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Effect of Weed Management Practices in Rainfed Chickpea (*Cicer arietinum* L.)

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ABSTRACT
A field experiment was conducted during the winter season of 2005-06 at the Rajaula Research Farm, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna (M.P.) to find out the most effective weed control method in controlling weeds in rainfed chickpea (Cicer arietinum L.). Pre emergence application of Pendimethalin @ 1.00 Kg a.i./ha + hand weeding at 30 days crop stage recorded minimum weed intensity, dry matter/plant and maximum weed control efficiency, yield attributes and yields followed by pre emergence application of Pendimethalin @ 1.00 Kg a.i./ha, respectively but the values of these two treatments were statistically on par. However, maximum net return/rupee investment was calculated in treatment where application of Pendimethalin @ 1.00 Kg a.i./ha as pre-emergence was done. In treatments where Fluchloralin @ 1.00 Kg a.i./ha was applied as pre plant incorporation resulted poorest performance. The treatment one hand weeding at 30 days or 60 days after sowing and the treatments combined with two hand weedings at 30 and 60 days after sowing gave significantly inferior weed control efficiency. Weed control efficiencies were highest in treatments where Pendimethalin was applied @ 1.00 Kg a.i./ha + hand weeding at 30 days crop stage followed by Pendimethalin @ 1.00 Kg a.i./ha and it was found minimum in the treatments where one hand weeding was done at 30 days stage of crop.
Keywords : *Hand weeding, weedicides, weed control efficiency, crop weed competition.*

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INTRODUCTION
Chickpea (*Cicer arietinum* L.) is one of the most important pulse crop in India contributing about 34% of total production of grain legumes (Asthana & Chaturvedi, 1999). Madhya Pradesh is leading state in the country with 2.63 m ha area, 2.34 m. tones production and an average of 887 Kg/ha productivity, respectively [1]. However, it is major rabi crop of the state and productivity is far low as compared with production potential on the experimental stations. The crop is raised mainly on conserved moisture. The yield level of farmers field is very low due to poor management practices and heavy infestation of weeds in the early stage of crop is a major cause, which drastically reduced the crop yield. i.e. 30-50 % [8]. However, meagre information is available to control weed flora in chickpea in this region. Therefore, present investigation was undertaken to find out the effective weed management practice in chickpea.

MATERIAL AND METHODS
The field experiment was conducted during rabi season of 2005-06 at Rajaula Research Farm of M. G. C. G. V. V, Chitrakoot, Satna (M.P.). The soil was sandy loam containing

o.39% organic carbon, 8.2 Kg/ha available P and 265 Kg/ha available K, with 7.4 pH. Chickpea cultivar 'Pusa-256' was sown using 100 Kg seed /ha. A total of thirteen treatments including weedy-check, weed free, hand weeding at 30 days, 60 days, and four weedicides were tried alone and combining with one hand weeding at 30 days. The experiment was laid out in randomized block design with three replications. Among the weedicides Fluchloralin @ 1.00 Kg a.i./ha was well incorporated in field before 24 hours of the seed sowing. Remaining three other weedicides viz. Oxyfluorfen @ 0.20 Kg a.i./ha, Oxadiazon @ 0.75 Kg a.i./ha and Pendimethalin @ 1.00 Kg a.i/ha were applied as pre-emergence after 3 days of sowing (DAS) with Knapsack sprayer to study the effect of weedicides on the crop. Three plants from each plot were randomly selected for study weed population/m^2, weed dry weight/m^2 and weed control efficiency. Effective pods/plant, seed/pod, seed yield/plant (g) and 1000-grain weight (g) were computed after harvesting of the crop.

RESULTS AND DISCUSSION

Effect on weeds

The data mentioned in table-1 revealed that higher number of weeds/m^2 were recorded in early stage of crop and it was gradually decreased with advancement of the crop age in various treated plots. The highest weed density was in weed check plots up to 90 days crop stage due to no adoption of any weed control measure. It was noticed that weed population was increased up to 60 days stage of the crop in Fluchloralin, Oxyfluorfen and Pendimethalin treated plots. It might be due to loss of the efficacy of these weedicides after 30 days of their application. However, it was noticed in all the treatments of weedicides combined with hand weeding at 30 days crop stage, weed population was drastically reduced at 60 to 90 days stages of the crop [6]. It might be due to one hand weeding at 30 days stage of crop by destroying a significant number of weeds and avoids crop weed competition**.** The results are in line with the findings of [7].

Table 1 – Effect of weed management practices on weed population, weed dry weight and weed control efficiency in chickpea (*Cicer arietnum* L.) at different growth stages.

