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Integrated Weed Management in Chickpea

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Abstract: ***A field investigation was planned during rabi season of 2011-12 and 2012-13 at Research Farm of Department of Agronomy CCS Haryana Agricultural University, Hisar to study the efficacy of different herbicides integrating with hand weeding in chickpea. Various treatments included were trifluralin 750 g/ha PPI (pre plant incorporation), trifluralin 750 g/ha PPI + 1 HW (hand weeding) 45 DAS (days after sowing), trifluralin 1000 g/ha PPI, trifluralin 1250 g/ha PPI, pendimethalin 750 g/ha PPI, pendimethalin 750 g/ha PPI + 1 HW 45 DAS, pendimethalin 1000 g/ha PPI, pendimethalin 1250 g/ha PPI, pendimethalin 750 g/ha PRE (pre emergence), pendimethalin 750 g/ha PRE + 1 HW 45 DAS, pendimethalin 1000 g/ha PRE, pendimethalin 1250 g/ha PRE, 1HW 30 DAS, 2 HW 30 and 60 DAS, weedy and weed free check. The seed yield and various yield attributes of irrigated chickpea were increased when trifluralin (PPI) or pendimethalin (PPI & PRE), each at 750 g/ha integrated with 1 HW at 45 DAS, and these were comparable to the treatment of 2 HW (30 and 60 DAS) and also to the weed free conditions. In chickpea, the PPI application of pendimethalin was superior over PRE application, however there was no significant differences in yield. Weeds allowed to grow through the crop season reduced the seed yield of chickpea to the extent of 31.29 and 25.49 % during 2011-12 and 2012-13, respectively.***
Keywords: Chickpea, weeds, hand weeding, pendimethalin, trifluralin

Introduction:

Chickpea is one of the most important *rabi* pulse crop of India and occupies first position among the pulses. It is grown in an area 10.56 million ha and producing 11.38 million tonnes with productivity of 1078 kg/ha during 2017-18 in India (Anonymous, 2019). The productivity of chickpea has fallen due to various constraints such as biotic and abiotic factors. Poor weed management is one of the most important yield limiting factors in chickpea. Weeds can removes plant nutrients from soil more efficiently than crops. Being slow in its early growth and short statured plant, chickpea is highly susceptible to weed competition and weeds causes up to 75% yield loss (Chaudhary *et al.* 2005). Moorthy *et al.* (2004) reported that the losses in seed yield due to increasing density of *Cascuta* ranged 28 to 100% in chickpea. Crop is severely infested by both grassy and broadleaf weeds, particularly under irrigated conditions. Yield losses due to crop-weed competition in chickpea have been estimated to the tune of 11-57 % (Gore *et al.*, 2018, Jaswal and Menon, 2020) depending upon the type, intensity and duration of competition. Initial 60 days is the period considered

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too critical for weed crop competition in chickpea (Singh and Singh, 2000). With the increasing demand for food, cost reduction and high intensive management and increasing wages and scarcity of labour, the use of pesticide, particularly herbicides, has been increasing in modern agriculture. Traditional methods of weeding by khurpa or kasola is still the most common practice of weed control in chickpea fields but non-availability and high wages of labor make it difficult and costly. We need some suitable method of weed management in chickpea either with herbicide alone or in integration with mechanical/manual weeding for higher crop yield (Singh and Jain, 2017). Present investigation was planned to study the efficacy of different herbicides integrating with hand weeding in chickpea after keeping in view of above facts.

Methodology:

