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Short communication

Efficacy of imazethapyr on productivity of soybean and its residual effect on succeeding crops

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The existing herbicides recommended for weed control in soybean have shorter persistence and relatively narrow spectrum of weed control The herbicide imazethapyr is known to be very effective in controlling broad range of weeds including annual and perennial grasses for soybean and other legume crops (Patel *et al.* 2009). Imazethapyr has been extensively applied because of their high herbicidal activity at low application rates and broad spectrum of weed control. The present investigation aims to find the efficacy of imazethapyr in soybean and its residual effect on the succeeding sunflower and pearl millet followed by soybean.

Experiment was conducted in Agricultural Research Station, Bhavanisagar, Tamil Nadu Agricultural University, Coimbatore during 2009-10. The soil of the experimental field was red sandy loam having pH 6.72, EC 0.18 dS/m, OC 0.55%, available N, P, K 230, 20, 268 kg/ha, respectively. The treatments were applied consisting of imazethapyr 50, 75, 100 and 200 g/ha as early post-emergence (EPOE) at 15 days after sowing, oxyfluorfen 125 g/ha and pendimethalin 750 g/ha as pre-emergence (PE) at 3 days after sowing, hand weeding twice and control. All these treatments for comparison, except unweeded check were given with an earthingup on 45 DAS in randomized block design with three replications. Soybean variety *'CO* (*Soy*) *3'* was sown in 30 cm wide rows. Crop phytotoxicity was studied three days after spraying of herbicide using standard method for post-emergence herbicide. Weed control efficiency (WCE) was calculated in relation to total biomass by using the following formula:

$$WCI = \frac{(X-Y)}{X} \times 100$$

Where,

X= biomass of weeds in weedy plots Y= biomass of weeds in treated plots and expressed in per cent.

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After the harvest of soybean, residual effect of treatments was studied by raising succeeding crops such as sunflower and pearl millet without disturbing the layout. The residual effect of treatments was assessed by recording the germination, plant height, dry matter production and yield of the succeeding crops.

The experimental field was infested with various weed species, consisting of dicot, monocot weeds and sedges. Most common weeds among grasses were *Dactyloctenium aegyptium, Acrachne racemosa, Bracharia reptans* and *Boerhaavia diffusa;* among broadleaved weeds *Digera arvensis, Parthenium hysterophorous* and *Trichodesma indicum* and *Cyperus rotundus* was the only sedge weed.

Effect on soybean

Plant height was altered due to application of different herbicides compared to unweeded control. At 30 and 45 DAS**,** application of EPOE imazethapyr at 100 g/ha registered taller plants followed by EPOE imazethapyr at 200 g/ha. Whereas, application of EPOE imazethapyr at 200 g/ha caused injury to soybean resulting in lesser plant height during initial stages which recovered at later growth stages (Table 1) by one or two irrigation. Unweeded control resulted in shorter plants, obviously due to the effect of weeds. Similarly, Lakshmanakumar (2008) observed that in tobacco post emergence application of imazethapyr increased the plant height significantly. Thus, heavy weed infestation resulted in etiolated soybean plants competeting for light. Minimum leaf are a index (LAI) was recorded in unweeded control. Higher LAI was recorded with EPOE imazethapyr at 100 g/ha (T_3) which was closely followed by EPOE imazethapyr at 200 g/ha and PE pendimethalin at 750 g/ha (Table 1). Whereas, all other treatments recorded lower LAI. It might be due to heavy weed infestation, which reduced aeration, light, nutrients, water, and space available to the soybean plants resulting in poor developments of leaf.

Weed control treatments positively influenced the dry matter production of soybean at different growth stages.

At 30 DAS, EPOE imazethapyr at 100 g/ha recorded higher dry matter of soybean (Table 1). At subsequent stages, treatments with EPOE imazethapyr either at 100 g/ha (T_3) or EPOE imazethapyr 200 g/ha (T_3) recorded higher DMP in all the stages from 30 DAS onwards. The reason might be due to the better weed control resulted in favourable environment to have higher nutrient uptake reflected on higher leaf area index and better source sink relationship for accumulating higher dry matter. Raghuwanshi (2005) had recorded higher biomass of sobean with imazethapyr application. On the other hand, unweeded control recorded lower total dry matter due to severe weed competition at all the stages of crop growth.

