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Evaluation of Imazethapyr 10% SL for controlling weeds of groundnut in new alluvial soil of West Bengal

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ABSTRACT

Weed infestation in the field crops is one of the major problems faced by the farmers in crop cultivation. Slow growth habit of legumes during early crop growth stages encourages rapid growth of weeds and leads to severe crop-weed competition which finally reduce the crop yield. An experiment was executed during kharif seasons of 2011 and 2012 at Chandamari Village (22º57'N, 88º20'E) of Nadia district of West Bengal to study the effect of Imazethapyr in controlling the predominant weeds in groundnut (Arachis hypogaea). The experiment was laid out in randomized block design with eight different treatments replicated thrice. Pod as well as haulm yield of groundnut was found to be the highest where hand weeding was practiced at an interval of 20 and 40 DAS (T_7) and it was at par with the treatment T_3 (Imazethapyr 10% SL @ 125 g a.i. ha^{-1}) for pod yield and T_3 and T_2 (Imazethapyr 10% SL @ 100 g a.i. ha^{-1}) for pod and haulm yield. Though the maximum suppression of targeted weed density vis-à-vis weed biomass was obtained with the T_4 (Imazethapyr 10% SL @ 150 g a.i. ha^{-1}), it showed delayed maturity due to bit phytotoxicity on groundnut.

Keywords: Groundnut, imazethapyr, weed control

At this juncture, it must be admitted that the agricultural productivity should be sustained for providing food and nutrition to the mammoth population of the entire nation. Groundnut or peanut plays an important role in the dietary requirement of resource poor women and children and haulms are used as livestock feed (El Naim *et al.,* 2011). Further, though groundnut is an legume oilseed crop, it can fix a good amount of atmospheric nitrogen through its root nodules. India holds a major position in the global oilseed scenario (accounting for about 14% of the area and 8% of production) and among them groundnut is one of the most important oilseed crops (Reddy, 2009). Area wise, about 85% groundnut is grown during the *kharif* season under rainfed situation where the vagaries of monsoon and seasonal biotic and abiotic stresses attenuating the productivity (Dayal, 2004). There are several constraints in groundnut production. Among them, one of the major constraints to raise the productivity of groundnut crop is the weed infestation. A yield loss to the tune of 35 to 80 per cent due to weed infestation. Weeds not only compete with this crop for the resources but also interfere with pegging, pod development and harvesting of it. The critical period of crop-weed competition was found to be 4 to 8 weeks after sowing (Hamada, 1988). Thus, in case of groundnut, early removal of weeds before flowering and during pegging is important (Page *et al.*, 2002). Chemical control of weeds forms an excellent alternative to manual weeding (Sumathi *et al.,* 2000). Herbicides, though selective in nature, are efficient and cost effective measure in controlling weeds in groundnut. Therefore, an investigation was carried out to evaluate Imazethapyr as a herbicide for groundnut.

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MATERIALS AND METHODS

The present experiment was conducted in Randomized Block Design (RBD) during *kharif* seasons of 2011 and 2012 at Chandamari Village (22º57'N, 88º20'E) of Nadia district of West Bengal with 8 different weed management practices, each replicated thrice. The treatments were Imazethapyr 10% SL @ 75 g a.i. ha^{-1} at 10 DAS (T_1), Imazethapyr 10% SL @ 100 g a.i. ha^{-1} at 10 DAS (T_2), Imazethapyr 10% SL @ 125 g a.i. ha^{-1} at 10 DAS (T_3), Imazethapyr 10% SL @ 150 g a.i. ha^{-1} at 10 DAS (T_4), Pendimethaline 30% EC @ 750 g a.i. ha^{-1} at pre-emergence (T_5), Oxyfluorfen 23.5% EC @ 150 g a.i. ha^{-1} at pre-emergence (T_6), Hand weeding twice at 20 and 40 DAS (T_7) and Untreated Control (T_8). Groundnut (cv. TAG 24) crop was sown at a spacing of 30 × 10cm at the end of June with a fertilizer dose of 30:60:40 kg NPK ha^{-1} (Singh *et al.* 2003). The required quantity of commercial formulation of each herbicidal treatment was sprayed with the help of knapsack sprayer fitted with flat fan nozzle. The amount of water used for spraying was 500 liters ha^{-1}. Weed count was done by using quadrate of 0.5 × 0.5m size at two places; dry weight of weeds of each plot was also recorded in the

laboratory following proper procedures. Predominant weed population and weed biomass was recorded at 30 days after post emergence spray (DAP), phytotoxicity observation as per CIB guidelines (observations on yellowing, stunning, necrosis, leaf injure on tips and leaf surface, wilting, epinasty and hyponasty) were recorded accordingly. Finally, the crop yield was measured at the time of harvest.

