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Efficacy of new herbicide molecule imazethapyr on weed control in soybean

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ABSTRACT

An experiment was conducted to study the efficacy of the herbicide imazethapyr in soybean. The treatments consisted of imazethapyr 10% SL in four rates of applications (750, 1000, 1250 and 1500 ml ha^{-1}, respectively), metribuzin 75% WP at 0.50 kg ha^{-1}, two hand weeding and un-weeded check. The study revealed that imazethapyr @ 1500ml ha^{-1} can effectively control the weeds of soybean such as grasses, sedges and broadleaved weeds as post emergence spray at seven days after sowing of soybean. Though the yield was high with hand weeding twice, the benefit : cost ratio was higher in the case of imazethapyr treatment and this herbicidal treatment recorded the minimum weed density and weed biomass and ultimately produced better yield.

Key words: Imazethapyr, soybean, weed control

Weeds are a major cause of reduction in crop yields in soybean. Soybean is grown throughout the year in India under varied situations. The losses due to weeds vary from 22 to 27 percent depending upon the type and intensity of infestation (Tiwari and Kurchania, 1990). Therefore, weed management is the most important aspect that plays a crucial role in exploiting the yield potential of soybean, provided other inputs are not limiting (Chhokar *et al.,* 1995). The nature of yield response to weed management and economic analysis determines the feasibility of adoption of technology by the growers.

Controlling weeds is perhaps the most important reason for frequent cultivation during the fallow periods and around 50 per cent of the energy required for tillage is spent on weed control. If weeds are controlled by means other than tillage, the number of cultivations can be significantly reduced. Modern herbicides and selective grazing practices can control weeds and this is the essence of reduced tillage practices. The chemical weed control methods are being easy, economic and time saving one in soybean.

Among the new herbicide molecule, imazethapyr has foliar activity. It is generally recommended as a post emergence herbicide in soybean. Chirita *et al.* (1993) reported the best control of weeds *viz., Sinapis arvensis, Raphanus raphanistrum* and *Chenopodium album* in soybean and the highest yield were obtained with post emergence application of 750ml ha^{-1} of imazethapyr at the leaf rosette phase. Bhattacharya *et al.* (1998) reported from an experiment conducted during Rabi season of 1997-98 in soybean, revealed that the hand weeding at 20 and 40 DAS was the best treatment and among herbicides, imazethapyr (Pursuit) at 0.15 kg ha^{-1} plus Pendimethalin at 1kg ha^{-1} as pre emergence application was found to be quite effective as broad spectrum in controlling of weeds and increasing the seed yield of soybean. Further, they reported that Imazethapyr at 0.15 kg ha^{-1} were found to be the best among the herbicides for controlling all categories of weeds. Rani *et al.* (2004) conducted two field trials in Andhra Pradesh, India during the rainy seasons of 1997-98 and 1998-99 to evaluate the different weed control practices in soybean and found that post-emergence application of Imazethapyr at 75g ha^{-1} was promising alternative to hand weeding practices and recorded 23 per cent higher yield over the weedy control. Pandey *et al.* (2007) revealed that application of imazamox + imazethapyr was found most effective in reducing weed count and biomass and resulted in higher weed control efficacy over other pre and post emergence herbicides. Deore *et al.* (2008) studied the effect of pre and post emergence herbicides on weed control and productivity of soybean in Rahuri, Maharashtra, in India during the *kharif* season of 2003. Among the all pre and post emergence herbicides Imazethapyr was most effective. Imazethapyr at 200 g a.i. ha^{-1} resulted in the greatest plant spread (46.66 cm), number of branches plant^{-1} (6.90), number of functional leaves plant^{-1} (37.10), mean leaf area (41.43 dm^2), dry matter plant^{-1} (38.30 g) and seed yield (27.75 q ha^{-1}) with the lowest dry weight of weed (0.72 q ha^{-1}).

Therefore, the present experiment was undertaken to study the efficacy of herbicide Imazethapyr 10% SL as post emergence to control major weeds in soybean and also to arrive at an optimum dosage that can be recommended in soybean growing areas in West Bengal.

