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Short communication

Efficacy of chlorimuron for controlling weeds in soybean

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Soybean is a crop of multiple qualities as it is both a pulse and oilseed crop. It is third largest oilseed crop of India after rapeseed-mustard and groundnut. In India, it is cultivated in 9.73 million hectares area with the annual production of 9.96 million tonnes. In Madhya Pradesh it is grown over an area of 5.35 million hectares with a production of 6.41 million tonnes which shows the dominance of soybean in M.P. during *Kharif*. Therefore, M.P. is known as soybean state in the country (IIOES 2010). The competition stress between weeds and crop for the nutrients, water, light and space are responsible for poor yield of soybean. One of the major reason for this poor performance is inadequate weed control. The excessive occurrence of weeds, limit the full expression of yield potential of crop, thus an early control of weeds in soybean is very essential and if it is not done, the yield losses may reach up to 43%. Hand weeding is one of the most efficient mean to control weeds in soybean, but it is time consuming and difficult due to unavailability of labours during peak period of demand. The weather-conditions may restrict the manual weed control. Use of mechanical weeding by hand hoe is also popular in the Malwa tract of the state. Secondly, the timing of herbicides application also much concern on weed control efficiency. Therefore, there is need to explore the possibility of pre and post emergence herbicides for effective weed control in soybean.

A field experiment was conducted at Product Testing Unit, Adhartal farm, Jawaharlal Nehru Kirshi Vishwa Vidyalaya, Jabalpur (M.P.) in *Kharif* season of 2012. The field selected for experimentation was fairly infested with location specific weeds representing to this area. Jabalpur is situated at 23^0 9' North latitude and 79^0 58' East longitudes with an altitude of 411.78 meters above the mean sea level. The total rainfall received during the crop season was 1542 mm, which was equally distributed in 54 rainy days from June to third week of November. Minimum and maximum mean temperature ranged from 11 ^{0}C to 32.8 ^{0}C respectively. The relative humidity ranged from 86 to 96% in morning and 24 to 85% in evening. The soil of the experimental field was clayey in texture, neutral in reaction (7.2), medium in organic carbon (0.60%), medium in available N (372 kg/ha), low in available P (16.40 kg P_2O_5/ha) and high in available K (293 kg K_2O/ha). The experiment consisted of nine treatments were laid out on well prepared seed bed in randomized block design with three replications. The herbicide spray solution was prepared by mixing the required quantity of herbicide in water at 500 litre/ha for each plot. Sowing of seed was done manually on July 12th, 2012. Before sowing, the seeds were treated with carbendazim at 2.0 g/kg of seeds followed by inoculation with *Rhizobium japonicum* culture at 5 g/kg of seeds. The rows were opened with the help of pick axe and later sowing was regulated for each plot using a seed rate of 70 kg/ha of *'JS 97-52'* variety of soybean. Sowing of seeds in each plots was done in rows 45 cm apart at the depth of 3-4 cm and then seeds were covered with fine soil and was harvested on 16 November, 2012. Full dose of major plant nutrients (20 kg N + 60 kg P_2O_5 + 20 kg K_2O/ha) was applied as basal application through urea, single super phosphate and murate of potash. The observations on density and dry weight of weeds were recorded at 45 DAS and harvest by quadrate count method. The quadrate of 0.25 m^2 (0.5 x 0.5 m) was randomly placed at four places in each plot and then the species wise and weed count was recorded. The data on weed count and weed biomass were subjected to square root transformation *i.e.* $\sqrt{x+0.5}$, before carrying out analysis of variance and comparisons were made on transformed values. The net monetary returns (NMR) under each treatment was determined by substracting the cost of cultivation from GMR of the particular treatment.