Treatments	Weed population at /m^2			Weed dry wt. (g/m^2) at			W C E at		
	30 days	60 days	90 days	30 days	60 days	90 days	30 days	60 days	90 days
T_1-Weedy check	16.33	22.00	23.00	4.10	6.51	4.60	00.00	00.00	00.00
T_2-Weed Free	00.00	00.00	00.00	00.00	00.00	00.00	100.0	100.0	100.0
T_3-HW at 30 DAS	15.00	9.00	7.33	3.63	3.90	3.16	11.4	40.9	31.3
T_4-HW at 60 DAS	13.23	18.00	6.33	3.13	4.43	3.06	23.5	31.9	33.5
T_5-HW at 30 & 60 DAS	13.0	10.00	3.66	3.08	3.53	2.50	24.8	45.8	45.6
T_6-Fluchloralin @ 1.00 Kg a.i/ha as PPI	10.00	13.00	3.33	3.41	4.36	3.51	16.8	33.0	23.7
T_7-Fluchloralin @ 1.0Kg a.i/ha as PPI + HW at 30 DAS	9.00	6.00	2.66	2.98	4.03	2.47	27.3	38.5	46.3
T_8-Oxyfluorfen @ 0.20 Kg a.i/ha as P E	13.66	15.33	3.00	2.90	4.36	2.71	29.9	33.0	41.0
T_9-Oxyfluorfen @ 0.20 Kg a.i/ha as PE+ HW at 30 DAS	14.00	5.00	2.66	2.83	3.93	2.56	30.9	39.6	44.3
T_{10}- Oxadiazon @ 0.75 Kg a.i/ha as Pr. Em.	8.33	8.00	6.66	2.30	4.03	3.50	43.9	38.1	23.9
T_{11}-Oxadiazon @ 0.75 Kg a.i/ha as Pr. Em. + HW at 30 DAS	9.00	5.00	4.33	2.28	3.86	3.00	46.4	40.7	34.8
T_{12}-Pendimethalin @ 1.0 0 Kg a.i/ha as P E	4.33	5.33	3.66	2.30	2.50	2.28	43.9	61.6	50.4
T_{13}-Pendimethalin @ 1.00 Kg a.i/ha as P E+ HW at 30 DAS	4.66	3.00	2.00	2.28	2.33	1.81	44.4	64.2	60.6
CD (P=0.05)	1.01	0.89	0.98	0.31	0.45	0.32	--	--	--

Maximum weed dry matter was recorded in T_1 weedy check plot and minimum in T_{13} Pendimethalin @ 1.00 Kg a.i/ha + hand weeding at 30 DAS and followed by treated with T_{12}

Pendimethalin at all the stages of crop. The above trend might be due to impact of control measures on reduction of weed population in respective treatments. These results are accordance with the findings of [1].

It was also observed that the lowest weed control efficiency was in T_3 hand weeding at 30 DAS plots while higher in the treatments of weedicides combined with hand weedings at 30 days crop age. Weedicides alone gave intermediate values of weed control efficiency most probably due to intermediate weed density and weed dry weight in respective treatments. The maximum weed control efficiency was computed in the treatments of @1.00 kg a. i./ha T_{13} Pendimethalin @ 1.00 Kg a.i/ha + hand weeding at 30 DAS of the crop. It might be due to good combined effect of this treatment that cause significant reduction in weed population as well as weed dry weight [5].

Table 2 : Effect of weed management practices on yield attributes, grain and straw yield of chickpea (*C. arietinum* L.).

Treatments	No. of pods/ plant	No. of seeds/ pod	1000-grain Wt. (g)	Seed yield/ plant (g)	Grain yield (Kg/ha)	Straw yield (Kg/ha)
T_1-Weedy check	37.0	1.23	135.0	27.6	1334	2569
T_2-Weed Free	70.3	1.53	163.3	49.0	1732	3225
T_3-HW at 30 DAS	59.2	1.40	150.0	32.6	1555	2796
T_4-HW at 60 DAS	53.9	1.30	145.0	36.6	1490	2778
T_5-HW at 30 & 60 DAS	59.3	1.40	150.0	34.0	1440	2556
T_6-Fluchloralin @ 1.00 Kg a.i/ha as PPI	46.6	1.30	153.3	36.6	1463	2778
T_7-Fluchloralin @ 1.0Kg a.i/ha as PPI + HW at 30 DAS	46.9	1.30	160.3	36.6	1465	3056
T_8-Oxyfluorfen @ 0.20 Kga.i/ha as P E	52.2	1.30	156.4	38.3	1574	2834
T_9-Oxyfluorfen @ 0.20 Kg a.i/ha as P E + HW at 30 DAS	53.2	1.33	156.6	41.6	1575	2859
T_{10}- Oxadiazon @ 0.75 Kg a.i/ha as P E	50.0	1.26	161.3	40.6	1519	2908
T_{11}- Oxadiazon @ 0.75 Kg a.i/ha as P E + HW at 30 DAS	50.7	1.26	159.6	46.0	1629	2945
T_{12}-Pendimethalin @ 1.0 Kg a.i/ha as P E	65.3	1.50	160.3	47.0	1600	3037
T_{13}-Pendimethalin @ 1.0 Kg a.i/ha as P E + HW at 30 DAS	70.3	1.50	161.6	47.0	1666	3155