MATERIALS AND METHODS

The study was conducted in humid subtropics of West Bengal at the Central Regional Research Farm, Gayeshpur of Bidhan Chandra Krishi Viswavidyalaya, Nadia, located at 22^{0}58' N longitude and 88^{0}31' E latitude and at an altitude of 9.75m above the mean sea level during summer season (pre-*Kharif*) of 2009 (March to June). The soil of the experimental site was a typical Gangetic Alluvium

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(Entisol), sandy loam with moderate fertility status of available nutrients (N: 253.67; P: 24.6 and K: 168.5 kg ha^{-1}) with pH 6.9 and organic carbon content of 0.69%. The experiment was laid out in RBD with seven treatments replicated trice. The plot size was $12m^2$ and soybean variety PK-327 was raised. The treatments consisted of Imazethapyr 10% SL in four rates of applications at 75, 100, 125 and 150 g a.i. ha^{-1} (750, 1000, 1250 and 1500 ml ha^{-1}, respectively), Metribuzin 75% WP at 500g a.i. ha^{-1}, hand weeding twice at 15 and 30 DAS and un-weeded check. In this experiment the crop was sown on 06.03.2009 and harvested on 20.06.2009. The spraying treatments were imposed on 09.03.2009 in case of pre emergence herbicide Metribuzin and post emergence herbicide Imazethapyr on 26.03.2009. In the hand weeding treatment, the weeds were uprooted at 15 and 30 days after sowing (DAS). The observations on weed population and dry matter production of weeds were recorded at 30, 45 and 60 days after sowing (DAS) from three randomly selected spots of $0.25m^2$ in each plot. The plant height and leaf area index (LAI) were recorded at 30 and 60 DAS. The number of pods $plant^{-1}$, number of seeds pod^{-1}, test weight of seeds and seed yield were recorded at harvest.

RESULTS AND DICUSSION

Weed Flora

The weed flora of the experimental field included *Cynodon dactylon, Echinocloa colonum, Eleusine indica, Digitaria sanguinalis, Cyperus rotandus, Chenopodium album, Melilotus alba, Physallis minima, Amaranthus spp. etc.*

Effects on weeds

The results indicated that all the herbicide treatments resulted in significant reduction in the weed population and weed biomass production compared to the un-weeded control (Table 1). The weed count as well as dry matter production recorded at 30, 45 and 60 days after sowing (DAS) showed that imazethapyr 10% SL @150g a.i. ha^{-1} could effectively control the weeds compared to lower doses. The trend in total weed density (No.m^{-2}) was the same during 30 and 45 DAS. Though the treatment T_4 recorded less weed density (34 g m^{-2}) it is on par with T_3 (40.67 gm^{-2}) both at 30 and 45 DAS but it was significantly superior at 60 DAS. Similarly, T_2 and T_3 were also on par at all the stages of observation. The treatment T_2 was also on par with T_5 at 30 and 45 DAS. Imazethapyr @75 g a.i. ha^{-1} recorded significantly higher values of weed and dry matter production and weed count. However it was significantly superior to the unweeded control. The herbicide imazethapyr could effectively control the grasses, sedges and broadleaved weeds and its effectiveness was observed even at 60 DAS as indicated by the low weed dry matter production. This is in line with the findings of Kushwah and Vyas (2006) that application of Imazethapyr 10% at 75g a.i. ha^{-1} was most effective in reducing weed biomass and gave the highest weed control efficiency over other pre- and post-emergence herbicides besides the highest soybean yield.

Plant height and leaf area index (LAI)

The variation in plant height among the various herbicidal treatments was not very conspicuous. At 30 DAS, the highest plant height was obtained in twice hand weeded plot which was statistically at par with metribuzin @ 500 g ha^{-1} and imazethapyr @150 g a.i. ha^{-1} treatments. And at 60 DAS, the highest plant height was obtained in hand weeded plot which was statistically at par with imazethapyr at 150 g a.i. ha^{-1} treatments (Table 2). The treatment twice hand weeding at 15 DAS and 30 DAS registered higher LAI at all the crop growth stages and was considered to be the best treatment followed by imazethapyr at @ 150g a.i. ha^{-1} (Table 2).

Table 1: Effect of treatments on total weed density and total weed biomass

Treatments	Total weed density (No.m^{-2})			Total weed biomass (g m^{-2})		
	30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS
T_1 : Imazethapyr 10% SL @ 75 g a.i. ha^{-1}	57.00	91.33	118.00	18.74	25.34	32.38
T_2 : Imazethapyr 10% SL @ 100 g a.i. ha^{-1}	47.00	75.67	104.67	16.49	20.62	26.56
T_3 : Imazethapyr 10 % SL @125 g a.i. ha^{-1}	40.67	70.00	105.00	15.83	19.83	25.67
T_4 : Imazethapyr 10% SL @ 150 g a.i. ha^{-1}	34.00	67.00	93.67	12.61	17.49	22.67
T_5 : Metribuzin 75% WP @ 500g ha^{-1}	49.67	82.00	128.33	15.92	21.29	27.89
T_6 : Two hand weeding (15 DAS and 30 DAS)	20.33	16.00	37.67	5.96	5.06	11.61
T_7 : Unweeded (control)	75.33	104.67	143.00	26.98	33.77	42.06
LSD (0.05)	**7.07**	**8.63**	**8.46**	**0.67**	**0.97**	**0.74**

