Indian Journal of Weed Science 41(3&4) : 213-217, 2009 **Short communication**

Efficacy of post-emergence herbicides in soybean under various fertility levels and their residual effects on succeeding crops

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ABSTRACT

A field experiment was conducted during the rainy season of 2006 at Instructional farm, College of Agriculture, Junagadh Agriculture University, Junagadh on clayey soil to study the efficacy of post-emergence herbicides on soybean under different fertility levels and their residual effects on succeeding crops of sorghum, bajra, barley and ragi. Among the weed management practices, the weed free treatment produced significantly higher grain yield (2336 kg/ha) and stover yield (2772 kg/ha). The next best treatment to control the weeds at initial growth stage was pendimethalin 0.5 kg/ha pre-em + HW + IC at 30 DAS. The treatment imazethapyr 75 g/ha post-em. at 25 DAS +HW +IC 45 DAS) recorded the lowest no. of weeds/m^2. Among the fertilizer levels the treatments F_3 40:80:40 and F_2 30:60:30 N, P_2O_5, K_2O kg/ha recorded equally the higher grains (2006 kg/ha and 1973 kg/ha) and stover yield (2321 kg/ha and 2228 kg/ha, respectively).The crops like sorghum, bajra, barley and ragi can be sown safely as succeeding crops after harvesting the *kharif* soybean. In soybean the effective weed management up to 60 DAS and fertilizing the crop with 30:60:60 N, P_2O_5, K_2O kg/ha gave higher grains and stover yield and had no residual effect on succeeding crops.

Key words: Herbicides, Pendimethalin, Imazethapyr, Soybean, Residual effect.

Soybean is mainly grown in rainy (*kharif*) season. Among the various factors responsible for low productivity of soybean, weed infestation during early stages of crop growth is major one. Weed infestation in soybean results in loss up to extent of 79% (Reddy *et al.* 1990). Soybean growth and seed yield are seriously affected if weeds are not controlled at initial stages (Bhan 1994). The traditional methods of weed control i.e. hand weeding is expensive, tedious and time consuming and also becomes difficult due to unfavorable weather, wet soil and unavailability of labour *etc.* Under such circumstances, use of effective herbicides in suitable dose remains the pertinent choice for controlling the weeds. Herbicides in isolation, however, are unable to obtain complete weed control because of their selective killing. Their use can be made more effective if supplemented with hand weeding or hoeing *etc*. Although herbicides give better and timely weed control, high costs prohibit their use by the average cultivators. A judicious combination of chemicals and cultural methods of weed control would not only reduce the expenditure on herbicides but will also benefit the crop by providing proper aeration and conservation of moisture.

Fertilizer even though comparatively costly inputs of production is essential for securing higher yield. The prudent use of fertilizer with appropriate methods and time of application is the prime importance in securing higher yield of soybean.

A judicious combination of chemical and culture weed control was expected to be effective for controlling weeds in soybean. The present investigation was under taken to evaluate the efficacy of post-emergence herbicides in comparison with different levels of fertilizer doses for obtaining maximum yields of soybean and to study the residue effects on succeeding crops of sorghum, bajra, barley and ragi.

A field experiment was conducted on soybean variety *Gujarat soybean-2* in clayey soil at Instructional farm, College of Agriculture, Junagadh Agriculture University, Junagadh, during the rainy season 2006. The soil of the experimental field was low in available nitrogen (223.4 kg /ha), medium in phosphorus (35.5kg/ha) and high in potassium (229.9 kg/ha). The treatments were as follows :

W_1 = Pendimethalin 0.5 kg/ha pre-emergence+hand weding (HW) + inter-cultivation (IC) at 30 DAS)

W_2 = Quizalofop-ehyl 40g/ha post-emergence (25 DAS) + HW + inter-cultivation (IC) (45 DAS)

W_3 = Imazethapyr 75 g/ha post-emergence (25DAS) + HW + inter-cultivation (IC) (45 DAS)

W_4 = 2HW and 2 inter-cultivation (IC) at 20 and 40 DAS

W_5 = Weed free through hand weeding up to 60 days

W_6 = Unweeded control.

Three treatment of fertilizer levels were :

F_1 = 20:40:20 N, P, K.

F_2 = 30:60:30 N, P, K.

F_3 = 40:80:40 N, P, K.

