

Efficacy of imazethapyr against monocot weeds in groundnut

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ABSTRACT

A field experiment was conducted during *kharif* seasons of 2008 and 2009 at Livestock Farm, JNKVV, Jabalpur, to evaluate the efficacy of imazethapyr against weeds in groundnut. Eight treatments comprising of five doses of imazethapyr 50, 100, 150, 200 and 300g/ha alone, combined application of imazethapyr + chlorimuron (100+24 g/ha), hand weeding twice (20 and 40 DAS) including weedy check were laidout in randomized block design with three replications. The experimental field was infested with monocot weeds like *Cyperus iria* (44.08%) *Echinochloa colona* (30.51%) and *Dinebra retroflexa* (25.39%) at 40 DAS during both the years among the sedges and grassy weeds. The efficacy of imazethapyr at lowest rate (50 g/ha) was poor, which improved with the increase in application rates from 150 to 300 g/ha. However, combined application of imazethapyr at lower rate 100 g/ha with chlorimuron 24 g/ha paralyzed the weed growth identically (98.1%) to that of hand weeding twice (98.6%) and attained the superior values of yield attributes (13.5 pods/plant, 2.4 kernels/pod) as well as higher pod and haulm yields (12.83 and 21.21 q/ha). The latter treatment was also found more remunerative as it fetched the maximum values of net monetary returns (Rs 14096/ha) and benefit:cost ratio (1.8) and surpassed the recommended practice of weed control *viz.*, hand weeding twice which recorded the inferior values of net monetary return (Rs 10194/ha) and B:C ratio (1.4) due to more cost of weed control.

Key words : Groundnut, Weed growth, Weed control efficiency, Yield

India is the second largest producer of groundnut in the world with an area of 5.61 millions hectares, with 4.86 million tonnes production but productivity is only 866 kg/ha. Madhya Pradesh alone occupies 0.20 million hectares area, with 0.19 million tonnes production but productivity is only 948 kg/ha (Anonymous 2008). Weed infestation is one of the major constraints that limit the productivity of groundnut. Critical period of crop-weed competition for groundnut crop is ranged between 40 to 60 DAS (Singh *et al.* 1992). Generally weeds are controlled through hand weeding in groundnut, which is very expensive, laborious and some times damaging to the crop plants. It is, therefore, important to find out suitable herbicides that would control the weeds economically and safely. Presently, several herbicides like trifluralin, pendimethalin, alachlor, fluchloralin, *etc.* are being used for controlling grassy weeds in groundnut, but they have not been found much effective against broad leaved weeds. So, there is need for the new herbicide molecules which could control all types of weeds. In India, imazethapyr has been reported to give good control of weeds in groundnut (Singh 2009) when applied as post emergence between 14-20 days after sowing when the weeds are in 1-2 leaf stage. It has also been reported to give effective control of yellow and purple nut sedge when applied at 5 to 10 cm height of crop besides excellent control of broad leaf weeds and some grasses also at

different part of the country in soybean. But very meagre information is available on the efficacy of this herbicide against grassy and broad leaf weeds in groundnut.

MATERIALS AND METHODS

An experiment was conducted at Livestock Farm, Department of Agronomy, JNKVV, Jabalpur during *kharif* seasons of 2008 and 2009 in order to test the efficacy of imazethapyr against weeds in groundnut. The climate of this region is subhumid and tropical. The total rainfall received during cropping period (July and November) for the year 2008 and 2009 was 1380.1 and 1460.6 mm, respectively. The maximum and minimum temperature was 38.6°C, 33.65°C; and 11.1°C, 22.16°C during the crop growth in 2006 and 2009, respectively. The soil of experimental site was clay in texture with pH 7.2, medium in organic carbon 0.64%, available nitrogen (371 kg/ha), phosphorus (16.2 kg/ha) but high in potassium (296 kg/ha). Eight treatments comprising of five doses of imazethapyr (50, 100, 150, 200 and 300 g/ha), combined application of imazethapyr with chlorimuron (100 + 24 g/ha) as post emergence, hand weeding (20 and 40 DAS) and weedy check, were laidout in randomized block design with three replications. Groundnut cultivar TG-24 was sown on July 19 and 12 with a row spacing of 45 cm and a plant spacing of nearly 10 cm during 2008 and 2009, respectively. The recommended dose of fertilizers for

groundnut was 20 kg N, 80 kg P and 20 kg K/ha. The whole quantity of N, P and K was applied through urea, single superphosphate and muriate of potash at the time of sowing of groundnut. Total weed population/m² was recorded at 40 DAS and harvest under each treatment with the help of 0.25 m² quadrat. Weed population was recorded in weedy check to work out the relative density of weeds. The weed dry matter was also recorded at 40 DAS and harvest under each plot. The economic analysis of each treatment was done on the basis of prevailing market price of inputs used and output obtained under each treatment. Data on weed density and weed biomass were transformed using $\sqrt{x+0.5}$ transformation.

