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Herbicidal weed control in soybean (*Glycine max*)

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ABSTRACT

A field experiment was conducted during the rainy season of 2001 and 2002 at Sehore, to study the effect of herbicidal weed control on growth, yield and economics of soybean [*Glycine max* (L.) Merr.]. Application of imazethapyr 10% @ 75 g/ha was found most effective in reducing weed biomass and resulting higher weed-control efficiency over other pre- and post-emergence herbicides. Quizalofop ethyl 5 EC @ 50 g/ha was also found effective with fairly low weed shoot biomass during both the years and controlled particularly the monocot weeds effectively. Treatment of 2 hand-weedings recorded higher values for growth, yield attributes, harvest index and yield followed by post-emergence application of imazethapyr 10% @ 75 g/ha.

Key words : Weed control, Soybean, Herbicides, Yield

Soybean is an important oil-yielding, rainy-season (*kharif*) legume crop of Madhya Pradesh. Simultaneous emergence and rapid growth of large number of weed species causes severe crop-weed competitions and reduction in crop yields. In Madhya Pradesh, the weeds reduce the growth and yield of soybean up to 77% (Tiwari and Kurchania, 1990). The incessant rains on Vertisols of Vindhyan plateau do not permit timely inter-cultivations and their manual control is also very difficult on large scale on acount of high cost and labour shortage during weeding peaks. Therefore it is necessary to suggest alternative methods of reducing the weed load during early crop-growth period of soybean (30 DAS) to sustain yield. Thus herbicidal weed control remains the only choice under such a situation. Keeping this in view, the present investigation for weed control was undertaken in soybean through herbicides.

MATERIALS AND METHODS

A field experiment was conducted during rainy seasons (*kharif*) of 2001 and 2002 at R.A.K. College of Agriculture, Sehore. The soil was clayey loam with organic carbon content 0.42% and available N, P_2O_5 and K_2O 214.16, 16.20 and 290 kg/ha respectively. Soil was neutral in reaction (pH 7.50). The area received mean annual rainfall of 1,100 mm, the actual rainfall received during the growth period of the crop, i.e. from July to October, was 340.4, 290.7, 29.4 and 52.6 mm in 2001 and 80.8, 530.7, 183 and 0 mm in 2002.

The experiment consisted of 14 treatments (Table 1) laid out in randomized block design with 3 replications. Soybean variety 'JS 335' was sown in rows, 45 cm apart, in all the treatments. A uniform basal dose of N, P_2O_5 and K_2O @ 20, 60 and 20 kg/ha was applied at the time of sowing. Pre-emergence herbicides, viz. Alachlor 50 EC, Metolachlor 50 EC and S-metolachor 90 EC, were applied just after sowing, whereas post-emergence herbicides, viz. Quizalofop ethyl 5 EC, Quizalofop-p-tefuryl 4 EC, Imazamox (70%) and Imazethapyr (10%), were sprayed 23 days after sowing. Hand-weedings were carried out at 20 and 40 days after sowing. All the recommended package of practices were followed for the crop. Weed counts/m^2 and dry weight/m^2 were recorded from 0.5 m × 0.5 m quadrant at 75 days stage of the crop. Weed-control efficiency and weed index were calculated from the related observations. The observations on crop-growth parameters were also recorded at this stage.

RESULTS AND DISCUSSION

Weeds

The experimental field was infested with about 26 weed species, consisting of both narrow and broad-leaf and sedges. The infestation of narrow-leaf weeds and sedges was more than that of broad-leaf weeds. Among different monocot weeds, *Digiteria sanguinalis* (L.) Scop., *Echinochloa colonum* Link, *Commelina benghalensis* L., *Dinebra arabica* Jacq. were dominant, whereas *Cyanotis axillaris* Roam. & Schem., *Echinochloa*

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crus-galli Beauv. and *Cynodon dactylon* (L.) Pers. were with lesser density. Among different dicot weeds, *Caesulia axillaris* Roxb., *Acalypha indica* L., *Anotis monthulani* Hook. and *Digera arvensis* Forsk. were dominant, whereas *Euphorbia geniculata* Orteg., *Corchorus acutagulus* Link., *Parthenium hysterophorus* and *Tridex procumbens* L. were in lower density. *Cyperus rotundus* L. only represented the group of sedges.