Table 2: Effect of treatments on plant height (cm) and LAI of soybean

Treatments	Plant height(cm)		Leaf area index (LAI)		
	30 DAS	60 DAS	30 DAS	60 DAS	90 DAS
T_1 : Imazethapyr 10% SL @ 75 g a.i. ha^{-1}	36.61	59.47	2.09	4.20	3.25
T_2 : Imazethapyr 10% SL @ 100 g a.i. ha^{-1}	41.83	70.67	2.16	4.29	3.31
T_3 : Imazethapyr 10 % SL @125 g a.i. ha^{-1}	40.27	61.33	2.15	4.44	3.45
T_4 : Imazethapyr 10% SL @ 150 g a.i. ha^{-1}	43.27	75.67	2.29	4.74	3.75
T_5 : Metribuzin 75% WP @ 500g ha^{-1}	44.00	71.27	2.10	4.36	3.40
T_6 : Two hand weeding (15 DAS and 30 DAS)	45.83	80.13	2.47	5.04	4.00
T_7 : Unweeded (control)	33.44	63.40	1.89	3.16	2.83
LSD (0.05)	**3.86**	**6.39**	**0.07**	**0.05**	**0.09**

Yield components and yield

Effect of treatments on number of pods $plant^{-1}$ and number of seeds pod^{-1} of soybean was found to be significant. The maximum number of pods $plant^{-1}$ was obtained with two hand weeding which was statistically at par with imazethapyr @150g a.i. ha^{-1}; imazethapyr @125g a.i. ha^{-1} was on par with 150g a.i. ha^{-1} and with metribuzin. The number of seeds pod^{-1} was maximum for hand weeded plots and among the weedicide treatments effective results found in case of imazethapyr at 1000 ml ha^{-1} which were statistically at par with imazethapyr @150g a.i. ha^{-1} and @75g a.i. ha^{-1} treatments and 75g a.i. ha^{-1} was at par with metribuzin. The test weight of soybean did not show any significant relation to weed infestation. As because the test weight is genetic character, weeds perhaps did not influence directly test weight (Table3).

In case of seed yield, twice hand weeding gave significantly the best performance with 74.48% increase in yield (2.38 t ha^{-1}) over un-weeded (control) which was followed by imazethapyr @150g a.i. ha^{-1} which gave 59.60% yield increase (2.18t ha^{-1}). Data pertaining to Stover yield indicates that the treatment twice hand weeding gave significantly the maximum increment (3.51t ha^{-1}) and closely followed by imazethapyr @150g a.i. ha^{-1} (3.36 t ha^{-1}). Among the weedicide treatments imazethapyr @150g a.i. ha^{-1} showed the highest harvest index (39.32) and the lowest weed index (8.53) (Table 4). Cantwell *et al.* (1989) reported that application of imazethapyr at 0.05 to 0.14 kg ha^{-1} was effective in controlling weeds in soybean. Imazethapyr at 0.05 kg ha^{-1} controlled jimson weed (*Datura stramonium)* and gave 30 per cent better result in post-emergence application as compared with soil applications. Imazethapyr at 0.10 kg ha^{-1} also controlled the velvet-leaf (*Abutilon theoprasti)* and pig-weed (*Amaranthus hybridus).* Tewari *et al.*, (2007) conducted field trials during the rainy (*kharif*) seasons of 2001 and 2002 in Madhya Pradesh, India, to evaluate the efficacy of post emergence herbicides against weeds in soybean (*Glycine max)* and reported in contrast that the post emergence herbicides imazethapyr @75g a.i. ha^{-1} controlled only broadleaved weeds.