These treatments were tested in split plot design with three replications. The experiment was sown on 11/07/2006 with gross net plot size 6 x 3.60 and 5.1 x 2.7 m^2 with the spacing 45 x15 cm between row to row and plant to plant. The seed rate 60 kg/ha was used and the crop was fertilized as basal dose as per treatment. The total weed population/m^2 was recorded at 20, 40 and 60 days after sowing (DAS) randomly under each treatment with the help of 0.25 m^2 quadrat. Species wise weed population was also recorded. The weed dry matter and grain yield and stover yield were recorded at harvest.

The weed flora obtained in plots was as follows :

1) Sedge *Cyperus rotundus* 2) Monocot weeds *Cynodon dactylon, Brachiara* spp., *Echinochloa colona* 3) Dicot weeds - *Digera arvensis*, *Phyllanthus niruri*, *Commelina benghalensis, Physalis minima*, *Portulaca oleracca*, *Leucas aspera, Tridex procumbens*, *Indigofera glandulosa*, *Euphorbia hirta*, *Parthenium hysterophorus* .

Effect of weed management practices on yield

The grain yield and stover yield of the soybean crop was significantly influenced by the various treatments of weed management practices. Among all the treatments W_5 (weed free) produced significantly higher grain (2336 kg/ha) and stover (2772 kg/ha) yield (Table 1). But the grain yield in the treatment W_5 (weed free) was statistically at par with the treatment W_4 (2 HW and 2 IC at 20 and 40 DAS). The lowest grain and stover yields were produced by the treatment W_6 (un weeded check). These findings corroborate the recent achived Chavan *et al.* (2000) and Sonawane and Sable (2003).

Effect of fertilizer levels on yield

Among the three fertilizers levels the treatment F_3 (40:80:40 ; N, P, K kg/ha) recorded the highest grain (2006 kg/ha) and stover (2321 kg/ha) yield which was at par with the treatment F_2 (30:60:30 : N, P, K kg/ha). The lowest grain and stover yield was recorded by the treatment F_1.

The interaction between weed management treatments and fertility levels was found to be non significant.

Effect of weed management practices on weeds

Data (Table 1 and 2) revealed that different treatment exhibited their significant influence on monocot weed, dicot weed and sedges. At 20 DAS, the monocot weed, dicot weed and sedges were significantly affected by different treatment. Besides the treatment W_5 (weed free) the next best treatment was W_1 (pendimethalin 0.5 kg/ha pre-emergence + HW + IC at 30 DAS). At early growth stage, the pre-emergence herbicides was most responsible for effective control of monocot weed, dicot weed and sedges (Table 1).

At 40 DAS and 60 DAS, the monocot weeds, dicot weeds and sedges were significantly influenced by different weed management treatments. Among all the treatments, W_5 (weed free) recorded the lowest no. of weed/m^2 at 40 and 60 DAS. The next best treatment at 40 and 60 DAS was W_3 (imazethapyr 75 g/ha post-emergence (25 DAS) +HW +IC (45 DAS), which recorded less number of monocot weed/m^2 (2.23) (2.60), dicot weed/m^2 (2.66) (2.32) and sedge/m^2 (2.86) (2.47), respectively. This is due to the combined effect of hand weeding, interculturing and post-emergence herbicides. These finding corroborate the results reported by Suzuki (1991) and Chavan *et al.* (2000).

Effect of fertilizer levels on weeds

At 20 DAS, the significantly lowest count of monocot dicot and sedges weed was recorded in the treatment F_1 (20 :40:20 count of N, P, K kg/ha) (monocot 5.7/m^2), dicot 4.7/m^2), sedge (3.8m^2) followed by F_2 (30:60:30 : N, P, K kg/ha) F_3 (40:80:40 : N, P, K kg/ha).

At 40 DAS and 60 DAS the monocot, dicot and sedges weeds/m^2 were significantly influenced due to different fertilizer levels. Monocot (3.78) (3.70), dicot (3.45) (3.18), sedges (3.43) (3.24) weeds/m^2 were found Significantly lower under the treatment F_1 (20:40:20 : N, P, K kg/ha) followed by the treatment F_2 (30:60:30 : N, P, K kg/ha) which remained statistically at par with F_3 (40:80:40 : N, P, K kg/ha) by recording significantly higher monocot, dicot and sedges weeds/m^2 (Table 1).