To study the efficacy of different herbicides integrating with hand weeding in chickpea, a field experiment was conducted during the *rabi* seasons of 2011-12 and 2012-13 at Research Farm of Department of Agronomy, CCS Haryana Agricultural University, Hisar to find out the suitable method of weed management in chickpea. The soil of the experimental field was sandy loam in texture, low in available N, medium in available P_2O_5 and high in K_2O with slightly alkaline in reaction (pH 8.2). Chickpea variety HC 1 was sown by drill at 30 cm row to row spacing on 09th November and 17th November during 2011-12 and 2012-13, respectively. The experiment consisting of various treatments *viz*. trifluralin 750 g/ha PPI (pre plant incorporation), trifluralin 750 g/ha PPI + 1 HW (hand weeding) 45 DAS (days after sowing), trifluralin 1000 g/ha PPI, trifluralin 1250 g/ha PPI, pendimethalin 750 g/ha PPI, pendimethalin 750 g/ha PPI + 1 HW 45 DAS, pendimethalin 1000 g/ha PPI, pendimethalin 1250 g/ha PPI, pendimethalin 750 g/ha PRE (pre emergence), pendimethalin 750 g/ha PRE + 1 HW 45 DAS, pendimethalin 1000 g/ha PRE, pendimethalin 1250 g/ha PRE, 1HW 30 DAS, 2 HW 30 and 60 DAS, weedy and weed free check was laid out in randomized block design replicated thrice. The herbicides were applied by using knapsack sprayer fitted with flat fan nozzle in a spray volume of 500 liters/ha. The crop was raised with all the package of practice recommended by the state university. The data on density of individual weeds and dry weight of total weeds was recorded at 70 DAS by randomly placing two quadrates (0.5 × 0.5 m) per plot. The dry weight of weeds was recorded by keeping the weeds in oven at 70 ^{0} C till constant weight was achieved. To draw inference of results, seed yield of crop along with other yield attributes were recorded at harvest.

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Results and Discussion:

Effects on Weeds

Major weeds which infested the experimental field were bathu (*Chenopodium album*), hirankhuri (*Convolvulus arvensis*), metha (*Melilotus indicus*) and kandai (*Cirsium arvense*) during the study. The density and dry weight of weeds reduced with the corresponding increase in the dose of each herbicide, however, such reactions were more pronounced when trifluralin (PPI) and pendimethalin (PRE), each at 750 g/ha were integrated with 1 HW at 45 DAS (Tables 1). Integration of 1 HW at 45 DAS with any of the herbicide reduced the dry weight of weeds similar to 2 HW (30 and 60 DAS). Trifluralin at 1000 and 1250 g/ha (PPI), pendimethalin 1250 g/ha (PRE) reduced the dry weight of weeds to the extent of more than 80 % during two years. About 90 % dry weight of weeds was reduced by trifluralin and pendimethalin each at 750 g/ha *fb* 1 HW (45 DAS) being as effective as 2 HW. Sharma and Goswami (2006) also supported these results.

Effect on Crop

Weed infestation significantly reduced the chickpea yield. Due to heavy weed infestation, the seed yield of chickpea was minimum (931 kg/ha during 2011-12 and 821 kg/ha during 2012-13) in untreated weedy check and it was maximum in weed free check (1355 kg/ha during 2011-12 and and 1102 kg/ha during 2012-13) during both years (Table 2). Among different herbicidal treatments, trifluralin 1000 and 1250 g/ha (PPI), pendimethalin 1250 g/ha (PRE), fluchloralin 750 g/ha *fb* 1 HW, trifluralin 750 g/ha (PPI) *fb* 1 HW and pendimethalin 750 g/ha *fb* 1HW being at par with each other produced seed yield of chickpea statistically similar to 2 HW (30 & 60 DAS) and weed free check during both the years, and these treatments were superior to all other treatments. The seed yield and various yield attributes of irrigated chickpea were increased when trifluralin (PPI) or pendimethalin (PPI & PRE), each at 750 g/ha integrated with 1 HW at 45 DAS, and these were comparable to the treatment of 2HW (30 and 60 DAS) and also to the weed free conditions. Singh and Singh (2000) also observed the integrated approach for controlling weed flora in late sown chickpea, pre-emergence application of pendimethalin 0.75 kg/ha + one hand weeding at 45 DAS reduced the weed biomass with weed control efficiency (WCE) of 74% and gave significantly higher seed yield. In chickpea, the PPI application of pendimethalin was superior over PRE application; however there were no significant differences in yield. Weeds growing throughout the crop season reduced the seeds yield of chickpea to the extent of 31 and 25 % during 2011-12 and 2012-13, respectively. In general, integrated method of weed management involving lower dose of herbicides *fb* 1 HW (45 DAS) proved more effective and remunerative. Similarly Chopra *et al*. (2001) observed that the supplementing one weeding along with pre planting incorporation of fluchloralin 0.4 kg/ha or pendimethalin 0.5 kg/ha registered sharp decline in dry matter of weeds over sole application of pendimethalin, alachlor and fluchloralin. Significantly lowest weed dry matter and highest

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weed control efficiency were observed when one hand weeding was done at 45 DAS followed by integration of one hand weeding at 45 DAS with pre-emergence application of pendimethalin 0.75 kg/ha (Singh *et al*., 2003).