Crop phytotoxicity

The phytotoxic effect of imazethapyr was observed at higher doses *viz.*, 200 g/ha (T_4). However, EPOE imazethapyr at 200 g/ha recorded slight crop damage (rating = 30) at 3 days after herbicide spray (DAHS). At 7 DAHS, the effect was less (rating = 20) while after 14 DAHS, the effect was negligible (rating = 10) and at 21 DAHS the soybean plants recovered from phytotoxicity and the symptoms were not evident afterwards by one or two irrigation.

Effect on weeds

At 30 DAS, all the weed control treatments recorded more than 70% WCE, EPOE application of imazethapyr at 200 g/ha recorded higher WCE followed by application of imazethapyr at 100 g/ha (Table 1). More reduction of weed dry weight by reducing the weed density in these treatments might have resulted in higher WCE. At 45 and 60 DAS, same trend was observed with EPOE imazethapyr at 200 g/ha recording higher WCE followed by EPOE imazethapyr at 100 g/ha. Vyas and Jain (2003) also reported higher WCE after application of post-emergence application of imazethapyr.

Yield and yield attributes

Favourable crop growth environment with a minimum disturbance due to biotic factors like lesser weed competition reflected on crop yield by enhancing the growth and yield attributes. Among the weed control treatments, application of EPOE imazethapyr at 100 g/ha recorded higher grain yield (1645 kg/ha) which was on par with EPOE imazethapyr 200 g/ha. Similar results were reported by Chandel and Saxena (2001), where POE imazethapyr at 100 g/ha was as found to be effective in controlling weeds at various stages and also enhanced the grain yield to the tune of 51% over control in soybean. More number of pods and higher test weight were obtained with EPOE application of imazethapyr at 100 g/ha (T_3). It might be due to better control of weeds from earlier stage itself, followed by EPOE application of imazethapyr at 200 g/ha recorded higher yield attributes against unweeded control which obviously experienced severe weed competition at all crop growth stages. Similarly Singh and Mehar-Singh (2000) reported that due to better weed control resulted into higher number of pods, number of seeds per pod and bolder seeds were obtained (Table 2).

Germination percentage of the sunflower and pearl-millet had no significant difference among treatments. There was no residual toxicity on the succeeding crops. Plant height, dry matter production at 30 DAS showed no

Table 1. Effect of treatments on growth attributes and weed control efficiency

Treatment	Plant height (cm)		Leaf area index		Dry matter production (kg/ha)		Weed control efficiency (%)		
	30 DAS	45 DAS	30 DAS	45 DAS	30 DAS	45 DAS	30 DAS	45 DAS	60 DAS
EPOE imazethapyr 50 g/ha	36.3	69.0	0.61	1.73	611	1385	77.7	59.7	93.1
EPOE imazethapyr 75 g/ha	37.6	70.0	0.63	1.85	633	1413	81.6	60.6	94.8
EPOE imazethapyr 100 g/ha	41.7	77.5	0.76	1.98	763	1655	87.7	71.9	96.8
EPOE imazethapyr 200 g/ha	39.1	76.6	0.70	2.20	717	1529	91.1	78.3	98.1
PE oxyfluorfen 125 g/ha	35.2	63.7	0.60	1.71	648	1253	80.0	55.5	93.8
PE pendimethalin 750 g/ha	36.1	68.5	0.61	1.79	632	1328	80.3	65.8	94.4
HW on 25 and 45 DAS	35.1	66.1	0.60	1.48	564	1055	81.4	50.9	53.5
Unweeded control	28.2	56.4	0.56	1.25	420	887	-	-	-
LSD (P=0.05)	2.8	6.9	0.08	0.62	70	222	NA	NA	NA

