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Efficacy of imazethapyr on weed management in soybean

D.S. Meena, Baldev Ram, Chaman Jadon and J. P. Tetarwal
Agricultural Research Station, Maharana Pratap University of Agriculture & Technology, Ummedganj farm, Kota (Rajasthan)
E-mail: meenads1967@yahoo.co.in

ABSTRACT

The experiment was conducted to evaluate the efficacy of post emergence applications of imazethapyr on weed control and soybean yield. The field was infested with grassy weeds (51.6%), broad leaf weeds (34.1%) and sedges (13.2%). Application of imazethapyr XL 10% SL at 150 g/ha as post emergence significantly reduced the density of all grassy, broad leaf weeds sedges and their dry weight, and provided maximum number of branches/plant, pods/plant, seeds/pod and seed yield as compared to weedy check and imazethapyr 10% at 50 g/ha. Infestation of weeds throughout the growth period caused 57.2% reduction in seed yield of soybean. Maximum seed yield (1075 kg/ha) and weed control efficiency of grasses (86.9%), broad leaf (88.4%) and sedges (73.0%) was obtained with 2 hand weeding at 20 and 40 days after sowing closely followed by imazethapyr XL 10% at 150 g/ha (957 kg/ha). Application of imazethapyr XL 10% SL at 100 g/ha recorded significantly higher net return (Rs 14,237/ha) and B : C ratio (1.68) followed by imazethapyr XL 10% at 150 g/ha over weedy check and imazethapyr XL 10% at 50 g/ha.

Keywords: Soybean, Imazethapyr formulations Weed control efficiency, Yield attributes, Yield.

Soybean (*Glycine max*) is an important rainy season crop grown more than 0.71 mh in south eastern parts of Rajasthan mainly in Kota, Bundi, Baran and Jhalawar districts producing 0.61 mt with average productivity of 859 kg/ha which is very low compared to national productivity of 1006 kg/ha (Anon 2009). Presently, several herbicidal formulations are available in the market used as PRE and post-emergence (POE) for controlling weed complex in soybean crop. The sowing time for soybean in rainy (*kharif*) season is very short and farmers give first priority to sow the crop rather than to use PER herbicides for controlling the weeds. The various grassy and broad leaf weeds emerge simultaneously with the crop plants and compete for essential nutrients, moisture, sunlight and space, causing substantial loss in yield (35-55%), depending on the types of weed flora and density (Chandel and Saxena 1998, Kewat *et al*. 2000, Singh 2007). Due to intermittent rainfall during rainy season and scanty labour, manual weeding at right stage is difficult and time consuming and expensive, so farmers rarely adopt this practice for weed control. Under such situation, herbicidal weed control particularly POE remains the only viable option. Use of selective herbicides as PRE provide only the initial weed control and often needs integration with one manual or mechnical weeding for effective weed control. Recently molecule of POE herbicide (imazethapyr) is being marketed with the assurance of selective control of grassy as well as broad leaf weeds in soybean. The objective of the study was to evaluate the efficacy of imazethapyr on weed management of soybean.

MATERIALS AND METHODS

The experiment was conducted during *kharif* 2008 and 2009 at Agricultural Research Station, Ummedganj, Kota to evaluate the efficacy of imazethapyr on weed dynamics and yield of soybean. The experimental site was clay loam in soil texture, alkaline in reaction (pH 7.55), medium in organic carbon (0.56%), low in available nitrogen (275.0 kg/ha), medium in available phosphorus (23.0 kg/ha) and high in available potassium (320.0 kg/ha). The experiment was laid out in randomized block design with seven treatments, *viz*., imazethapyr XL 10% SL (50, 100, 150 g/ha) obtaind from company; imazethapyr 100 and 150 g/ha purchaed from market weed free (2 hand weeding at 20 and 40 DAS) and weedy check (unweeded). The experiment was replicated thrice in both the consecutive years. Imazethapyr was applied as POE i.e. at 10 and 14 days after sowing (DAS) in 500 litres water/ha using flat fan nozzle during the year 2008 and 2009, respectively. The recommended dose of nitrogen, phosphorus and potash (20, 40 and 40 kg/ha) were applied through di-ammonium phosphate (DAP) and murate of potash (KCl) and drilled in the soil before sowing the crop. Soybean variety *'Pratap Soya 2'* and *'JS 335'* was sown in July and harvested in October during the year 2008 and 2009, respectively. The crop was raised under irrigated conditions with recommended package of practices. Weed data on total weed density and weed dry weight were recorded at 60 DAS using 1.0 m^2 quadrat randomly at two places in a plot. While observations on grain yield and yield attributing parameters *viz*., number of

Table 1. Effect of imazethapyr on grassy, broad leaf and sedges on weed density and their dry weight, weed control efficiency (WCE) and weed index in soybean (pooled data of 2 years) at 60 days.