Conclusion:

Higher chickpea yield and lower weed density along with lower dry weight of weeds was achieved by integration of one hand weeding at 45 DAS with pendimethalin (PPI & PRE) or trifluralin (PPI), each at 750g/ha, which remained comparable to 2 HW and weed free conditions.

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Table 1: Effect of various weed management treatments on density of different weeds in chickpea

Treatments	Density of different weeds (No./m^2) at 70 DAS								Dry weight of different weeds (g/m^2) at 70 DAS	
	C. album		*C. arvensis*		*M. indicus*		*C. arvense*			
	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13
Trifluralin 750 PPI + 1 HW	2.2	2.5	1.2	1.3	2.0	3.3	2.5	3.1	5.8	7.6
Trifluralin 1000 PPI	3.6	4.7	3.8	4.8	7.3	9.8	9.8	11.9	21.8	27.8
Trifluralin 1250 PPI	2.5	3.3	3.5	4.8	5.6	7.1	9.5	11.2	19.3	23.6
Pendimethalin 750 PPI + 1 HW	1.9	2.0	1.2	0.0	3.3	2.5	2.5	3.2	5.6	6.8
Pendimethalin 1000 PPI	3.2	4.0	2.9	4.8	5.2	6.2	10.0	12.3	25.2	32.6
Pendimethalin 1250 PPI	2.4	1.8	2.5	4.1	4.0	5.1	8.3	11.5	22.0	28.3
Pendimethalin 750 PRE + 1 HW	2.1	2.4	1.2	1.2	3.5	2.8	2.6	3.5	6.0	7.3
Pendimethalin 1000 PRE	3.5	4.4	3.3	5.3	5.6	6.8	11.1	13.6	26.6	34.2
Pendimethalin 1250 PRE	2.6	2.0	2.7	4.6	4.4	5.5	9.2	12.7	23.0	30.5
1 HW 30 DAS	5.9	7.8	2.2	2.6	8.1	10.7	6.6	9.5	17.8	26.1
2 HW 30 & 60 DAS	1.5	1.8	1.2	0.0	1.9	3.3	2.5	3.2	6.1	8.1
Weedy	18.0	21.6	4.4	6.0	19.4	24.8	12.3	17.6	170.9	224.9
Weed free	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SEm±	0.3	0.4	0.2	0.2	0.5	0.5	0.6	0.6	1.5	1.6
CD (5 %)	1.1	1.2	0.7	0.7	1.4	1.6	1.9	1.7	4.6	4.8

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Table 2: Effect of various weed management treatments on yield and yield attributes of chickpea

Treatments	Pods/ plant		Seeds/ pod		100 seed weight (g)		Seed yield (kg/ha)	
	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13
Trifluralin 750 PPI + 1 HW	43	45	1.61	1.67	13.56	13.84	1273	1064
Trifluralin 1000 PPI	41	41	1.53	1.56	13.36	13.57	1212	989
Trifluralin 1250 PPI	42	43	1.41	1.61	13.28	13.61	1234	1039
Pendimethalin 750 PPI + 1 HW	44	44	1.67	1.61	13.64	13.79	1284	1061
Pendimethalin 1000 PPI	40	40	1.47	1.51	13.56	13.47	1211	978
Pendimethalin 1250 PPI	41	43	1.56	1.53	13.36	13.56	1219	1038
Pendimethalin 750 PRE + 1 HW	43	44	1.53	1.67	13.36	13.81	1261	1071
Pendimethalin 1000 PRE	39	43	1.40	1.47	13.24	13.51	1144	1001
Pendimethalin 1250 PRE	42	44	1.51	1.56	13.37	13.69	1237	1042
1 HW 30 DAS	35	39	1.33	1.41	12.44	12.87	1035	912
2 HW 30 & 60 DAS	44	45	1.53	1.71	13.89	13.91	1297	1091
Weedy	32	33	1.30	1.33	12.26	12.21	931	821
Weed free	47	46	1.71	1.76	14.11	13.99	1355	1102
SEm±	1.0	1.1	0.16	0.18	0.26	0.17	30.1	21.4
CD (5 %)	3.0	3.1	N S	NS	0.76	0.54	90.2	65.4

