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Short communication

Effect of weed control on growth and productivity of soybean

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Soybean (*Glycine max* L.) is a "Golden bean" of 21st century mainly due to its high protein (40%) and oil (20%) content and is now making headway in Indian Agriculture. Heavy infestation of weeds with grasses, broad-leaved and sedges poses a big challenge for soybean production. Initial slow growth of this crop coupled with little lateral spread increases opportunity for weeds to easily occupy vacant spaces between rows and offer serious competition with the crop. Good sunshine and intermittent rains during rainy season further provides congenial environment for excessive growth of weeds. Simultaneous emergence and rapid growth of large number of weed species caused severe crop-weed competitions and reduces crop yields to the extent of 30-80% depending on the type of weed flora and weed density (Kurchania *et al*. 2001). The effective and economic weed control may not be possible through manual or mechanical means due to heavy and continuous rainfall in *Kharif*, increasing labour wages and their shortages. Under such circumstances, use of effective weed control treatments may give better and timely weed control.

A field experiment was carried out at research farm of Rajasthan College of Agriculture, Udaipur during *Kharif* 2014. The experimental soil was clay loam, alkaline, medium in nitrogen and phosphorus and high in potassium. The experiment was carried out in randomized block design (RBD) with 14 treatments, *viz*. weedy check, pendimethalin 0.75 kg/ ha pre-emergence and in combination with hand weeding 30 DAS, metribuzin 0.75 kg/ha pre-emergence and in combination with hand weeding 30 DAS, fenoxaprop-p-ethyl 0.075 kg/ha, imazethapyr 0.1 kg/ha, sequential application of pendimethalin and metribuzin with fenoxaprop-p-ethyl and imazethapyr, one hand weeding 20 DAS, two hand weeding 15 and 30 DAS and weed free up to 50 days stage of crop and these treatments replicated thrice. Soybean variety '*JS-9560*' was sown at 30 cm row spacing using 80 kg seed/ha. Sowing was done on 16 July 2014 and crop was sown by using package of practices of south-east Rajasthan. Dominant weed flora of the experiment field was *Amaranthus viridis, Commelina benghalensis, Parthenium hysterophorus, Trianthema portulacastrum, Digera arvensis, Cynodon dactylon, Echinochloa colona* and *Cyperus rotundus*.

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All the growth parameters *viz*. plant height, crop dry matter, leaf area index and branches/plant were significantly influenced by all the weed management treatments. Weed free treatment recorded the maximum plant height, crop dry matter, leaf area index and branches/ at different stages of observation which was closely followed by pre-emergence application of pendimethalin 0.75 kg/ha as pre-emergence + hand weeding 30 DAS and two hand weeding 15 and 30 DAS treatments (Table 1). More dry matter accumulation by the crop under weeded crop seems to be a direct effect of greater penetration of solar radiation in the crop canopy which resulted into greater rate of photosynthesis and subsequently more accumulation of dry matter. Further, in legumes nodulation plays a vital role in fixation of atmospheric nitrogen which is utilized by plants for various enzymatic processes resulting in enhanced carbohydrate and protein contents which are of prime importance for plant growth.

Yield attributing characters *viz*. pods/plant, number of grains per pod, hundred seed weight and pod length were significantly influenced by weed management practices (Table 2). Maximum number of pods/plant, number of grains/pod, hundred seed weight and pod length were observed with weed free treatment which was closely followed by pendimethalin 0.75 kg/ha PE + hand weeding 30 DAS and two hand weeding 15 and 30 DAS treatment. It can be stated from the above finding that, though pods/plant, number of grains/pod, hundred seed weight and pod length is a varietal character but tremendous weed infestation caused stress to the crop plant with respect to nutrient, light, moisture, space and other various aspects related to

Table 1. Effect of weed management treatments on growth parameter of soybean

Treatment	Plant height (cm)			Branches/plant	Dry matter accumulation (g/plant)			Leaf area index		
	50 DAS	75 DAS	At Harvest	75 DAS	50 DAS	75 DAS	At harvest	25 DAS	50 DAS	75 DAS
Weedy check	31.0	44.1	46.3	4.29	7.9	18.1	22.3	1.26	2.68	4.75
Pendimethalin 750 g/ha PE	29.9	43.7	44.7	4.08	7.9	17.4	21.4	1.22	2.60	4.67
Metribuzin 350 g/ha PE	31.3	42.8	43.8	4.11	8.0	18.6	24.6	1.15	2.53	4.53
Fenoxaprop-p-ethyl 75 g/ha POE	31.5	43.9	46.9	4.20	8.0	18.7	23.8	1.26	2.75	4.82
Imazethapyr 100 g/haPOE	41.1	55.3	58.0	5.99	11.3	24.8	31.0	1.20	3.91	6.17
Pendimethalin + HW 30 DAS	39.5	52.9	56.3	4.93	9.8	22.0	29.2	1.18	3.65	5.84
Metribuzin 350 g/ha + HW 30 DAS	38.5	51.6	53.5	4.79	9.8	21.6	27.4	1.51	3.33	5.67
Pendimethalin 750 g/ha+ Fenoxaprop-p-ethyl POE	39.3	52.5	55.2	4.83	9.9	22.2	29.8	1.58	3.49	5.80
Pendimethalin 750 g/ha+ Imazethapyr POE	38.3	50.4	54.4	4.80	9.7	21.4	28.0	1.48	3.43	5.66
Metribuzin 350 g/ha + Fenoxaprop-p-ethyl POE	38.4	52.2	54.9	4.93	9.7	22.0	28.4	1.50	3.31	5.41
Metribuzin 350 g/ha + Imazethapyr POE	28.4	37.6	38.3	3.39	5.8	12.7	15.6	0.95	2.11	3.84
One hand weeding at 20 DAS	36.1	46.2	49.1	4.72	9.1	20.1	25.4	1.39	3.00	4.97
Two hand weeding 15 and 30 DAS	39.7	53.6	56.5	5.32	11.2	23.6	30.6	1.72	3.78	6.04
Weed free	42.3	57.2	59.7	6.33	13.6	27.2	32.2	1.85	4.06	6.78
LSD (P=0.05)	5.7	7.0	8.6	0.4	1.10	2.5	3.5	0.09	0.21	0.34