EPOE- Early post-emergence, PE- Pre-emergence, NA- Not analysed

Table 2. Effect of treatments on yield attributes and yield of soybean

Treatment	No. of pods per plant	No. of seeds per pod	100 seed weight (g)	Seed yield (kg/ha)
EPOE imazethapyr 50 g/ha	73.3	2.2	10.3	1387
EPOE imazethapyr 75 g/ha	86.5	2.3	10.8	1467
EPOE imazethapyr 100 g/ha	90.5	2.4	11.5	1645
EPOE imazethapyr 200 g/ha	89.3	2.4	11.1	1514
PE oxyfluorfen 125 g/ha	63.0	2.2	10.2	1304
PE pendimethalin 750 g/ha	83.3	2.1	10.9	1481
HW on 25 and 45 DAS	61.0	2.2	9.8	1234
Unweeded control	37.0	2.0	8.0	833
LSD (P=0.05)	13.2	NS	0.57	86

EPOE- Early post-emergence, PE- Pre-emergence, NA- Not analysed

Table 3. Residual effect of treatments on germination, growth characters and yield of succeeding crops

Treatment	Germination at 10 DAS (%)		Plant height at 30 DAS (cm)		Dry matter production at 30 DAS (kg/ha)		Seed yield (kg/ha)	
	Sunflower	Pearl millet	Sunflower	Pearl millet	Sunflower	Pearl millet	Sunflower	Pearl millet
T_1 - EPOE imazethapyr 50 g/ha	90.00	86.33	56.8	75.39	202	225	911	622
T_2 - EPOE imazethapyr 75 g/ha	90.23	89.00	59.3	75.77	222	218.	933	748
T_3 - EPOE imazethapyr 100 g/ha	91.00	89.33	63.5	77.20	227	227	947	633
T_4 - EPOE imazethapyr 200 g/ha	90.73	88.67	63.2	78.28	242	242	1003	781
T_5 - PE oxyfluorfen 125 g/ha	87.00	86.00	53.9	72.18	219	230	911	777
T_6 - PE pendimethalin 750 g/ha	89.00	85.00	53.6	72.47	204	219	755	688
T_7 - HW on 25 and 45 DAS	90.67	87.67	57.3	70.71	211	133	844	803
T_8 - Unweeded control	90.66	86.67	58.3	69.27	222	121	800	788
LSD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS

EPOE- Early post-emergence, PE- Pre-emergence, NA- Not analysed

distinct variation in the test crops due to different dose of imazethapyr (Table 3). Various dose of imazethapyr tested in soybean had no adverse residual effect on the growth of the succeeding crop. Yield of sunflower and pearl-millet showed no distinct variation in succeeding crop due to different dose of imazethapyr (Table 3). Rana and Angiras (1997) also observed that residues of imazethapyr at 200 g/ha decreased significantly due to weed dry matter accumulation and had no effect on succeeding crop of wheat and pea. Thus, herbicidal weed control using early post-emergence imazethapyr at 100 g/ha followed by earthing up on 45 DAS was the best treatment to control majority of weeds for obtaining higher productivity of soybean and has no residual effect on succeeding crops.

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SUMMARY

Field experiment was conducted to evaluate the efficacy of imazethapyr on weed control in soybean and its residual effect on succeeding crops. Early post-emergence application of imazethapyr reduced broad-leaved weeds and grass density as well as dry weight when compared with pre-emergence application of pendimethalin and oxyfluorfen. Imazethapyr at 200 g/ha decreased the dry weight accumulation of all weeds significantly followed by imazethapyr 100 g/ha. Due to phytotoxic effect at 200 g/ha during initial stages yield and yield attributes were get reduced. Imazethapyr at 100 g/ha was found best treatment by giving more seed yield. To study the residual effect of imazethapyr on succeeding crops, sunflower and pearl millet were grown without disturbing the soil. The residues of imazethapyr at different doses did not influence germination, growth, yield of sunflower and pearl millet and was statistically at par with checks.

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