RESULTS AND DISCUSSION

Effect on weeds

Species wise weed data recorded in weedy plots at 40 DAS of groundnut indicated that there was predominance of only monocot weeds (100%) in the experiment field cropped with groundnut. Among the monocots, the *Cyperus iria* was more rampant (42 and 44 mean relative density) at both the stages due to continuous germination of this weed from seeds and vegetative parts as the field was fallow during last two years. Besides, *Echinochloa colona* (30.5%) and *Dinebra retroflexa* (25.4%) also marked their presence in good numbers. The predominance of grassy and sedge weeds have also been reported by several workers (Sukhadia *et al.* 1998, Gowda *et al.* 2002)

Density and dry weight of all the three weeds namely *C. iria*, *E. colona* and *D. retroflexa* recorded at 40 DAS and harvest varied significantly under different weed control treatments (Table 1). The density and dry weight of weeds were maximum under weedy plots at both the stages upto harvest of groundnut crop. However, identical reduction in density and dry weight of weeds was observed when weeds were controlled either through chemical or mechanical means. Post emergence application of imazethapyr at the lowest dose (50 g/ha) caused marginal reduction in density and dry weight of all the grassy weeds but reduction was more pronounced when imazethapyr was applied at 150 g/ha or higher rates (200 to 300 g/ha) or when combined application of imazethapyr (100 g/ha) was done with chlorimuron-ethyl (24 g/ha) during both the years. Similar views were also put by Richburg *et al.* (1993). Hand weeding done at 20 and 40 DAS reduced the density and dry weight of weeds to the maximum extent over herbicidal treatments during both the years. Similar observations were also made by Bhagat *et al.* (2002), Kumar *et al.* (2004) and Ahmed *et al.* (2008) due to elimination of all sorts of weeds during the course of hand weeding.

Weed control efficiency (WCE) during both the *kharif* seasons of 2008 and 2009 at 40 DAS and harvest under different weed control treatments, varied significantly (Table 1). The application of imazethapyr at the lowest dose (50 g/ha) had the lower WCE because of poor control of monocot weeds, but it was well marked when imazethapyr was applied at higher rates (200 to 300 g/ha) or when combined application of imazethapyr 100 g/ha was done with chlorimuron-ethyl 24 g/ha. Maximum WCE (96.1 and 87.8%) was recorded at both the stages (40 DAS and harvest) under hand weeding treatment due to elimination of weeds.

Effect on crop

Pod and kernel yields (Table 2) attained the minimum value (644 and 423 kg/ha, respectively) when weeds were not controlled throughout the season. This caused severe competitive stress on crop plants for growth resources and led to inferior yield attributing traits (pods/plant, kernels/pod and 100 kernel weight) hence had minimum pod and kernel yields. The application of imazethapyr at the lowest rate (50 g/ha) gave nearly similar pod and kernel yields to that of weedy check, which increased correspondingly (1208 and 833 kg/ha) with the increase in application rates being the higher when imazethapyr was applied between 200 to 300 g/ha. This led to record better yield attributing traits and finally higher pod and kernel yields. However, pod and kernel yields were further increased (1283 and 863 kg/ha) in plots receiving combined application of imazethapyr (100 g/ha)+chlorimuron (24 g/ha) being at par to hand weeding twice (133 and 906 kg/ha). These results in respect to pod and kernel yields were in close conformity with the earlier findings of Roy *et al.* (2003) and Sasikala *et al.* (2007).

Aerial biomass of crop contributes to haulm yield at harvest. Weedy check (1698 kg/ha) and imazethapyr at the lowest rate 50 g/ha (1829 kg/ha) had the lower haulm yields, however, application of imazethapyr at 150 g/ha or higher rates (200 and 300 g/ha) or when imazethapyr (100 g/ha) was applied in combination with chlorimuron (24 g/ha) and hand weeding, plots had higher values of haulm yield due to better growth and development of crop plants under weed free environment. These findings are in close conformation to that of Sasikala *et al.* (2007).

Harvest index (HI) was minimum under weedy check because of poor partitioning of photosynthates from source to the sink, whereas, hand weeding attained the maximum value of harvest index followed by herbicidal treatments (Table 2). The lowest dose of imazethapyr (50 g/ha) had only 30.01% HI, which improved with the increase in rate of application of imazethapyr from 150 g/ha (36.59%), 200 g/ha (37.96%), 300 g/ha (37.97%) g/ha and under combined application of imazethapyr (100

Table 1. Effect of imazethapyr on density, dry weight of weeds and weed control efficiency at 40 DAS and harvest stage in groundnut (mean of two seasons)