No significant interaction was found between weed management and fertility levels.

Effect of weed management practices and fertilizer level on dry weight of weeds

The total dry weight of weeds was significantly differed by different weed management treatments. Among all the treatments, W_5 (weed free) recorded significantly the lowest total dry weight of weeds (3.59 kg/ha). The next best treatment was W_4 (2HW and 2 IC at 20 and 40 DAS) followed by W_3 (imazethapyr 75 g/ha post-emergence (25DAS) + HW+IC (45 DAS). Significantly highest dry weight of weeds (38.94 kg/ha) was observed under unweeded control (W_6).

Fertility levels had significant influenced on total dry weight of weeds (kg/ha). The significantly lowest dry

Table1 Grain and stover yield (kg/ha) , monocot, dicot weeds and sedges/m^2 at 20, 40 and 60 days and dry weight of weeds (kg/ha) as influenced by different weed control treatments

Treatment	Grain yield (kg/ha)	Stover yield (kg/ha)	Monocot weeds/m^2			Dicot weeds/m^2			Sedges/m^2			Dry weight of weeds kg/ha
			20 DAS	40 DAS	60 DAS	20 DAS	40 DAS	60 DAS	20 DAS	40 DAS	60 DAS	
Weed Management												
W_1	1663	1997	3.7 (13.1)	3.9 (14.5)	3.9 (14.9)	3.3 (10.0)	3.5 (11.6)	3.9 (14.4)	3.3 (10.1)	3.5 (11.5)	3.9 (14.4)	32.8 (1073.4)
W_2	1852	2163	7.3 (53.1)	3.7 (13.4)	3.2 (10.0)	6.2 (38.4)	3.6 (12.2)	3.0 (8.3)	4.7 (22.0)	3.8 (13.7)	3.2 (9.6)	30.8 (945.1)
W_3	1950	2267	7.6 (56.9)	2.8 (7.5)	2.6 (6.2)	6.2 (38.0)	2.7 (6.6)	2.3 (4.9)	4.6 (20.7)	3.9 (7.7)	2.5 (5.6)	29.8 (885.8)
W_4	2129	2496	7.6 (56.5)	3.4 (10.9)	3.3 (10.3)	6.3 (39.4)	3.2 (10.1)	2.5 (5.7)	4.9 (23.7)	3.7 (13.5)	2.7 (6.7)	25.0 (625.0)
W_5	2336	2772	0.7 (0.0)	1.9 (3.0)	2.0 (3.5)	0.7 (0.0)	2.2 (4.2)	1.9 (3.1)	0.7 (0.0)	2.1 (3.9)	2.1 (3.7)	3.6 (12.4)
W_6	1220	1465	8.3 (67.6)	8.4 (69.4)	8.4 (70.0)	6.6 (43.1)	6.5 (41.9)	6.5 (42.1)	5.2 (26.5)	5.5 (29.7)	6.2 (37.9)	38.9 (1515.8)
LSD (P=0.05)	236	233	0.5	0.5	0.5	0.5	0.3	0.4	0.5	0.3	0.4	0.9
Fertility levels												
F_1	1596	1911	5.7 (31.6)	3.8 (13.8)	3.7 (13.2)	4.7 (22.0)	3.5 (11.4)	3.2 (9.6)	3.8 (13.6)	3.4 (11.3)	3.2 (10.0)	25.9 (671.4)
F_2	1973	2288	5.9 (34.3)	4.0 (75.7)	4.0 (15.3)	4.9 (23.7)	3.7 (13.0)	3.4 (11.1)	3.9 (15.0)	3.6 (12.8)	3.5 (11.5)	26.9 (720.9)
F_3	2006	2381	6.0 (35.4)	4.2 (17.2)	4.0 (15.8)	50.0 (24.5)	3.7 (13.1)	3.5 (11.4)	4.0 (15.6)	3.6 (12.8)	3.5 (11.8)	27.6 (762.9)
LSD (P=0.05)	108	108	0.2	0.2	0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.9
Interaction												
LSD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Orignal Values are in parenthesis' NS - Non - significant; DAS - Days after sowing, Details of treatment are given in material and methods

Table 2 Residual effects of different herbicides applied to sorghum, bajra, barley and ragi crop at 30 DAS and their dry matter influenced by different weed control treatments

