Indian Journal of Weed Science **45**(1): 39–41, 2013

Yield and economics of soybean under integrated weed management practices

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Received: 23 January 2013; Revised: 14 March 2013

ABSTRACT

A field experiment was conducted at Agricultural Research Station, Karad, Satara, Maharashtra to find out the suitable integrated weed management method to enhance the yield in soybean. Higher yield component and yield were recorded under weed free treatment. Weed biomass was reduced significantly by the integrated weed management methods comprising quizalofop ethyl 0.05 kg/ha + chloromuron-ethyl 0.009 kg/ha as post-emergence application at 15 DAS + hand weeding at 30 DAS.

Key words: Economics, Integrated weed management, Soybean, Yield

Soybean (*Glycine max*) is an important rainy season crop having national productivity of 1006 kg/ha (Anonymous 2010). The sowing time for soybean in rainy season is very short and farmers give first priority for sowing the crop rather than controlling the weeds. The weeds-emerges simultaneously with the crop and compete with soybean causing loss in yield upto 35-55% depending upon the weed flora and density (Chandel and Saxena 1998, Kewat *et al*. 2000, Singh 2007). Manual weeding at right stage is difficult, time consuming and expensive due to intermittent rainfall during rainy season and scanty labour, therefore, farmers rarely adopt manual weeding for weed control. Under such situation, herbicides use with suitable dose remains the pertinent choice for controlling the weeds.

Herbicides in isolation, however, are unable do complete weed control because of their selective kill. Their use can be made more effective if supplemented with hand weeding or hoeing *etc*. A judicious combination of chemical and cultural methods of weed control would not only reduce the expenditure on herbicides but would benefit the crop by providing proper aeration and conservation of moisture (Prakash *et al.* 1991, Velu and Shankaran 1996). Thus, an experiment was conducted with an objective to identify a judicious combination of chemical and cultural methods for controlling weeds in soybean.

MATERIALS AND METHODS

The experiment was conducted during *Kharif* season of 2010, 2011 and 2012 at Agricultural Research Station, Karad, Satara, Maharashtra, India to identify the suitable integrated weed management method for managing weeds in soybean. The experiment was laid out in randomized block design with 10 treatments replicated thrice. The soil of the experimental field was medium deep, with low in available nitrogen (260 kg/ha) medium in available phosphorus (45.2 kg/ha) and rich in available potash (350 kg/ha). The soil was slightly acidic in reaction with pH 6.7.

Experimental treatments comprised hoeing at 15 days after seeding (DAS) and 30 DAS, hoeing at 15 DAS and hand weeding (HW) at 30 DAS, imazethapyr (Pursuit) 10 EC, 0.075 kg/ha as post-emergence (POE) at 15 DAS, imazethapyr 10 EC, 0.075 kg/ha as POE at 15 DAS and HW at 30 DAS, pendimethalin 1.0 kg/ha as pre-emergence, pendimethalin 1.0 kg/ha as pre-emergence and HW at 30 DAS, quizalofop-ethyl (Turga super) 5% EC 0.05 kg/ha + chlorimuron-ethyl (Cloben) 25% WP 0.009 kg/ha as post-emergence at 15 DAS, quizalofop-ethyl (Turga super) 5% EC 0.05 kg/ha + chlorimuron-ethyl (Cloben) 25% WP 0.009 kg/ha as post-emergence at 15 DAS + HW at 30 DAS and of weedy check, weed free check.

Weed biomass was recorded by weighing the dry weeds from the treatment plots. Weed control efficiency was estimated on the basis of reduction in weed weight in comparison with unweeded control and expressed as an index taking weed free as 100% efficiency. Weed index refers to reduction in yield due to presences of weeds in comparison to the weed free treatment plot yield. The economics of treatment was computed with prevailing market prices of products. The experimental plot size was 6.00 x 4.20 m. The soybean was sown by dibbling at 30 x 10 cm spacing.