Effect on yield attributes and yields

Maximum number of yield attributes viz. number of pods/plant, number of seeds/pod, 1000- grain weight and seed yield/plant was recorded in T_2 weed free plots and minimum in T_1 weedy check plots. Similarly, the yield components like pods/plant, seeds/pod, 1000-grain weight and seed yield/ plant were also higher in hand weeded and treated plots against weedy check plots. However, seeds/pod, 1000- grain weight, seed yield/plant and straw yield was found statistically at par in control and treated plots except pods/plant, which was significantly higher in weedicides treated plots **(**Table-2**)**. Maximum number of pods/plant was counted in T_2 weed free plots and plots of T_{13} Pendimethalin @1.00 kg a.i./ha + hand weeding at 30 DAS of crop. However, least number of seeds/pod was observed in T_1 control plots. Ahuja *et al* [2] also reported similar results.

Maximum grain yield (1732 Kg/ha) was obtained in T_2 weed free plots which was significantly higher over T_1 weedy check, T_5 hand weeding at 30 and 60 days, T_7 Fluchloralin + hand weeding at 30 DAS. And remained treatments were statistically at par with T_2 weed free treatments. Minimum grain yield of chickpea was recorded in T_1 weedy check plots. Among weed control methods, T_{13} Pendimethalin @1.00 kg a.i./ha + hand weeding 30 DAS produced highest grain yield (1666 Kg/ha) followed by T_{11} Oxadiazon + hand weeding at 30 DAS (1629 Kg/ha) and T_{12} Pendimethalin (1600 Kg/ha) which were significantly higher over T_1 control and rest of treatments were statistically at par with T_{13}, T_{11} and T_{12} (Table- 2). Grain yield of T_{13}, T_{11} and T_{12} treatments recorded by 24.88%, 22.11%

and 19.94%, respectively more over T_1 control. This might be due to higher weed control efficiencies of these treatments at 30 days stage of crop, which avoided crop and weed competition at this most critical stage. Similar observations were made by Singh and Sahu [4].

Table 3: Effect of weed management practices on economics of chickpea(*Cicer arietinum* L).

Treatments	Cost of cultivation (Rs/ha)	Gross returns (Rs/ha)	Net returns (Rs/ha)	Return/rupee investment
T_1-Weedy check	8202	19099	10897	0.20
T_2-Weed Free	1516	27786	12620	1.80
T_3-HW at 30 DAS	8899	19771	10872	2.20
T_4-HW at 60 DAS	8899	22167	13268	2.50
T_5-HW at 30 & 60 DAS	9574	20298	10725	2.10
T_6-Fluchloralin @ 1.00 Kg a.i/ha as PPI	8765	20950	12185	2.40
T_7-Fluchloralin @ 1.00 Kg a.i/ha as PPI + HW at 30 DAS	9461	21183	11722	2.20
T_8-Oxyfluorfen @ 0.20 Kga.i/ha as P E	8507	22445	13938	2.60
T_9-Oxyfluorfen @ 0.20 Kg a.i/ha as P E + HW at 30 DAS	9204	22471	13267	2.40
T_{10}- Oxadiazon @ 0.75 Kg a.i/ha as P E	8597	21768	13171	2.50
T_{11}- Oxadiazon @ 0.75 Kg a.i/ha as P E + HW at 30 DAS	9294	23238	13944	2.50
T_{12}-Pendimethalin @ 1.00 Kg a.i/ha as P E	8674	22821	14147	2.60
T_{13}-Pendimethalin @ 1.00 Kg a.i/ha as P E + HW at 30 DAS	9465	23866	144 01	2.50
CD (P = 0.05)	--	--	3572.00	--

Economics

Maximum cost of cultivation (Rs.9465/ha) was calculated in T_{13} Pendimethalin @ 1.00 kg a.i./ha + hand weeding at 30 DAS which produced significantly higher net return (Rs. 14401/ha) over T_1 weedy check and T_5 hand weeding at 30 and 60 DAS treatments only. The application of Pendimethalin @ 1.00 kg a.i./ha alone (T_{12}) gave maximum returns per rupee investment (2.60) and little lower net returns (Rs. 14147 /ha), which is statistically at par with T_{13}. It might be due to less cost of cultivation and comparatively higher grain and straw yields. A minimum return per rupee investment (0.20) was observed in T_1 control.

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