RESULTS AND DISCUSSION

Weed flora

The predominant weed species found in weedy check (unweeded control) throughout the crop growth period were of three categories. The grasses were *Echinochloa colona, Digitaria sanguinalis, Cynodon dactylon, Eleusine indica* and *Setaria glauca*. The broad-leaved weeds were *Amaranthus viridis, Commelina benghalensis, Trianthema portulacastrum, Physalis minima, Euphorbia hirta* and *Alternanthera sessilis* and the sedge weeds were *Cyperus difformis* and *Fimbristylis miliacea*. Mainly the three weeds *viz., Commelina benghalensis, Trianthema portulacastrum* and *Cyperus difformis* were found in the experimental groundnut field.

Weed population

Data regarding the effects of different treatments on population of target weeds (number m^{-2}) at 30 DAP differed significantly with each other and have been presented in table-1. Density of sedge (*Cyperus difformis*) was much higher than that of broad leaved weeds like *Trianthema portulacastrum* and *Commelina benghalensis*. Rainy season is highly favourable for grass and sedge population. Similar opinion was also reported by (El Naim *et al.,* 2011). The treatment T_7 *i.e.,* twice hand weeding at 20 and 40 DAS showed the maximum reduction of all three species of weed and it was *at par* with the treatments T_4 (Imazethapyr 10% SL @ 150 g a.i. ha^{-1} at 10 DAS) and T_3 (Imazethapyr 10% SL @ 125 g a.i. ha^{-1} at 10 DAS). The highest population of all the weeds was found under the weedy check treatment (T_8) which was statistically inferior to any other treatments. The pre-emergence herbicidal treatment (T_6) showed higher population of all the three types of weed in comparison to other treatments, except weedy check treatment (T_8). From the findings, it may be stated that post emergence application of imazethapyr @ 150 g a.i. ha^{-1} and @ 125 g a.i. ha^{-1} reduced the density of broad as well as narrow leaved weeds significantly as compared to pre-emergence herbicides under study (Arregui *et al.*, 2005; Mosjidis and Wehtje, 2011; Kundu *et al.*, 2011).

Weed biomass

Biomass (g m^{-2}) of different weed species in each plot of the experiment was recorded at 30 DAP and it varied significantly with different treatments (Table-1). The highest biomass of all categories of weed flora was observed in weedy check plot (T_8) among all the treatments. Highest reduction in biomass of sedge like *Cyperus defformis* was recorded with T_7 (twice hand weeding done at 20 and 40 DAS) which was *at par* with T_4, T_3 and T_2 respectively. The biomass of broad leaved weed flora in groundnut field reflected the same trend with that of the biomass of sedge weed flora. Similar work was also reported by Malligawad *et al.* (2000). The pre-emergence herbicidal treatment T_6 showed the maximum biomass of all the categories of weed flora in comparison to other treatments except T_8.

Weed control efficiency

Species wise weed control efficiency (%) in groundnut field was recorded at 30 DAP and it was found higher in case of *Cyperus defformis* (Table-1). The weed control efficiency (%) of all the weed flora was maximum under the treatment T_7, where twice hand weeding done at 20 and 40 DAS, and followed by the treatments T_4 and T_3 respectively. The pre-emergence application of Oxyfluorfen (T_6) showed lowest weed control efficiency in groundnut. The bio-efficacy of imazethapyr on weed control efficiency in groundnut was in order to $T_4>T_3>T_2>T_1$, irrespective of all predominant weed species.

Crop yield

Seed yield and stover yield of groundnut were observed at the time of harvest and they varied significantly with the variation in weed management practices (Table-2). Hand weeding twice at 20 and 40 DAS (T_7) produced the highest seed yield (1671 kg ha^{-1}) of groundnut. Similar results were found by Sankaranarayan *et al.* (2000). The lowest seed yield (753 kg ha^{-1}) was observed in weedy check treatment (T_8) among all the treatments. The pre-emergence application of Oxyfluorfen (T_6) produced the lower seed yield (981 kg ha^{-1}) as compared to all other herbicidal practices. Treatment effects on stover yield followed the same trend as found with seed yield of groundnut. From the results it may be expressed that higher weed infestation was responsible for reducing seed yield of the groundnut during *kharif* season. Similar observation

Table 1: Bio efficacy of imazethapyr 10% SL on population, dry weight and weed control efficiency of target weeds in groundnut at 30 days after spray during *kharif* season