Treatments	Grassy weeds			Broad leaf weeds			Sedges			Weed Index (%)
	Weed density (No./m^2)	Weed dry weight (g/m^2)	WCE (%)	Weed density (No./m^2)	Weed dry weight (g/m^2)	WCE (%)	Weed density (No./m^2)	Weed dry weight (g/m^2)	WCE (%)	
Imazethapyr XL 10% IPR 50 g/ha	16.2 (4.1)	21.3	60.65	14.2 (3.9)	19.5	51.0	8.7 (3.1)	6.7	33.76	57.16
Imazethapyr XL 10% IPR 100 g/ha	11.3 (3.5)	13.7	74.65	9.5 (3.2)	13.5	66.3	6.2 (2.7)	4.3	56.77	13.75
Imazethapyr XL 10% IPR 150 g/ha	10.3 (3.4)	12.5	76.92	9.2 (3.2)	12.8	67.9	5.7 (2.6)	3.6	64.64	12.33
MS of Imazethapyr 10% SL 100 g/ha	12.2 (3.6)	14.3	73.58	10.7 (3.4)	14.7	63.3	7.3 (2.9)	4.5	55.28	17.23
MS of Imazethapyr 10% SL 150 g/ha	11.3 (3.5)	13.3	75.42	10.2 (3.3)	14.3	64.1	6.5 (2.7)	4.2	57.77	15.09
Hand weeding (at 20 & 40 DAS)	7.5 (2.9)	7.1	86.94	4.8 (2.4)	4.6	88.4	3.3 (2.1)	2.7	73.01	-
Weedy check (control)	46.7 (6.9)	54.2	-	31.7 (5.7)	39.9	-	11.8 (3.6)	10.0	-	258.30
LSD(P=0.05)	3.7	5.9	-	2.5	3.2	-	1.8	1.6	-	-

DAS= Days after sowing, M S = Market sample
# Figures are subjected to square root transformation $\sqrt{X + 0.5}$, Original values are in parantheses.

Table 2. Effect of imazethapyr on growth, yield attributes and yield and economics of soybean (pooled data of 2 years)

Treatments	Branches/ Plant (No.)	Pods/ Plant (No.)	Seeds/pod (No.)	Seed Index (%)	Harvest index (%)	Seed yield (kg/ha)	Straw yield (kg/ha)	Net returns (Rs/ha)	B:C Ratio
Imazethapyr XL 10% IPR 50 g/ha	2.2	23.2	2.1	9.1	37.7	684	1129	8686	1.12
Imazethapyr XL 10% IPR 100 g/ha	2.7	29.0	2.5	9.8	38.1	945	1535	14237	1.68
Imazethapyr XL 10% IPR 150 g/ha	2.8	29.5	2.6	10.0	38.2	957	1551	13785	1.50
MS Imazethapyr 10% SL 100 g/ha	2.6	28.1	2.4	9.7	38.0	917	1496	13568	1.61
MS of Imazethap yr 10% SL 150 g/ha	2.7	28.3	2.5	9.7	38.1	934	1520	13256	1.45
Hand weeding (at 20 & 40 DAS)	3.1	33.9	2.8	10.1	38.6	1075	1709	14717	1.33
Control	1.8	16.7	1.6	9.1	37.5	300	501	200	0.03
LSD (P=0.05)	0.3	3.8	0.3	NS	NS	124	202	2226	0.25

DAS : Days after sowing, MS : Market sample

branches/plant, pods/plant, seeds/pods and seed index were recorded at harvest. The economics of treatment was computed with minimum support price or prevailing market rate of products. All the data were subjected to analyses with standard statistical procedure. Since, similar trend was noticed during both the years, pooling was done over the years. Where the F- test was significantly (at 5% level of significance) the least significant difference was used to compare the means at P= 0.05. The data on number of weeds were subjected to square root transformation $\sqrt{X + 0.5}$ before statistical analysis.