The dominant weeds associated with soybean in the experimental field were among the monocots, the *Echinochloa colona* (26.27 and 21.18%) was the most dominant weed followed by *Cyperus iria* (11.59

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Table 1. Effect of chlorimuron-ethyl in different doses against weed density and dry weight (m^2) in soybean 45 DAS

Treatment	*Alternanthera philoxiroides*	*Echinoochloa colona*	*Eclipta alba*	*Commelina benghalensis*	*Cyperus iria*	Other weeds
Chlorimuron-ethyl 12 g/ha	2.8 (7.33)	6.52 (42.0)	1.71 (2.44)	1.47 (1.65)	2.84 (7.56)	5.08 (25.3)
Chlorimuron-ethyl 24 g/ha	2.57 (6.13)	5.98 (35.3)	1.53 (1.85)	1.43 (1.55)	2.92 (8.00)	5.38 (28.4)
Chlorimuron-ethyl 36 g/ha	2.55 (6.00)	5.88 (34.1)	1.52 (1.80)	1.42 (1.52)	2.85 (7.65)	5.15 (26.0)
Chlorimuron-ethyl 48 g/ha	2.54 (5.95)	5.71 (32.2)	1.46 (1.65)	1.40 (1.45)	2.72 (6.89)	5.09 (25.4)
Chlorimuron-ethyl 72 g/ha	2.53 (5.90)	5.53 (30.1)	1.38 (1.40)	1.38 (1.40)	2.17 (4.23)	5.05 (25.0)
Hand weeding (20 & 40 DAS)	0.71 (0.00)	2.91 (8.0)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)
Mechanical weeding (20 DAS)	2.54 (5.93)	5.82 (33.3)	1.53 (1.85)	1.45 (1.60)	2.66 (6.58)	5.08 (25.3)
Chlorimuron-ethyl 24 g/ha + MW (40 DAS)	2.12 (4.01)	3.17 (9.5)	1.27 (1.11)	1.25 (1.07)	2.15 (4.12)	4.96 (24.1)
Weedy check	6.04 (35.9)	7.69 (58.6)	4.62 (20.80)	3.36 (10.7)	5.14 (25.80)	8.43 (70.6)
LSD(0.05)	0.16	0.13	0.09	0.08	0.11	0.10

Data subjected to $\sqrt{x+0.5}$ transformation and figure in parentheses are original values; DAS- Days after sowing

and 14.70%) and in dicot *Commelina benghalensis* (4.82 and 8.91%) at both the stages due to continuous germination of these weeds from seeds. By the mechanical method of weed control, hand weeding at 20 DAS controlled both monocot and dicot weeds. The application of chloimuron-ethyl at lowest dose 12 g/ha as early post emergence caused marginal reduction in density and dry weight of dicot weeds but reduction was more pronounced (in case of dicot weed only) when chlorimuron-ethyl was applied at highest dose 72 g/ha, but both monocot and dicot weeds effectively controlled when combined application of chlorimuron-ethyl 24 g/ha + mechanical weeding at 40 DAS, was applied. Similar views were also endorsed by several research workers (Halvankar *et al*. 2005). Hand weeding done at 20 and 40 DAS reduced the density including dry weight of weeds to maximum extent over herbicidal treatments due to elimination of short of weeds. Similar views were also endorsed by Veeramani *et al* (2000). The weed free treatment registered maximum weed control efficiency 100 and 97.3% at 45 DAS and harvest respectively than other treatments because of least dry matter production of the weeds over weedy check treatment. Subsequent application of chlorimuron-ethyl 24 g/ha along with mechanical weeding and gave the WCE of 83.0 and 79.2 % at 45 DAS and harvest respectively it was significant superior over other herbicidal treatments. These findings are in agreement with findings of Singh *et al* (2003).

Crop biomass and LAI

Weedy check had significantly lower crop biomass among all the treatments at harvest due to severe competition between crop and weeds for growth resources during critical period of crop growth. The increased crop biomass in plots receiving hand weeding (790.70 g/m^2) at harvest followed by combined application of chlorimuron-ethyl 24 g/ha + mechanical weeding (796.65 g/m^2) at harvest and chlorimuron-ethyl 72 g/ha (780.85 g/m^2) at harvest may be attributed to reduced weed competition as a result of effective control of weeds, which promoted the better growth and development of plants and ultimately produced higher biomass as compared to lower rate of chlorimuron-ethyl 12, 24, 36, 48 g/ha and mechanical weeding. The results are in close conformity with the findings of Singh *et al* (2004). LAI differed significantly due to different treatments at 60 days growth stage. At 60 days stage, maximum LAI was recorded in weed free treatment (6.04) followed by chlorimuron-ethyl 24g/ha + MW (40 DAS) (6.01). This may be because of better growth and development of foliage under weed free environment and consequently resulted in more assimilatory area per unit land area. Almost similar results were obtained by Shivakumar (1978).

