

Integrated weed management in soybean (*Glycine max*)

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ABSTRACT

A field experiment was conducted on 'JS 72-44' soybean [*Glycine max* (L.) Merr.] to ascertain effective and economically viable weed management in clay soils of Sagar during the rainy (*khari*) season of 1990–1992. Application of fluchloralin 1 kg/ha as pre-planting and incorporation of butachlor 2.5 kg/ha as pre-emergence gave seed yield (10.16–11.17 q/ha) as good as to 1 hand-weeding (11.17 q/ha) at 30 days after sowing. Herbicidal weed control appeared more economical over hand-weeding. Interculture with *kulpa* also gave good yield (10.05 q/ha) and proved more remunerative than hand-weeding. Integration of mechanical and chemical treatments had little effect in enhancing soybean yield.

Soybean [*Glycine max* (L.) Merr.] is extensively grown in all over Madhya Pradesh because of its wide adaptability to agroclimatic conditions and high market value of the produce. A large number of weed species infest the crop during its growth season and result in decline in its productivity. Unavailability of adequate labourers during weeding peaks and difficulty in the use of mechanical weeders in heavy soil due to rains create problem for effective control of weeds. Herbicidal weed control remains the only choice under such situations. However, herbicides are costly and their availability in desired quality is also problematic. Therefore integrated approach of chemical and mechanical control may be more feasible. Since lacking of information on this aspect, present investigation was undertaken to determine

the effective integrated weed management

MATERIALS AND METHODS

A field experiment was conducted at Regional Agricultural Research Station, Sagar, during the rainy (*khari*) seasons of 1990, 1991 and 1992. The soil was clayey in texture and neutral in reaction. It had medium N (401.48 kg/ha), low P (9.24 kg/ha) and high K (425.92 kg/ha) contents. The rainfall received during the 3 consecutive years was 1,999, 1,141 and 1,080 mm. Eight treatments consisted of hand-weeding (a), interculture with *kulpa* (b), tilling with country plough (c), interculture with hand-hoe (d), all at 30 days after sowing (DAS), preplanting and incorporation (ppi) fluchloralin 1 kg/ha (e), pre-emergence (pre-em.) butachlor 2.5 kg/ha (f), post-emergence (post-em.) classic 0.018 kg/ha (g),

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Table 1. Effect of weed management on weed intensity, weed biomass, weed-control efficiency (WCE) and weed-competition index (WCI)

Treatment	Weed intensity (plants/m ²)			Weed biomass (g/ha)			WCE (%)			WCI (%)		
	1990	1991	1992	1990	1991	1992	1990	1991	1992	1990	1991	1992
HW 1, 30 DAS (a)	16.3 (4.09)	15.7 (4.07)	105.3 (10.27)	3.98	3.75	2.05	86.2	83.4	87.7			4.7
Kulpa 1, 30 DAS (b)	42.3 (6.54)	46.2 (6.83)	40.5 (6.39)	9.65	10.57	8.82	66.6	53.2	47.2	11.2	15.4	11.7
DP 1, 30 DAS (c)	71.1 (8.46)	62.1 (7.91)	87.8 (9.38)	16.84	14.41	8.80	41.7	36.3	47.4	26.6	24.7	22.6
HH 1, 30 DAS (d)	60.1 (7.78)	55.0 (7.50)	58.6 (7.69)	10.96	10.25	5.62	62.0	54.7	66.4	40.8	28.8	24.3
Fluchloralin (ppi) 1 kg/ha (e)	31.3 (5.63)	30.2 (5.54)	152.0 (12.35)	4.60	4.90	4.75	84.0	79.0	71.6	0.4	0.8	6.1
Butachlor pre-em. 2.5 kg/ha (f)	60.7 (7.82)	76.3 (8.76)	84.0 (9.17)	10.54	14.28	9.87	63.5	36.8	41.9	12.6	12.9	9.9
Classic post-em. 0.018 kg/ha (g)	119.4 (10.94)	93.4 (9.69)	123.8 (11.14)	23.00	20.51	11.00	20.4	9.3	34.2	35.0	37.5	26.3
Weedy check	212.2 (14.58)	196.3 (14.02)	142.0 (11.94)	28.90	22.61	16.72				38.1	41.0	42.4
f + a			45.8 (6.82)			2.20			86.9			
f + b			52.3 (7.25)			4.75			71.6			5.1
f + c			95.8 (9.42)			7.12			57.4			11.8
f + d			73.0 (8.57)			4.25			74.6			2.4
CD (P = 0.05)	1.51	1.37	1.82	3.02	3.14	0.83						