RESULTS AND DISCUSSION

Effect on weed dynamics

The experimental field was infested with grassy (51.6%), broadleaf (34.1%) and sedges (13.2%) weeds. The predominant weed flora in the weedy check plot at 60 DAS was *Echinochloa* spp. *Cyperus rotundus (*L.), *Celosia argentea* (L.), *Commelina benghalensis* L, *Digera arvensis* Forsk, *Boerhavia diffusa* L, *Convolvulus arvensis* L, *Cynodon dactylon* (L.) *etc*. All the weed control treatments caused significant reduction in density and dry matter accumulation of weeds as compared to check (Table 1). Application of graded dose of imazethapyr 10 % SL significantly curtailed the density as well as dry weight of weeds at 60 DAS as compared to untreated control. Lowest weed density and dry weight at 60 DAS was recorded with hand weeding twice at 20 and 40 DAS. Among herbicidal treatments, application of imazethapyr XL 10% SL at 150 g/ha was found most effective in controlling weeds and their dry weight at 60 DAS but remained statistically at par with two hand weeding, imazethapyr XL 10% SL at 100 g/ha, imazethapyr market sample (MS) 10% SL at 100 and 150 g/ha while it was significantly superior over lower dose of imazethapyr XL 10 % SL at 50 g/ha and weedy check. Kelly *et al* (1998) reported that imazethapyr as POE effectively controlled grassy as well as broad leaf weeds in soybean. The maximum weed control (WCE) of broad leaf (88.4%), grassy (86.9% and sedges (73.06%) was recorded in two hand weeding (20 and 40 DAS) at 60 DAS. Among herbicidal doses imazethapyr XL 10 % SL 150 g/ha gave higher WCE of grassy (76.9%), broad leaf (67.9%) and sedges (64.6%) as compared to weedy check.

Effect on yield attributes and yields of soybean

Two hand weeding at 20 and 40 DAS gave maximum and significantly higher branches/plant (3.07), pods/plant (33.9), seeds/pod (2.83), seed yield (1075 kg/ha) and straw yield (1709 kg/ha) compared to weedy check and imazethapyr XL 10% SL at 50 g/ha (Table 2). Application of imazethapyr XL 10% SL at 150 g/ha recorded maximum yield attributes and seed yield (957 kg/ha) which was similar to imazethapyr XL10% SL at 100 g/ha (945 kg/ha), imazethapyr MS 10% SL at 100 (917 kg/ha) and 150 g/ha (934 kg/ha), but these were significantly superior to imazethapyr XL 10% SL at 50 g/ha and weedy check, respectively. However, imazethapyr XL 10% SL at 150 g/ha was found statistically at par with HW (20 and 40 DAS) in yield attributes and yield. Imazethapyr XL 10% SL at 150 g/ha increased seed yield to the tune of 219 and 39.9% over weedy check and imazethapyr XL 10% SL at 50 g/ha, respectively. The seed index and harvest index of soybean showed marked difference due to application of graded doses of imazethapyr. Higher seed yield of soybean was recorded due to effective control of weeds by imazethapyr (Kelly *et al.* 1998). The selective action of imazethapyr is the reason for the better control of grassy and broad leaf weeds. Stidham and Singh (1991) reported that the imidozolinone herbicides inhibit acetolactate syntase (ALS) which is essential for leucine, valine and isoleucine synthesis. It may be inferred that weed free environment can be facilitated better growth and crop development and ultimately though herbicides with higher soybean yield.

Economics

Hand weeding twice at 20 and 40 DAS fetched maximum and significantly higher net return (Rs 14,717/ha) over weedy check and imazethapyr at 50 g/ha but remained at par with imazethapyr at 150 g/ha, imazethapyr at 100 g/ha, imazethapyr MS 10% SL at 100 and 150 g/ha. Amongst herbicidal treatments, application of imazethapyr 10% at 100 g/ha recorded maximum and significantly higher net return (Rs 14,237/ha) and B:C ratio (1.68) followed by imazethapyr at 150 g/ha over weedy check and imazethapyr at 50 g/ha (Rs 13,785/ha and 1.50).

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