at the Research Farm, Department of Agronomy, PAU, Ludhiana for three years to find out effective weed management technology in chickpea (gram) on loamy sand soil. Integration of one hand weeding (45 days after sowing) with either pre-plant application of trifluralin (Treflan) at 0.50 kg/ha or pre-emergence application of pendimethalin (Stomp) at 0.50 kg/ha proved very effective for controlling weeds as indicated by 82 and 86% reduction in final dry matter accumulation by weeds, respectively, as compared to the control treatment. Both these integrated treatments increased seed yield of chickpea by 60 and 59% than control and 4.0 and 2% than the standard treatment i. e. pre-emergence application of linuron (Afon) at 0.94 kg/ha, respectively. Also pre-plant application of trifluralin at 1.25 kg/ha performed comparable to herbicide+hand weeding. Net returns and B : C ratio were also highest in pre-plant application of trifluralin at 1.25 kg/ha and it was followed by integration of hand weeding (45 DAS) with either pre-plant application of trifluralin at 0.50 kg/ha or pre-emergence application of pendimethalin at 0.50 kg/ha.

Key words : Herbicides, hand weeding, weed control, cost-benefit ratio

INTRODUCTION

Chickpea is one of the most important **rabi** pulse crops of the Punjab state grown on an area of 3.8 thousand ha with production of 3.8 thousand tonnes with an average yield of 1010 kg/ha. The total productivity of pulses especially chickpea is much below its requirements and there is a great need to increase its area as well as productivity per unit area. Low yield of this crop may be due to the reason that most of the farmers grow chickpea on neglected soils low in fertility with less or no input facilities.

The average yield of this crop is very low which may be due to many factors but among these infestation of weeds is very important. Weeds are a serious problem in this crop as at present recommended herbicide is not available in the market and hand weeding is not practicable due to high wages of farm labourers. Due to short stature and slow initial growth of this crop, weeds compete severely with this crop for all growth factors. Depending upon the intensity of weed flora and duration of weed infestation, the losses due to weeds may be upto 40-80% (Vaishya *et al.*, 1996). The per unit yield of this crop can be improved with the adoption of effective weed control methods. Hence, a research trial was conducted to find out the effective herbicide for integrated method which can provide good control of these weeds.

MATERIALS AND METHODS

Experiments were conducted at the Research Farm, Department of Agronomy, PAU, Ludhiana during **rabi** seasons of 2003-04, 2005-06 and 2006-07 in order to develop some integrated approach for the control of weeds in chickpea. Pendimethalin 30 EC (Stomp) was applied at 0.5 kg (integrated with hand weeding 45 DAS), 0.75, 1.0 kg/ha as pre-emergence and trifluralin 48 EC (Treflan) at 0.5 kg (integrated with hand weeding), 0.75, 1.0 and 1.25 kg/ha as pre-plant incorporation. These treatments were compared with standard treatment i. e. pre-emergence application of linuron 50 WP (Afon) 0.94 kg/ha or two hand weedings at 30 and 45 DAS. Unweeded (control) treatment was also included. Sowing of chickpea variety GPF 2 was done on November 7, 2003, November 4, 2005 and November 5, 2006 in rows spaced 30 cm apart with pora. A seed rate of 40 kg/ha was used during all the years. The experimental field was loamy sand in texture with low in available N and medium in available P and K. Crop was raised by applying 6 kg N and 8 kg P₂O₅/ha at the time of sowing.

The experiment was laid out in randomized block design with 10 treatments (Table 1) replicated four times. 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 l/ha. Weed dry matter at harvest was recorded by using quadrat measuring 50

Table 1. Effect of different treatments applied to chickpea on dry matter of weeds at PAU Research Farm

Treatment	Dose (kg/ha)	Dry matter of weeds (q/ha)			
		2003-04	2005-06	2006-07	Mean
Pendimethalin , pre-emergence f. b. HW 45 DAS	0.50	0.94	1.75	2.71	1.80
Pendimethalin, pre-emergence	0.75	3.88	5.75	6.12	5.25
Pendimethalin, pre-emergence	1.00	4.22	4.82	4.35	4.46
Trifluralin , pre-plant f.b. HW 45 DAS	0.50	2.35	1.91	2.72	2.33
Trifluralin, pre-plant	0.75	4.85	4.16	4.91	4.64
Trifluralin, pre-plant	1.00	4.41	3.52	4.17	4.03
Trifluralin, pre-plant	1.25	2.85	2.69	4.62	3.39
Linuron, pre-emergence	0.94	3.69	2.06	3.94	3.23
2 HW (30 and 45 DAS)	-	2.87	3.07	5.81	3.92
Control (Unweeded)	-	14.78	6.71	17.56	13.02
LSD (P=0.05)		2.18	2.62	2.07	2.12

f. b. – followed by.