Table 2. Effect of weed management treatments on yield and economics of soybean

Treatment	Pods /plant	Seeds /pod	Pod length (cm)	Seed index (g)	Weed control efficiency (%)	Yield (t/ha)			Harvest index (%)	Net returns (x10^3 `/ha)	B:C ratio
						Seed	Haulm	Biological			
Pendimethalin 750 g/ha PE	23.6	2.7	4.53	11.9	57.7	0.91	2.08	30.0	30.5	15.1	1.80
Metribuzin 350 g/ha PE	24.3	2.6	4.59	11.2	58.9	0.83	1.90	2.74	30.4	12.5	1.68
Fenoxaprop-p-ethyl 75 g/ha POE	24.7	2.7	4.72	11.5	59.8	100	2.29	3.29	30.5	18.0	1.94
Imazethapyr 100 g/haPOE	25.6	2.7	4.75	11.8	61.6	1.04	2.38	3.42	30.5	19.2	1.98
Pendimethalin + HW 30 DAS	32.3	3.2	5.00	12.9	76.9	1.38	3.04	4.42	31.1	29.5	2.38
Metribuzin 350 g/ha + HW 30 DAS	27.7	3.0	4.92	12.5	71.0	1.13	2.57	3.70	30.5	21.0	2.00
Pendimethalin 750 g/ha+ Fenoxaprop-p-ethyl POE	26.3	2.9	4.86	12.1	69.7	1.18	2.69	3.87	30.5	23.2	2.12
Pendimethalin 750 g/ha+ Imazethapyr POE	29.0	3.0	4.92	12.8	71.5	1.23	2.79	4.02	30.6	24.7	2.17
Metribuzin 350 g/ha + Fenoxaprop-p-ethyl POE	28.8	2.9	4.89	12.6	70.0	1.13	2.57	3.70	30.5	21.6	2.06
Metribuzin 350 g/ha + Imazethapyr POE	29.2	2.9	4.85	12.0	69.8	1.18	2.71	3.89	30.4	23.4	2.13
One hand weeding at 20 DAS	28.8	2.8	4.83	12.3	66.6	1.12	2.54	3.65	30.5	21.5	2.08
Two hand weeding 15 and 30 DAS	31.7	3.1	4.95	12.9	74.5	1.32	2.90	4.22	31.3	27.2	2.26
Weed free	33.0	3.4	5.05	13.6	92.1	1.42	3.10	4.52	31.4	26.7	2.04
Weedy check	17.9	2.1	4.12	10.5	-	0.52	1.36	1.88	27.7	2.34	1.13
LSD (P=0.05)	1.8	0.20	0.30	0.79	-	0.21	0.40	0.48	NS	-	-

physiological process of crop plant and thus enforced the crop to have the less number of pods per plant and this was highly evident in weedy check treatments.

Data (Table 2) indicated that all the weed control treatments brought about significant improvement in yield of soybean over weedy check. Highest grain (1.42 t/ha) and haulm yields (3.10 t/ha) were recorded in weed free treatment which was followed by pendimethalin 0.75 kg/ha + hand weeding 30 DAS (1.38 t/ha and 3.04 t/ha, respectively). From the result, it is evident that higher weed infestation is responsible for reducing seed yield. Maximum harvest index was recorded under weed free treatment (31.43%), which was closely followed by two hand weeding and pendimethalin 0.75 kg/ha + hand weeding 30 DAS with the respective harvest

index value as 31.31 and 31.13%. The lowest yield reported in the weedy check was probably due to fact that crop faced the tremendous competition with vigorous weed infestation. Pendimethalin 0.75 kg/ha + hand weeding 30 DAS was the next best treatment after weed free because emergence of early growth of weeds was inhibited by pre-emergence application of pendimethalin and the late emerging weeds were effectively controlled by hand weeding performed 30 DAS. Consequently, the crop attained luxuriant growth and suppressed the future weed flushes. These results are in close conformity with those reported by Tuti and Das (2011).

Highest net returns and B:C ratio was noted in pendimethalin 0.75 kg/ha + hand weeding 30 DAS owing to higher seed yield and comparatively lower cost under this treatment (Table 2) because pre-emergence application of pendimethalin prevented the seedling growth of grasses in the early stages followed by one hand weeding 30 DAS gave a less or negligible competition to the crop. Though weed free treatment recorded highest yield but it failed to obtain most profitable result with respect to net return and B-C ratio due to higher labour wages. Similar findings were obtained by Verma *et al*. 2013.

SUMMARY

A field experiment was carried out at research farm of Rajasthan College of Agriculture, Udaipur during *Kharif* 2014 in randomized block design (RBD) with 14 treatments pre-emergence application of pendimethalin 0.75 kg/ha + hand weeding 30 DAS resulted broad spectrum of weed control besides gives higher grain yield. This weed management method found to be promising to control weeds of soybean crop and would play an important role in areas where labour is too expensive and time is a constraint.

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