Among various weed-control measures, hand-weeding twice at 20 and 40 days resulted in significantly lower weed population compared with rest of the treatments during both the years except 1 hand-weeding at 20 days in 2002 (Table 1). Two hand-weedings showed highest weed-control efficiency (WCE) of 95.65 and 96.29% during 2001 and 2002 respectively. Decrease in weed shoot biomass and higher WCE with hand-weeding were also reported by Vyas *et al.* (2000). Pre-emergence herbicide, viz. Alachlor 50 EC @ 2.0 kg/ha recorded significantly lowest weed biomass than other pre-emergence herbicides, which resulted in higher WCE of 79.81 and 80.07% in 2001 and 2002 respectively.

Among post-emergence herbicide application of imazethapyr 10% @ 75 g/ha gave signficantly less weed biomass and higher WCE expect quizalofop ethyl 5 EC @ 50 g/ha during both the years, which was at par for weed shoot biomass. Low weed biomass ultimately resulted in highest WCE (90.06 and 90.20%) with the use of imazethapyr 10% @ 75 g/ha among the post-emergence herbicides, followed by quizalofop ethyl 5 EC @ 50 g/ha.

Weedy check recorded significantly highest weed index over rest of the herbicidal and manual weed-control treatments, during both the years except metolachlor 50 EC @ 1.0 kg/ha in 2002 where it was statsitaclly at par (Table 1). Among different herbicides used in investigation, imazethapyr 10% @ 75 g/ha gave significantly lowest value of weed index during both the years except that was recorded with Quizalofop ethyl 5 EC @ 50 g/ha in the 2002, while among pre-emergence herbicides Alachlor 50 EC @ 2.0 kg/ha gave significantly lowest value of weed index except that obtained with s-metalachlor 90 EC @ 750 g/ha in 2001, however weed index obtained with alachlor 50 EC @ 2.0 kg/ha was at par with other pre-emergence herbicides, in 2002.

Soybean yield attributes

All the weed-control treatments gave significantly more height and branches than weedy check during both the years (Table 2). Two hand-weedings recorded maximum height and branches/plant than rest of the treatments. This could be attributed to the favourable growing conditions in view of low crop–weed competition.

All the weed-control treatments produced significantly higher number of pods/plant and seeds/pod than the weedy check in both the years. However, there was less podding in all the treatments in 2002 due to long dry weather (drought) conditions during last one and half month of crop life-span. Among herbicides, Imazethapyr 10% @ 75 g/ha gave highest values, and also observed, significantly supeiror to most of the herbicidal treatments for various yield attributes. These highest levels of yield attributes could be attributed to low competition stress. The results confirm the findings of Joshi and Billore (1998) and Nelson and Renner (1999).

Soybean seed yield

Two hand-weedings resulted in significantly higher

Table 1. Effect of herbicides on weed intensity, weed biomass, weed-control efficiency and weed index in soybean (pooled data of 2 years)

Treatment	Dose (kg ai/ha)	Weed intensity (plants/m²)	Weed biomass (q/ha)	Weed-control efficiency (%)	Weed index (pooled)
Alachlor 50 EC (PE)	2.000	43.7	1.0	79.9	16.9
Metolachlor 50 EC (PE)	1.000	47.8	1.8	65.7	28.4
S metolachlor 90 EC (PE)	0.500	49.4	2.0	63.1	26.2
S metolachlor 90 EC (PE)	0.750	42.9	1.7	66.8	16.7
Quizalofop ethyl 5% (PoE)	0.038	46.3	1.9	62.3	22.6
Quizalofop ethyl 5% (PoE)	0.050	39.7	0.9	82.1	12.5
Quizalofop-p-tefuryl 4% (PoE)	0.050	55.5	2.2	56.8	18.7
Quizalofop-p-tefuryl 4% (PoE)	0.060	46.5	2.0	61.0	16.7
Imazamox 70% (PoE)	0.040	60.0	2.7	48.2	21.1
Imazamox 70% (PoE)	0.060	55.2	2.3	55.8	15.3
Imazethapyr 10% (PoE)	0.075	24.0	0.5	90.1	8.8
1 hand-weeding		19.4	0.4	92.1	7.6
2 hand-weedings		8.0	0.2	96.0	0.0
Weedy check		182.9	5.1		35.1
CD (P=0.05)		14.6	0.5		0.9