RESULTS AND DISCUSSION

Effect on yield

Among the integrated weed management treatments, T_{10} *i.e.* quizalofop-ethyl 0.05 kg/ha + chlorimuron-ethyl 0.009 kg/ha as post-emergence at 15 DAS + hand weed-

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Table 1. Soybean plant height, pods per plant and weed biomass as influenced by different weed management treatments

Treatment	Plant height (cm)	Pods/plant	Weed biomass (kg/ha)
T_1 - Hoeings (at 15 DAS and 30 DAS)	64	24	666
T_2- Hoeings (at 15 DAS and HW at 30 DAS)	69	24	448
T_3 - Imazethapyr 0.0750 kg/ha (POE at 15 DAS)	59	19	726
T_4 - T_5 + HW at 30 DAS	70	22	457
T_5 - Pendimethalin 1.0 kg/ha (PE)	60	22	727
T_6 - T_7 + HW at 30 DAS	52	25	613
T_7 - Quizalofop-ethyl 0.05 kg/ha + chlorimuron-ethyl 0.009 kg/ha (POE at 15 DAS)	65	26	655
T_8- T_7 + HW at 30 DAS	71	28	381
T_9- Weedy check	63	18	1047
T_{10} - Weed free check	75	29	0000
LSD (P=0.05)			

*DAS- Days after sowing, HW- Hand weeding, POE- Post-emergence, PE- Pre-emergence

Table 2. Effect of different weed management treatments on soybean yield and weed control measures

Treatment	Soybean yield (t/ha)		Weed control efficiency (%)	Weed index (%)
	Grain	Straw		
T_1	2.46	1.74	38	34
T_2	3.42	2.45	62	8
T_3	2.54	1.92	36	32
T_4	2.90	2.17	55	23
T_5	2.35	1.70	31	37
T_6	3.08	2.22	54	18
T_7	2.34	1.75	30	37
T_8	2.70	2.07	47	28
T_9	1.90	1.61	0	49
T_{10}	3.73	2.60	100	0
LSD (P=0.05)	0.32	0.18	5	8

Treatment details are given in Table 1

ing at 30 DAS, recorded significantly higher plant height, pods/plant, less weed biomass and higher seed and straw yield (3423 and 2448 kg/ha), respectively, and was at par with weed free check (Table 1 & 2). Similar trend was also noticed in case of growth and yield attributes, weed control efficiency and weed index. Pendimethalin 1.0 kg/ha as pre-emergence recorded the lowest seed yield among the chemical weed control treatments which was followed by imazethapyr 10 EC, 0.750 kg/ha as post-emergence at 15 DAS.

These results revealed that comparative inefficiency of the chemical methods of weed control in isolation in reducing the crop weed competition resulting in comparatively lower yields as compared to their use in combination. These results were in conformity with Dubey *et al.* (1996). The increase in soybean seed yield with integrated methods could be attributed to the fact that the crop was kept free of competition at the early critical stages of growth which resulted efficient use of land and climatic resources by the crop. These results were in confirmations with the earlier findings of Velu and Sankaran (1996) and Natrajan *et al.* (1997).

Economics

The monetary returns were found to be significantly influenced by different weed control treatments. Quizalofop-ethyl 0.05 kg/ha + chlorimuron-ethyl 0.009 kg/ha as post-emergence at 15 DAS + hand weeding at 30 DAS recorded the significantly higher gross and net monetary returns and B:C ratio than other treatments and were at par with weed free treatment (Table 3). These results are in close conformity with the findings of Chandel *et al.* (1995) and Jain *et al.* (2000).

Table 3. Economics of different weed management treatments used for managing weeds in soybean

Treatment	Gross monetary returns (x10^3 ₹/ha)	Net returns (x10^3 ₹/ha)	B:C ratio
T_1	46.43	27.12	2.40
T_2	52.94	31.90	2.52
T_3	42.98	22.87	2.14
T_4	56.25	34.28	2.56
T_5	42.85	23.29	2.19
T_6	49.36	27.94	2.30
T_7	44.91	25.21	2.28
T_8	62.62	41.06	2.90
T_9	34.74	18.34	2.12
T_{10}	68.26	45.85	3.05
LSD (P=0.05)	5.82	5.82	0.28

Treatment details are given in Table 1

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