HW, Hand-weeding; DP, *desi* or country plough; HH, hand-hoe
 Figures in parentheses are transformed values

and weedy check (h) were laid out in randomized block design with 4 replications. Four treatments of integrated weed control, viz. f + a, f + b, f + c and f + d were tested in 1992 along with aforesaid treatments. Crop variety 'JS 72-44' was sown on 11 July, 4 August and 20 July in the 3 respective years. Sowing was done in rows 30 cm apart using 100 kg seed/ha by a seed drill. Before sowing, seeds were inoculated with rhizobium culture @ 5 g/kg seed. A uniform dose of diammonium phosphate @ 100 kg/ha was applied before sowing. Weed count was made by using least count quadrat method.

RESULTS AND DISCUSSION

Weed intensity

The dominating weeds in crop were *Echinochloa crus-galli* Beauv., *Dinebra ret-*

roflexa Panz; syn. *D. arrabica* Jacq., *Cyperus iria* L. and *Commelina benghalensis* L. among the grassy weeds; and *Euphorbia* spp., *Imula indica* Willd., *Tridax procumbens* L., *Caesulia axillaris* Roxb., *Digitaria adscendens* Henr, *Celosia argentea* L. and *Eclipta alba* Hassk. among the broad-leaf weeds.

Maximum weed intensity (plants/m²) was recorded under weedy check, closely followed by a treatment where classic Chlorimuron ethyl 28 EC (0.018 kg/ha) was applied as post-emergence. All other treatments where chemical or mechanical weed-control method was applied alone or in combination with each other significantly reduced the weed infestation (Table 1). These treatments having lower weed intensity produced significantly lower weed biomass than weedy check and classic 0.018 kg/ha

Table 2. Effect of weed management on growth and yield parameters of soybean

Treatment	Plant height (cm)			Branches/ plant			Pods/ plant			Seeds/ pod		
	1990	1991	1992	1990	1991	1992	1990	1991	1992	1990	1991	1992
HW 1, 30 DAS (a)	32.3	33.2	51.4	2.52	2.33	4.30	35.7	32.8	46.6	2.68	2.40	2.40
Kulpa 1, 30 DAS (b)	32.1	34.2	48.1	2.60	2.45	3.50	19.4	15.3	34.9	2.70	2.35	2.45
DP 1, 30 DAS (c)	35.0	33.6	47.2	2.39	2.16	3.55	18.7	15.6	31.5	2.47	2.27	2.40
HH 1, 30 DAS (d)	35.1	33.1	43.2	2.18	2.08	4.20	17.6	16.0	47.5	2.31	2.20	2.15
Fluchloralin ppl 1 kg/ha (e)	36.8	38.3	50.7	2.66	2.54	3.95	21.2	19.7	39.7	2.60	2.46	2.68
Butachlor pre-em. 2.5 kg/ha (f)	33.4	33.8	49.5	2.46	1.83	3.75	19.3	18.1	35.1	2.31	2.30	2.50
Classic post-em. 0.018 kg/ha (g)	33.5	33.3	44.2	2.17	1.79	3.75	15.6	20.0	34.6	2.41	2.55	2.45
Weedy check	32.2	34.0	45.0	2.06	1.95	4.15	17.5	19.0	40.1	2.30	2.29	2.55
f + a			47.8			3.98			41.7			2.39
f + b			47.2			3.95			38.8			2.05
f + c			52.5			3.95			41.9			2.20
f + d			50.9			3.50			36.8			2.45
CD (P = 0.05)			5.5	0.53	0.81	1.13	2.84	2.13	3.24	0.38	0.25	0.51