Treatment	Mean weed density/m ²						Mean dry weight (g/m ²)						Weed control efficiency (%)	
	<i>Echinochloa colona</i>		<i>Dinebra retroflexa</i>		<i>Cyperus iria</i>		<i>Echinochloa colona</i>		<i>Dinebra retroflexa</i>		<i>Cyperus iria</i>		40 DAS	At harvest
	40 DAS	At harvest	40 DAS	At harvest	40 DAS	At harvest	40 DAS	At harvest	40 DAS	At harvest	40 DAS	At harvest	40 DAS	At harvest
Imazethapyr 50 g/ha	2.4 (5.4)	2.4 (5.4)	2.87 (7.75)	2.8 (7.8)	4.78 (22.4)	4.1 (16.7)	3.4 (11.7)	3.7 (13.4)	3.7 (13.5)	3.7 (13.7)	4.3 (18.1)	4.7 (22.4)	61.5	49.5
Imazethapyr 100 g/ha	2.1 (4.0)	1.4 (1.7)	2.1 (4.0)	2.4 (5.4)	4.1 (17.1)	3.8 (14.3)	3.0 (8.8)	1.9 (3.3)	2.0 (3.7)	2.3 (4.9)	3.3 (10.6)	3.76 (13.6)	78.8	78.6
Imazethapyr 150 g/ha	1.3 (1.3)	1.3 (1.3)	1.3 (1.3)	1.7 (2.7)	3.2 (9.9)	3.4 (11.2)	2.5 (5.8)	1.9 (3.3)	1.3 (1.23)	1.7 (2.4)	2.7 (6.9)	3.43 (11.2)	87.3	83.1
Imazethapyr 200 g/ha	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	2.8 (7.8)	2.4 (5.4)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	2.52 (5.8)	2.9 (8.1)	98.1	97.2
Imazethapyr 300 g/ha	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	2.42 (5.4)	2.4 (5.4)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	2.3 (5.2)	2.8 (7.5)	98.3	97.4
Imazethapyr 100 g/ha + chlorimuron 24 g/ha	1.1 (0.7)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	3.1 (9.2)	2.1 (4.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	2.2 (4.6)	2.4 (5.5)	98.6	98.1
Hand weeding	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	2.1 (4.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	2.1 (4.1)	100	98.6
Weedy check	5.7 (32.3)	5.3 (28.2)	5.2 (26.7)	4.8 (22.7)	6.8 (46.3)	6.2 (38.6)	6.6 (44.3)	6.3 (40.2)	4.8 (22.8)	4.6 (21.1)	6.8 (46.4)	6.2 (38.7)	-	-
LSD (P=0.05)	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.6	0.1

Figures in paranthesis are original value.

Table 2. Effect of imazethapyr on yield attributes, pod yield, kernel yield, haulm yield, harvest index and economics of groundnut (mean of two years)

Treatment	Pods/ plant	Kernels/ pod	100 kernel weight (g)	Pod yield (kg/ha)	Kernel yield (kg/ha)	Haulm yield (kg/ha)	Harvest index (%)	NMR (Rs/ha)	B:C ratio
Imazethapyr 50 g/ha	7.4	2.5	49.8	784	564	1829	30.01	4224	1.2
Imazethapyr 100 g/ha	8.7	2.6	50.1	1138	759	2168	34.90	10611	1.6
Imazethapyr 150 g/ha	12.5	2.6	50.3	1164	796	2096	36.59	11228	1.6
Imazethapyr 200 g/ha	12.6	2.6	50.4	1201	829	2071	37.96	11745	1.6
Imazethapyr 300 g/ha	12.7	2.7	50.5	1208	833	2081	37.97	10640	1.5
Imazethapyr 100 g/ha + chlorimuron 24 g/ha	13.5	2.7	50.5	1283	863	2122	38.98	14096	1.8
Hand weeding	15.4	2.8	50.5	133	906	2157	40.0	10194	1.4
Weedy check	7.2	2.3	48.9	644	423	1668	27.16	426	1.0
LSD(P=0.05)	0.1	0.6	0.1	15	6	33	0.15	-	-

g/ha) + chlorimuron (24 g/ha) (38.98%). However, the difference between combined application of imazethapyr + chlorimuron (100+24g/ha) and hand weeding twice did not touch the level of significance. Higher coefficient of partitioning of photosynthetic in the sink (kernel) led higher values of harvest index under aforesaid treatments.

Hand weeding required maximum additional investment (Rs 7000/ha) because of more labour requirement (70 man days) for removing weeds two times at 20 and 40 DAS (Table 2). All the herbicidal treatments needed lesser additional investments (Rs 825 to 3950/ha) depending upon the cost and rate of herbicide application.

The gross return was minimum (Rs 15085.7/ha) under weedy check because of lowest economic yield. But it identically increased to a maximum level (Rs 32402/ha) when weeds were controlled by hand weeding closely followed by post emergence application of imazethapyr 100 g/ha in combination with chlorimuron 24 g/ha (Rs 30909.8/ha), imazethapyr 300 g/ha (Rs 29887/ha), imazethapyr 200 g/ha (Rs 29743/ha), imazethapyr 150 g/ha (Rs 28654 /ha) and imazethapyr 100 g/ha (Rs 27474 /ha).

The net return and benefit : cost ratio were minimum under weedy check and these indices were increased in the range of Rs 4224 to 14096; and 1.2 to 1.8, respectively, when weeds were controlled either by herbicides or by hand weeding. Though hand weeding twice fetched the highest gross returns, it had net monetary return (Rs 10194 /ha) and benefit:cost ratio (1.4) lesser than combined application of imazethapyr and chlorimuron (100+24 g/ha), which had the highest net monetary return and benefit:cost ratio, closely followed by alone application of imazethapyr between 100 to 200 g/ha in groundnut. Guggari *et al.* (1995) also reported similar results from their studies.

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