Treatment	Weed population (m^{-2})			Weed dry weight (g m^{-2})			Weed control efficiency (%)		
	C. difformis	*T. portulacastrum*	*C. benghalensis*	*C. difformis*	*T. portulacastrum*	*C. benghalensis*	*C. difformis*	*T. portulacastrum*	*C. benghalensis*
T_1	9.34	3.93	1.71	3.05	2.24	1.02	69.00	35.60	53.31
T_2	7.03	3.12	1.03	2.05	1.61	0.59	79.12	53.74	73.12
T_3	5.21	2.34	0.54	1.38	1.03	0.33	85.91	70.30	84.89
T_4	4.50	2.04	0.52	1.03	0.99	0.25	89.54	71.65	88.45
T_5	7.61	3.63	1.31	2.59	1.82	0.83	73.67	47.69	62.07
T_6	14.23	4.71	2.60	5.13	2.60	1.77	47.74	25.28	19.21
T_7	2.72	1.02	0.34	0.62	0.54	0.20	93.65	84.51	90.83
T_8	26.84	7.44	3.52	9.82	3.48	2.19	-	-	-
SEm(±)	**0.32**	**0.16**	**0.08**	**0.23**	**0.16**	**0.10**			
LSD(0.05)	**0.97**	**0.50**	**0.27**	**0.70**	**0.48**	**0.31**			

Table 2: Effect of of imazethapyr 10% SL in comparison with the standard checks on yield, harvest index, weed index of groundnut

Treatment	Yield (kg ha^{-1})		Harvest index (%)	Weed index (%)	Increase in yield over control (%)
	Seed yield	Stover yield			
T_1	1228	4535	21.31	26.51	63.10
T_2	1425	4876	22.62	14.72	89.24
T_3	1530	5010	23.39	8.44	103.19
T_4	1457	4978	22.64	12.81	93.50
T_5	1379	4789	22.36	17.47	83.13
T_6	981	4296	18.59	41.29	30.28
T_7	1671	5221	24.25	-	121.91
T_8	753	3875	16.27	54.94	_
SEm(±)	**48.71**	**104.82**	**-**	**-**	**-**
LSD(0.05)	**147.75**	**317.94**	**-**	**-**	**-**

Note: *Imazethapyr 10% SL @ 75 g a.i. ha^{-1} at 10 DAS (T_1), Imazethapyr 10% SL @ 100 g a.i. ha^{-1} at 10 DAS (T_2), Imazethapyr 10% SL @ 125 g a.i. ha^{-1} at 10 DAS (T_3), Imazethapyr 10% SL @ 150 g a.i. ha^{-1}at 10 DAS (T_4), Pendimethaline 30% EC @ 750 g a.i. ha^{-1} at pre-emergence (T_5), Oxyfluorfen 23.5% EC @ 150 g a.i. ha^{-1} at pre-emergence (T_6), Hand weeding twice at 20 and 40 DAS (T_7) and Untreated Control (T_8).*

was found by Malligawad *et al.* (2000). Hand weeding twice at 20 and 40 DAS reduced the weed infestation most efficiently and as a consequence it produced the highest seed yield of rainy season groundnut. This result is supported by the findings of Dhakar *et al.* (2000) stating the highest yield (1717 kg ha^{-1}), resulted from weeding at 20 DAS and hoeing at 20 and 40 DAS in rainfed groundnut. From the table 2, it can be concluded that the highest harvest index (24.25%) was found under treatment T_7 and the weedy check treatment (T_8) recorded the lowest harvest index (16.27%). The maximum weed index (54.94%) was found from the treatment T_8 among all the weed management practices and the treatments T_3 showed minimum weed index (8.44%).

Crop phytotoxicity

None of the treatments used in this experiment showed any of the phytotoxicity symptoms on groundnut crop; excepting the case of yellowing symptom to the phytotoxicity score of 1 in the plots treated with treatment T_4 (Imazethapyr 10% SL @ 150 g a.i. ha^{-1} at 10 DAS). Crop maturity was also affected by the plot treated with imazethapyr @ 150 g ha^{-1} as compared to lower level of imazethapyr in groundnut field. Phytotoxicity of this herbicide was also observed in other leguminous crops, application of imazethapyras as pre-emergence at higher dose reduced plant height and caused leaf chlorosis in chickpea (Lyon and Wilson, 2005).

To conclude from the above findings, it can be stated that the imazethapyr can effectively control different categories of weeds, especially sedge in groundnut field. Again, the higher economic yields may be achieved in groundnut crop without any phytotoxic effect under the treatment T_3 (Imazethapyr 10% SL @125 g a.i. ha^{-1} at 10 DAS), where crops matured earlier than the control plots.

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