Yield attributes, namely number of pods per plant and number of seeds per pod were significantly superior in the weed free treatment (154.06 and 2.67, respectively) than other treatments. Excellent growth and development of soybean plants under weed free environment during critical period of crop growth might have resulted in higher number of pods per plant and seeds per pod under weed free treatment as compared to weedy check, which had severe weed competition right from early growth stages and ultimately resulted in most inferior yield attributes. Combined application of chlorimuron-ethyl 24 g/ha + mechanical weeding as early post-emergence produced higher number of pods per plant and seeds per pod as (151.64 and 2.61), respectively as compared to other treatments on account of

Table 2. Effect of chlorimuron-ethyl in different doses against weeds dry weight (g/m^2) in soybean

Treatment	*Alternanthera philoxiroides*		*Echinochloa colona*		*Eclipta alba*		*Commelina benghalensis*		*Cyperus iria*		Other weed	
	Before	Harvest	Before	Harvest	Before	Harvest	Before	Harvest	Before	Harvest	Before	Harvest
Chlorimuron-ethyl	4.40	3.18	5.38	4.69	3.62	3.22	4.62	3.56	4.51	4.35	5.67	4.33
12 g/ha	(18.8)	(9.61)	(28.4)	(21.5)	(12.6)	(9.86)	(20.9)	(12.2)	(19.8)	(18.4)	(31.6)	(18.7)
Chlorimuron-ethyl	4.32	3.01	5.46	4.63	3.76	2.92	4.63	3.28	4.63	4.10	5.58	4.11
24 g/ha	(18.1)	(8.59)	(29.3)	(20.9)	(13.6)	(8.00)	(20.9)	(10.3)	(20.9)	(16.3)	(30.7)	(16.4)
Chlorimuron-ethyl	4.38	2.83	5.47	4.58	3.67	2.84	4.61	3.28	4.61	3.88	5.65	4.16
36 g/ha	(18.6)	(7.49)	(29.6)	(20.5)	(13.0)	(7.60)	(20.8)	(10.2)	(20.8)	(14.5)	(31.4)	(16.8)
Chlorimuron-ethyl	4.26	2.71	5.35	4.52	3.68	2.74	4.56	3.27	4.53	3.67	5.57	4.04
48 g/ha	(17.6)	(6.85)	(28.1)	(19.9)	(13.0)	(7.00)	(20.3)	(10.2)	(20.1)	(13.0)	(30.5)	(15.9)
Chlorimuron-ethyl	4.16	2.63	5.27	4.50	3.62	2.72	4.47	3.23	4.64	3.60	5.62	3.88
72 g/ha	(16.8)	(6.40)	(27.3)	(19.7)	(12.6)	(6.90)	(19.5)	(9.93)	(21.1)	(12.5)	(31.0)	(14.5)
Hand weeding	4.24	1.92	5.35	1.32	3.65	1.22	4.53	1.09	4.50	1.41	5.68	1.16
(20 and 40 DAS)	(17.5)	(3.20)	(28.1)	(1.25)	(12.5)	(1.00)	(20.0)	(0.70)	(20.0)	(1.50)	(31.8)	(0.85)
Mechanical weeding	4.22	2.82	5.32	4.52	3.61	3.00	4.49	3.29	4.63	3.95	5.63	4.16
(20 DAS)	(17.3)	(7.48)	(27.8)	(19.9)	(13.2)	(8.53)	(19.7)	(10.3)	(20.9)	(15.1)	(31.1)	(16.8)
Chlorimuron-ethyl 24	4.12	2.61	5.43	4.26	3.70	2.64	4.53	3.19	4.54	3.56	5.71	3.80
g/ha + MW (40 DAS)	(16.5)	(6.29)	(29.0)	(17.7)	(13.1)	(6.46)	(20.0)	(9.66)	(20.1)	(12.2)	(32.2)	(14.0)
Weedy check	4.32	7.14	5.34	7.46	3.68	7.12	4.52	6.98	4.54	7.12	5.63	8.12
	(18.2)	(50.4)	(28.0)	(55.2)	(12.9)	(50.1)	(19.9)	(48.3)	(20.1)	(50.2)	(31.2)	(65.5)
LSD (P=0.05)	0.17	0.12	0.28	0.09	0.06	0.15	0.14	0.13	0.12	0.16	0.05	0.14