Treatments	Sorghum at 30 DAS			Bajra at 30DAS			Barley at 30 DAS			Ragi at 30 DAS		
	Germination (%)	Height (cm)	Dry matter (g)	Germination (%)	Height (cm)	Dry matter (g)	Germination (%)	Height (cm)	Dry matter (g)	Germination (%)	Height (cm)	Dry matter (g)
Weed management												
W_1	90.8	20.5	20.6	90.8	21.5	18.4	91.2	22.2	18.9	89.4	20.5	23.1
W_2	88.8	18.7	19.3	88.7	22.0	17.6	89.2	21.6	18.2	88.5	20.2	22.6
W_3	90.1	19.2	20.2	90.5	22.3	18.1	90.7	22.1	18.9	89.0	20.4	22.8
W_4	92.1	20.9	21.2	92.1	23.4	18.6	91.4	22.6	19.1	89.9	21.2	23.1
W_5	94.1	21.7	21.5	93.1	23.7	19.1	92.1	22.8	19.4	91.0	21.6	23.3
W_6	93.1	22.4	21.7	94.1	24.9	19.2	92.7	23.5	20.2	91.7	22.2	23.8
LSD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fertilizer levels												
F_1	90.6	20.0	20.3	90.5	22.3	17.9	90.3	22.2	18.6	89.0	20.7	22.8
F_2	91.5	20.6	20.8	91.6	22.7	18.6	91.3	22.3	19.1	90.1	20.9	23.0
F_3	92.3	21.1	21.1	92.6	23.9	18.9	92.1	23.0	19.7	90.6	21.5	23.6
LSD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Interaction												
LSD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

* Details of treatment are given in materials and method, DAS - Days after sowing, NS - Not significant

weight of weed was recorded in the treatment F_1 (20 : 40:20 : N, P, K kg/ha) (25.92 kg/ha) which remained statistically at par with F_2 (30:60:30 : N, P, K kg/ha) (26.26 kg/ha) (Table 1).

The interaction effect between weed management treatment and fertility levels was found to be non-significant.

It was concluded that weed free treatment recorded significantly highest grain and stover yield. Besides weed free situation, W_1 (pendimethalin 0.5 kg/ha pre-emergence + HW + IC at 30 DAS) was found effective for weed control at early growth stages of soybean crop and W_3 (imazethapyr 75 g/ha as post-emergence at 25DAS + HW + IC at 45 DAS was most beneficial to control weeds up to 60 DAS and resulted in to less total dry weight of weeds.

Highest grain and stover yield was recorded with the application of 40:80:40: N, P, K kg/ha (F_3) and 30: 60:30 : N, P, K kg/ha (F_2) was found equally effective.

Residual effects on succeding crops

The Residual effects of different herbicides on sorghum, bajra, barley and ragi were recorded in term of germination per cent, plant height at 30 DAS and total dry matter in g at 30 DAS. The residual effect of different herbicides on weed management treatment showed no significant effect on sorghum, bajra, barley and ragi crops.

In sorghum crop the treatment W_5 gave the only higher % germination (94.8%) then all other treatment but the treatment W_6 produced the higher height (22.43 cm) and dry matter (21.74g) among all the treatments (Table 2).

In bajra, barley and ragi crops, the treatment W_6 gave the highest % of germination (94.08, 92.69 and 91.67%), highest plant height (24.27, 23.29 and 22.24cm), also the highest weight of dry matter (19.19, 20.20 and 23.22 g), among all the treatment respectively. These results are in agreement to results reported by Chhatrala (2005) Selvamani and Shankaran (1989) in groundnut crop (Table 2).

Among the three fertilizer levels the treatment (F_3) 40 : 80 : 40 : N, P, K kg/ha produce the highest % of germination, plant height at 30 DAS and total dry matter of plant (g) among all the treatments and in all the crops like sorghum, bajra, barley and ragi. The per cent germination (94.29, 92.59, 92.06 and 90.60%), plant height at 30 DAS (21.11, 23.86, 22.99 and 21.46 cm) and total dry matters at 30 DAS were (21.13, 18.94, 19.69 and 23.59%) in sorghum, bajra, barley and ragi, respectively (Table 2).

The interaction between weed management treatments and fertility levels was found to be non significant in residual studies.

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