HW – Hand weeding which was applied 45 DAS.

× 50 cm randomly from two locations in each plot.

Economics was calculated by taking minimum support price (MSP) of this crop as Rs. 1425/q. Cost of cultivation excluding the expenditure on weed management in different treatments was taken as Rs.14250/ha. Herbicide prices used for calculating economics were Rs. 380 per litre for Treflan, Rs. 390/l for Stomp and Rs. 350/kg for Afalon. Cost of hand weeding was taken as Rs. 2000/ha (20 labourers) for first hand weeding and Rs. 1250/ha (12.5 labourers) 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 follow :

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

Benefit : Cost ratio was calculated by using the formula given below :

B : C ratio = Gross returns/Cost of cultivation

RESULTS AND DISCUSSION

Effect on Weeds

The dry matter accumulation by weeds in all the weed control treatments including two hand weeding 30 and 45 DAS significantly reduced weed dry matter than unweeded (control) during all the three years of investigation (Table 1). Among the herbicidal treatments,

integration of hand weeding with pre-plant application of trifluralin at 0.5 kg/ha or pre-emergence application of pendimethalin at 0.5 kg/ha resulted in significant reduction in dry matter accumulation by weeds as compared to alone application of pendimethalin at 0.75 and 1.0 kg/ha or trifluralin 0.75 kg/ha.

The dry matter of weeds with trifluralin at all the levels during the three years and pendimethalin at 0.75 and 1.0 kg/ha during 2003-04 was found at par with the standard treatment i. e. pre-emergence application of linuron 0.94 kg/ha. Application of pendimethalin 0.5 kg or trifluralin 0.5 kg (PPI) each integrated with one hand weeding 45 DAS decreased dry matter accumulation by weeds to the tune of 86 and 82% as compared to unweeded control. Singh and Sahu (1996) and Siag (2000) also reported similar findings that when herbicides were integrated with hand weeding significantly lower dry matter accumulation by weeds was recorded.

Effect on Crop

The number of branches/plant and number of pods/plant recorded at the time of harvest during all the years of investigation were significantly more under herbicide+HW and alone herbicidal treatments as compared to unweeded control (Table 2). The differences in plant height due to different treatments were found to be non-significant during all the years of study. The seed yield of gram during 2003-04, 2005-06 and 2006-07 in all the weed control treatments was found to be

Table 2. Effect of different weed control treatments on yield and yield attributing characters of chickpea

Treatment	Dose (kg/ha)	No. of branches/plant						No. of pods/plant						Plant height (cm)						Seed yield (q/ha)											
		2003-		2005-		2006-		2003-		2005-		2006-		2003-		2005-		2006-		2003-		2005-		2006-		Mean					
		04	06	06	07	07	07	04	06	06	07	07	07	04	06	06	07	07	04	06	06	07	04	06	07	04	06	07			
Pendimethalin pre-emergence f. b. HW 45 DAS	0.50	2.99	3.10	3.21	3.21	3.21	40.7	43.1	44.1	44.1	44.1	49.5	55.7	54.2	54.2	19.04	18.57	17.05	18.22	19.04	18.57	17.05	18.22	19.04	18.57	17.05	18.22	19.04	18.57	17.05	18.22
Pendimethalin, pre-emergence	0.75	3.27	3.15	3.17	3.17	3.17	42.1	45.7	43.9	43.9	43.9	50.2	54.1	55.1	55.1	17.74	16.07	16.90	16.90	17.74	16.07	16.90	16.90	17.74	16.07	16.90	16.90	17.74	16.07	16.90	16.90
Pendimethalin pre-emergence	1.00	3.15	3.13	3.20	3.20	3.20	42.9	44.1	44.2	44.2	44.2	51.3	57.2	54.9	54.9	16.01	16.45	16.12	16.19	16.01	16.45	16.12	16.19	16.01	16.45	16.12	16.19	16.01	16.45	16.12	16.19
Trifluralin (pre-plant) f.b. HW	0.50	3.28	3.27	3.25	3.25	3.25	41.1	45.2	44.7	44.7	44.7	52.1	56.9	56.1	56.1	21.33	17.69	16.95	18.66	21.33	17.69	16.95	18.66	21.33	17.69	16.95	18.66	21.33	17.69	16.95	18.66
Trifluralin pre-plant	0.75	3.22	3.30	3.26	3.26	3.26	42.7	45.1	45.1	45.1	45.1	53.7	56.1	55.9	55.9	17.01	14.78	15.25	15.68	17.01	14.78	15.25	15.68	17.01	14.78	15.25	15.68	17.01	14.78	15.25	15.68
Trifluralin pre-plant	1.00	3.25	3.28	3.21	3.21	3.21	42.9	44.7	44.8	44.8	44.8	53.1	55.9	56.2	56.2	18.20	16.10	17.15	17.15	18.20	16.10	17.15	17.15	18.20	16.10	17.15	17.15	18.20	16.10	17.15	17.15
Trifluralin pre-plant	1.25	3.21	3.25	3.27	3.27	3.27	42.0	44.2	45.2	45.2	45.2	52.4	57.1	56.1	56.1	20.85	19.25	16.90	19.00	20.85	19.25	16.90	19.00	20.85	19.25	16.90	19.00	20.85	19.25	16.90	19.00
Linuron	0.94	3.17	3.21	3.22	3.22	3.22	41.9	43.2	43.8	43.8	43.8	51.9	56.8	55.8	55.8	16.81	19.07	17.93	17.94	16.81	19.07	17.93	17.94	16.81	19.07	17.93	17.94	16.81	19.07	17.93	17.94
2 HW (30 and 45 DAS)	-	3.24	3.19	3.17	3.17	3.17	42.0	42.9	43.4	43.4	43.4	52.1	57.1	54.7	54.7	17.94	16.81	16.25	17.00	17.94	16.81	16.25	17.00	17.94	16.81	16.25	17.00	17.94	16.81	16.25	17.00
Control (Unweeded)	-	2.06	1.95	2.01	2.01	2.01	31.1	32.0	33.5	33.5	33.5	47.5	52.4	52.1	52.1	9.64	5.26	7.45	7.45	9.64	5.26	7.45	7.45	9.64	5.26	7.45	7.45	9.64	5.26	7.45	7.45
LSD (P = 0.05)			0.54	0.51	0.51	0.51	5.4	6.7	6.1	6.1	6.1	NS	NS	NS	NS	5.84	3.64	4.17	3.32	5.84	3.64	4.17	3.32	5.84	3.64	4.17	3.32	5.84	3.64	4.17	3.32