*PE, pre-emegence; PoE, post-emergence

Table 2. Effect of herbicides on growth, yield attributes and yield of soybean

Treatment	Dose (kg ai/ha)	Plant height* (cm)	Branches/ plant*	Pods/ plant*	Seeds/ pod*	Seed yield (q/ha) 2001	2002	Pooled
Alachlor 50 EC (PE)	2.000	64.6	3.1	31.1	2.5	15.6	7.2	11.4
Metolachlor 50 EC (PE)	1.000	61.1	2.8	29.4	2.3	12.5	6.5	9.5
S metolachlor 90 EC (PE)	0.500	62.1	2.9	30.5	2.2	12.7	6.8	9.7
S metolachlor 90 EC (PE)	0.750	63.7	3.2	30.1	2.2	15.3	7.0	11.2
Quizalofop ethyl 5% (PoE)	0.038	62.1	3.3	28.5	2.4	14.5	6.6	10.5
Quizalofop ethyl 5% (PoE)	0.050	67.1	3.7	30.4	2.5	15.8	7.7	11.7
Quizalofop-p-tefuryl 4% (PoE)	0.050	63.5	2.7	28.2	2.3	15.0	7.0	11.0
Quizalofop-p-tefuryl 4% (PoE)	0.060	63.8	2.9	29.4	2.5	15.0	7.3	11.2
Imazamox 70% (PoE)	0.040	61.4	2.7	29.3	2.4	14.7	6.7	10.7
Imazamox 70% (PoE)	0.060	63.6	3.0	29.6	2.5	15.1	7.5	11.3
Imazethapyr 10% (PoE)	0.075	63.2	4.1	31.5	2.7	16.7	8.3	12.5
1 hand-weeding		63.5	4.2	32.0	2.4	16.2	7.9	12.0
2 hand-weedings		69.1	4.5	35.4	2.8	17.6	9.0	13.3
Weedy check		56.5	2.6	22.0	2.0	11.3	5.9	8.6
CD (P=0.05)		2.5	0.3	3.0	0.3	1.2	0.7	0.9

*Pooled; PE, pre-emergence; PoE, post-emergence

yields over rest of the weed-control treatments tried under investigation except Imazethapyr 10% @ 75 g/ha in both the years. The yield obtained under Imazethapyr 10% @ 75 g/ha during both the years was statistically at par with that obtained with 2 hand-weedings. Among pre-emergence herbicides, Alachlor 50 EC @ 2.0 kg/ha recorded significantly higher yield over Metolachlor 50 EC @ 1.0 kg/ha and s-metholachlor 90 EC @ 500 g/ha in the 2001, whereas it was not found significantly superior to any of post-emergence herbicidal treatments in 2002. The significantly higher grain yield under treatment of 2 hand-weedings could be attributed to lower weed competition stress and almost weed-free environment, received by the soybean crop. The present findings corroborate the findings of Vyas *et al.* (2000). Among post-emergence herbicides tested in the present study, Imazethypyr 10% @ 75 g/ha and Quizalofop ethyl 5 EC @ 50 g/ha gave 32.26 and 28.18 and 29.38 and 23.30% more grain yield than weedy check during 2001 and 2002 respectively. These findings are in close proximity with that of Billore *et al.* (1999) with Imagethapyr and Vidrin *et al.* (1995) with Quizalofop ethyl.

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