Data subjected to $\sqrt{x+0.5}$ transformation and figure in parenthesis are original values; DAS- Days after sowing

Table 3. Influence of weed control treatments on yield attributes, yield, LAI, weed control efficiency, weed index and economics of soybean

Treatment	Pods/ plant	Seeds/ pod	Crop biomass (g/m^2)	Weed control efficiency (%)	Seed yield (t/ha)	Stover yield (t/ha)	LAI at 60 DAS	Weed index	GMR (x10^3 `/ha)	NMR (x10^3 `/ha)
Chlorimuron-ethyl 12 g/ha	130.9	2.20	746.3	71.9	11.8	2.91	4.45	30.2	28.99	11.13
Chlorimuron-ethyl 24 g/ha	146.6	2.33	758.2	74.8	14.9	3.19	4.75	12.4	35.75	17.87
Chlorimuron-ethyl 36 g/ha	150.4	2.37	767.0	75.8	15.1	3.23	4.85	11	36.43	18.53
Chlorimuron-ethyl 48 g/ha	151.7	2.38	774.7	77.2	15.2	3.24	5.23	10.4	36.71	18.78
Chlorimuron-ethyl 72 g/ha	153.1	2.40	780.8	78.1	15.3	3.26	5.66	9.7	37.05	19.06
Hand weeding (20 and 40 DAS)	154.1	2.67	790.7	97.3	17.0	3.49	6.04	0	41.14	20.01
Mechanical weeding (20 DAS)	147.0	2.45	762.8	75.5	14.9	3.25	5.32	12.2	35.85	15.92
Chlorimuron-ethyl24 g/ha + MW (40 DAS)	151.6	2.61	796.6	79.2	16.1	3.40	6.01	5.3	38.86	20.02
Weedy check	130.9	2.00	719.2	0	10.9	2.7	4.00	36	26.60	9.07
LSD(P=0.05)	0.58	0.46	20.83	-	1.47	0.08	0.05	_		

LAI: Leaf area index; GMR: Gross monetary returns; NMR: Net monetary returns

maximum reduction in weed growth coupled with no inhibitory effects on soybean plants. Almost similar results were obtained by Raghuwanshi *et al.* (2005).

Minimum weed index among herbicidal treatments was recorded under chorimuron-ethyl 24 g/ha + MW (40 DAS) (5.3%) which was almost similar to weed free treatment, closely followed by chlorimuron-ethyl (9.7%). Weed free treatment produced the maximum seed yield (1.70 t/ha) and proved its superiority over all the treatments. Among herbicidal treatments, combined application of 24 g/ha + mechanical weeding resulted in higher seed yield (1.61 t/ha) which was higher to other herbicidal treatment because of relatively low stress and better yield attributes. Application of chlorimuron-ethyl at highest dose 72 and 48 g/ha also produced significantly higher yield (1.53 and 1.52 t/ha respectively) over application of chlorimuron-ethyl 12, 24, 36 g/ha and mechanical weeding. This may be because of selectivity of these herbicides to either monocots or dicots, resulted in poor control of weeds might have failed to arrest the weed growth, this led to record lower yield attributing traits and consequently poor seed yield. Almost similar results were obtained by Singh *et al* (2006). All the treated plots produced significantly higher stover yield than weedy check (2.70 t/ha). Stover yield was increased with the increased application rates of chlorimuron-ethyl 12, 24, 36, 48, 72 g/ha and when combined application of chlorimuron-ethyl 24 g/ha + mechanical weeding was applied stover yield was increases at higher magnitude. However, weed free plots registered the highest stover yield (3.49 t/ha) and was significantly superior to all the treatments.