Table 3: Effect of treatments on yield components of soybean

Treatments	Yield components		
	Number of pods $plant^{-1}$	Number of seeds pod^{-1}	Test weight (g 100^{-1} seeds)
T_1 : Imazethapyr 10% SL @ 75 g a.i. ha^{-1}	26.07	3.03	8.97
T_2 : Imazethapyr 10% SL @ 100 g a.i. ha^{-1}	26.46	3.13	9.05
T_3 : Imazethapyr 10 % SL @125 g a.i. ha^{-1}	31.28	2.93	9.04
T_4 : Imazethapyr 10% SL @ 150 g a.i. ha^{-1}	34.71	3.10	9.09
T_5 : Metribuzin 75% WP @ 500g ha^{-1}	27.44	2.90	9.02
T_6 : Two hand weeding (15 DAS and 30 DAS)	37.07	3.33	9.10
T_7 : Unweeded (control)	23.22	2.97	8.95
LSD (0.05)	**4.11**	**0.13**	**NS**

Note: NS = Not significant

Table 4: Effect of treatments on seed and stover yield, harvest index and weed index

Treatments	Seed yield (t ha^{-1})	% increase over control	Stover yield (t ha^{-1})	% increase over control	Harvest index (%)	Weed index (%)
T_1:Imazethapyr 10SL@75g a.i. ha^{-1}	1.621	18.84	2.676	25.63	37.72	31.89
T_2:Imazethapyr 10SL@100g a.i. ha^{-1}	1.696	24.34	2.755	29.34	38.10	28.74
T_3:Imazethapyr 10SL@125 g a.i. ha^{-1}	1.864	36.65	2.973	39.57	38.54	21.68
T_4:Imazethapyr10SL@150 g a.i. ha^{-1}	2.177	59.60	3.359	57.70	39.32	8.53
T_5:Metribuzin 75% WP @ 500g ha^{-1}	1.725	26.47	2.895	35.91	37.33	27.52
T_6:Two hand weeding (15 DAS and 30 DAS)	2.380	74.48	3.507	64.65	40.42	
T_7 : Un-weeded (control)	1.364		2.130		39.04	42.69
LSD (0.05)	**0.06**		**0.05**			

The study revealed that, though the treatment twice hand weeding at 15 and 30 DAS gave higher net return than imazethapyr @150g a.i. ha^{-1}, the benefit : cost ratio of above said herbicidal treatment was higher than the hand weeding mainly due to requirement of more number of labour that in turn increased the cost of cultivation. So, it can be concluded that imazethapyr @150g a.i. ha^{-1} can be recommended for effective weed control in soybean during the critical period of crop weed competition.

REFERENCES

Bhattacharya, S. P., Das, D., Barat, T. K., Mukherjee, S. K., Bhattacharya, M., Chattopadhyay. A. K. and Brahmachari, K. 1998. Bio-efficacy of pursuit in controlling weeds of soybean. *J. Intercad.*, **2**: 168 -71.

Chirita, N., Dinu, C. and Chirita, D. 1993. Contributions to the study of the weed control of annual weeds in soybean crop. *Problem de Agrofitotechnique Teoretica Si Applicata*, **15**: 121-31.

Deore, N.R., Shete, B.T and Tambe, A.D. 2008. Effect of pre and post emergence herbicides on weed control and productivity of soybean (*Glycine max* L. Merrill). *J. Maharashtra Agric. Univ.*, **33**: 266- 67.

Pandey, A. K., Joshi, O. P., Billore, S. D. and Kumar, D. 2007. Effect of weed management practices on productivity of soybean, [*Glycine max* (L.) Merrill]. *Haryana J. Agron.*, **23**: 82-86.

Rani, B. P., Ramana, M. V. and Reddy, M. V. 2004. Evaluation of different post-emergence herbicides in soybean, *Glycine max* (L.) Merr., in vertisols of Andhra Pradesh. *J. Oilseeds Res.*, **21**: 293-95.

Tiwari, D.K., Kewat, M.L. Khan, J.A. and Khamparia, N.K. 2007. Evaluation of efficacy of post-emergence herbicides in soybean (*Glycine max*). *Indian J .Agron,* **52:** 74-76.

Tiwari, J. P. and Kurchania, S. P. 1990. Survey and management of Soybean (Glycine max) ecosystem in Madhya Pradesh. *Indian J. Agril. Sci.*, **60**: 672-76.

Chhokar, R. S., Balyan, R. S., and Pahuja, S. S. 1995. The critical period of weed competition in soybean (*Glycine max*). *Indian J. Weed Sci.*, **27**: 197-200.

Kushwah, S. S. and Vyas, M. D. 2006. Efficacy of herbicides against weeds in rainfed soybean under Vindhyan plateau of Madhya Pradesh. *Indian J. Weed Sci.*, **38** :62-64.