HW, Hand-weeding; DP, desi or country plough; HH, hand-hoe

Table 3. Effect of weed management on yield and economics in soybean

Treatment	Seed yield (q/ha)			Straw yield (q/ha)			Gross return (Rs/ha) (1992)	Cost of cultivation (Rs/ha) (1992)	Benefit : cost ratio (1992)
	1990	1991	1992	Mean	1990	1991	1992	Mean	
HW 1, 30 DAS (a)	11.12	9.31	13.39	11.27	14.71	11.95	15.25	13.97	1.79
Ku/ha 1, 30 DAS (b)	9.87	7.88	12.40	10.05	15.76	11.63	14.91	14.10	2.02
DP 1, 30 DAS (c)	8.16	7.01	10.87	8.68	11.06	9.73	10.71	10.50	2.16
HH 1, 30 DAS (d)	6.58	6.63	10.64	7.95	9.79	9.23	12.49	11.17	2.17
Fluchloralin ppl 1.5 kg/ha (e)	11.08	9.24	13.20	11.17	12.94	12.23	15.96	13.71	1.93
Butachlor pre-em. 2.5 kg/ha (f)	9.72	8.11	12.66	10.16	13.16	11.81	13.88	12.95	1.86
Classic post-em. 0.018 kg/ha (g)	7.23	5.82	10.35	7.80	10.51	9.98	10.47	10.32	1.48
Weedy check	6.88	5.49	8.09	6.82	11.83	8.62	6.25	8.90	1.36
f + a			14.05						1.66
f + b			13.34						1.88
f + c			12.39						1.75
f + d			13.71						1.96
CD (P = 0.05)	1.06	0.91	0.86	0.39	0.72	0.35	1.29	0.21	810

HW, Hand-weeding; DP, desi or country plough; HH, hand-hoe
Soybean seed and straw, Rs 800 and 20/q respectively

(Maurya *et al.*, 1990, Upadhyaya, 1992). Hand-weeding, interculturing with *kulpa* or *desi* plough or hand-hoe and fluchloralin ppi 1 kg/ha proved equally good for weed-control efficiency and weed-competition index. Supplementation of hand-weeding or different mechanical weed-control practices with pre-emergence application of butachlor had a little increase in weed-control efficiency owing to lower weed biomass and weed-competition index. These results are in conformity with the findings of Nimje (1989) and Ved Prakash *et al.* (1991).

Crop performance

Plant height and branches, pods, seeds and seed yield/plant were similar under hand-weeding, interculture with *kulpa* or hand-hoe and pre-emergence application of fluchloralin or butachlor (Table 2). These treatments were superior than other weed-control treatments. These superiority in growth and yield-attributing characters attributed to reduced weed intensity owing to less competition for nutrients, space, water and light. Therefore, grain and straw yields were significantly higher under the treatments receiving hand-weeding or mechanical as well as chemical weed control than weedy check (Table 3). Integration of hand-weeding or mechanical weed control with butachlor 2.5 kg/ha had a little improvement in seed and straw yields as compared to application of butachlor alone.

Economics

Gross monetary return was significantly the lowest in weedy check among all the

treatments. It increased under hand-weeding, inter-culture with *kulpa* or hand-hoe or country plough and pre-emergence application of fluchloralin 1 kg/ha or butachlor 2.5 kg/ha were practised alone or use of butachlor supplemented with hand-weeding and interculture operations. Though post-emergence application of classic 0.018 kg/ha fetched significantly higher gross profit than weedy check, it was significantly lower than other weed-control treatments. The benefit : cost ratio (1.79) was lesser than mechanical or herbicidal treatments except post-emergence classic because of higher cost involved in weeding. The benefit : cost ratio, reduced or increased when hand-weeding or mechanical weed control were supplemented with pre-emergence use of butachlor 2.5 kg/ha as compared to application of butachlor alone (1.86). On the basis of benefit : cost ratio, mechanical weed control proved more remunerative than other weed control treatments.

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