f. b.-Followed by. NS-Not Significant.
 HW- Hand weeding which was applied 45 DAS.

Table 3. Net returns and B : C ratio of gram as influenced by various treatments

Treatment	Dose (kg/ha)	Net returns (Rs./ha)			B : C ratio				
		2003-04	2005-06	2006-07	2003-04	2005-06	2006-07		
		Mean			Mean				
Pendimethalin pre-emergence f. b. HW 45 DAS	0.50	11287	10617	8451	10119	1.71	1.67	1.53	1.64
Pendimethalin pre-emergence	0.75	10055	7675	8858	8862	1.66	1.50	1.58	1.58
Pendimethalin pre-emergence	1.00	7255	7882	7412	7516	1.47	1.51	1.48	1.48
Trifluralin pre-plant f.b. HW 45 DAS	0.50	14515	9328	8274	10706	1.91	1.59	1.52	1.67
Trifluralin pre-plant	0.75	9396	6219	6888	7501	1.63	1.42	1.46	1.51
Trifluralin pre-plant	1.00	10893	7901	9397	9397	1.72	1.53	1.62	1.62
Trifluralin pre-plant	1.25	14472	12192	8843	11835	1.95	1.80	1.58	1.78
Linuron pre-emergence	0.94	9046	12267	10642	10652	1.61	1.82	1.71	1.71
2 HW (30 and 45 DAS)	-	9065	7454	6656	7725	1.55	1.45	1.40	1.47
Control (Unweeded)	-	-86	-6755	-3634	-3491	0.99	0.53	0.75	0.76

f. b.-followed by. NS-Not Significant.
HW-Hand weeding which was applied 45 DAS.

significantly higher as compared with unweeded (control) treatment; however, the seed yield of different herbicidal and two hand weeding treatments was at par among themselves. On an average of three years, the highest seed yield was obtained with trifluralin at 1.25 kg/ha pre-plant which was followed by integration of hand weeding with trifluralin at 0.5 kg pre-plant and pendimethalin at 0.5 kg/ha pre-emergence which were 61, 60 and 59% higher than unweeded (control) treatments, respectively. Singh and Sahu (1996) and Siag (2000) also corroborated these findings.

On an average of three years, the highest net profit of Rs. 11835/ha was recorded with trifluralin at 1.25 kg/ha pre-plant which was followed by integration of hand weeding with pendimethalin at 0.5 kg/ha pre-emergence or trifluralin at 0.5 kg pre-plant as well as linuron 0.94 kg/ha pre-emergence (Table 3). A loss of Rs. 3491/ha was observed in the unweeded (control)

treatment which indicated significance of weed control in chickpea. Also benefit : cost ratio in all the weed control treatments was approximately double than the unweeded control treatment which showed a loss of 24 paisa per rupee invested in crop production. All the herbicidal treatments integrated with one hand weeding registered a B : C ratio of more than 1.6, whereas the two hand weeding treatment registered only 1.47

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