Highest weed index was recorded under weed free treatment (0.00%). The gross monetary returns (GMR) and net monetary returns were minimum under weedy check because of the lowest seed and stover yields. But it were increased to a maximum level under weed free treatments received two hand weeding closely. The application of combined application of chlorimuron-ethyl 24 g/ha + mechanical weeding and chlorimuron-ethyl at highest dose 72 g/ha, chlorimuron-ethyl 12, 24, 36, 48 g/ha and mechanical weeding also found superior and fetched the greater GMR over weedy check because of increased seed and stover yields of the soybean. Net monetary returns was increased to a maximum level under weed free treatment closely followed by chlorimuron-ethyl 24g/ha + MW (40 DAS) and chlorimuron-ethyl 72g/ha, respectively. The low investment and better seed and stover yields coupled with good economic returns might be the reason for higher NMR over remaining treatments. Pandya *et al* (2005) also reported maximum NMR under hand weeding treatment.

SUMMARY

The field was infested with monocot weeds like *Echinochloa colona, Cyperus iria* whereas dicot weeds *Alternanthera philoxiroides, Eclipta alba, Commelina benghalensis and Phyllanthus niruri* were less dominant in soybean. The application of Chlorimuron-ethyl 24 g/ha as early post-emergence along with mechanical weeding was most effective in paralyzing the weed growth to that of chlorimuron-ethyl (12, 24, 36, 48 and 72 g/ha) and mechanical weeding at 20 DAS. The application of chlorimuron-ethyl herbicide at 24 g/ha as early post-emergence along with mechanical weeding was significant superior for growth parameters, yield attributes and seed yield (1.61 t/ha) of soybean than rest of the treatments without any phytotoxicity on soybean plants and was found more remunerative in terms of NMR (` 20023.8) and B-C ratio (2.06) than application of chlorimuron-ethyl herbicide at 12 g/ha to 72 g/ha, as early post-emergence. Two hand weedings (20 and 40 DAS) proved to be the best in terms of yield (1.69 t/ha grain, 3.49 t/ha stover); however, NMR ( ` 20011.7/ha) was almost at par to chlorimuron 24 g along with mechanical weeding (` 20023.8/ha).

REFERENCES

Halvankar GB, Varghese P, Taware SP and Raut VM. 2005. Effects of herbicides on weed dynamics and yield of soybean. *Journal of Maharashtra Agricultural Universities* **30**(1): 35-37.

IIOES. 2010. *Agricultural Statistics.* Directorate of Economics and Statistics. Ministry of Agriculture and Cooperation, Govt. of India, New Delhi.

Pandya N, Chauhan GS and Nepalia. 2005. Influence of integrated weed management on yield and economic viability of soybean [*Glycine max* (L.) Merrill] grown at different crop geometries. *Indian Journal of Agriculture Sciences* **75**(8): 510-512.

Raghuwanshi OPS, Deshmukh SC and Raghuwanshi SRS. 2005. Effect of some new post emergence herbicides on weed parameters and seed yield of soybean. *Research on Crops* **6**(3): 448-451

Singh Govindra, Singh VP and Singh Mahendra. 2004. Bioefficacy of chlorimuron-ethyl in soybean. *Indian Journal of Weed Science* **36**(1&2): 79-82.

Singh R, Singh G, Tripathi SSL and Singh M. 2003. Bio efficacy of acetachlor for weed control in soybean. *Indian Journal of Weed Science* **35**(1-2): 67-69.

SinghVP, Mishra JS, Dixit A and Singh PK. 2006. Comparative efficacy of herbicides against spurge (*Euphorbia geniculata*) in soybean. *Indian Journal of Agricultural Sciences* **76**(7): 420-422.

Sivakumar MVK. 1978. Predication of leaf area index in soybean. *Annals of Botany* **42**: 251-253.

Veeramani A, Balasubramanium N and Palchamy A. 2000. Integrated weed management in soybean under different moisture regimes. *Madras Journal of Agriculture* **87**(4&6): 249-252.