

Effect of new generation herbicides on weed parameters and seed yield of rice fallow black gram, *Vigna mungo* L

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ABSTRACT

A field experiment was conducted during the Rabi season of 2004 at Agricultural College and Research Institute, Madurai on sandy clay loam soil to study the effect of new generation herbicides and their rates on weed parameters and seed yield of rice fallow black gram, *Vigna mungo* L. The predominant weeds in the experimental field were grasses followed by broad leaved weeds and sedges. The results revealed that application of fenoxaprop-p-ethyl @ 75 g/ha was found to be very efficient in controlling the dominant grass weeds and found to be at par with fenoxaprop-p-ethyl @ 100 g/ha, cyhalofop butyl @ 100 g/ha and 125 g/ha. But all these herbicides failed to show their effect on sedges and broad leaved weeds (BLWs). Imazethapyr @ 100 g/ha caused significant reduction in BLW density and dry matter production followed by imazethapyr @ 75 g/ha. The extent of control of dominant grass weeds was 95.55 with fenoxaprop-p-ethyl @ 100 g/ha, 95.51 with cyhalofop butyl @ 125 g/ha and 59.32 per cent with imazethapyr @ 100 g/ha. However maximum seed yield was recorded with fenoxaprop-p-ethyl @ 100 g/ha which was comparable with cyhalofop butyl @ 125 g/ha.

Keywords: Herbicides; rice fallow black gram; weed control; zero till

INTRODUCTION

Pulses are cultivated under irrigated as well as rainfed conditions. They are also cultivated in another unique ecosystem known as rice fallow crop. Pulses are cultivated under rice fallow conditions in an areas of about 2.6 lakh hectares in Tamil Nadu and contribute about 40-50 per cent of the total pulse production in which black gram occupies a major share. The productivity of rice fallow black gram is

always far below the normal because of severe weed infestation due to zero tilled conditions. Rao et al (2001) reported 45-60 per cent loss in seed yield in rice fallow black gram due to weeds. The growth and seed yield of rice fallow black gram are seriously affected if weeds are not controlled at initial stage. Manual weeding is difficult and uneconomical to practice in this system because of presence of dense rice stubbles and non-availability of labour in time. Application of either pre-sowing

or pre-emergence herbicides is also difficult due to lack of field preparation and limited period of their application. Therefore in the present study an attempt was made to evaluate the effect of different new generation herbicides at variable doses on weeds and seed yield of rice fallow black gram.

MATERIAL and METHODS

Field experiment was conducted for efficient weed management in zero till sown rice fallow black gram at Agricultural College and Research Institute, Madurai during Rabi season of 2004. The experimental field was characterised by tropical climate with mean annual rainfall of 808.2 mm, the daily mean maximum and minimum temperatures were 30.9 and 21.1°C respectively. The soil of the experimental field was sandy clay loam in texture. The soil was about neutral in pH and low, medium and high in available N, P and K respectively. Black gram variety ADT 3 released by Tamil Nadu Agricultural University was selected for this study. The

experiment consisted of 11 treatments viz fenoxaprop-p-ethyl @ 50, 75, 100 g/ha, imazethapyr @ 50, 75, 100 g/ha and cyhalofop butyl @ 75, 100, 125 g/ha along with one manual weeding at 20 days after sowing (DAS) and unweeded check laid out in randomized block design replicated thrice.

Black gram seeds were treated with multi-strain Rhizobium @ 600 g/ha and recommended seed rate of 20 kg/ha was used in dibbling two to three seeds per hill at a depth of 3 to 4 cm adopting a spacing of 30 x 10 cm. Foliar spraying of 2 per cent DAP was done twice at flower initiation stage and 15 days after the first spray. All post-emergence herbicides were sprayed at 15 days after sowing (DAS). Data on parameters like weed density, weed dry matter production, weed control efficiency and seed yield were recorded. Weed control rating and crop phytotoxicity ratings were recorded in the visual cropping scaling of 1 to 10. Details of post emergence herbicides used for the study are furnished below:

Common name	Fenoxaprop-p-ethyl	Imazethapyr	Cyhalofop butyl
Manufacturer	Aventis	BASF	Denocil
Trade name	Whip Super	Pursuit	Clincher
Formulation	9 EC	10 SL	10 EC
Chemical group	Aryloxyphenoxy	Imidazolinones	Phenoxy propionics
Mode of action	Inhibits fatty acid synthesis		Inhibits fatty acid synthesis

RESULTS and DISCUSSION

Weed flora

The weed flora observed in the experimental field consisted of grasses, sedges and broad leaved weeds (BLWs). Grasses were found to be dominant followed by BLWs and sedges. Among grass weeds *Echinochloa colonum* was the pre-dominant species. The major weeds were *E colonum* (L) Link, *E crusgalli* Beav and *Panicum repens* (L) among grasses, *Cyperus rotundus* (L) and *C difformis* (L) among sedges and *Sphaeranthus indicus* (L), *Eclipta alba* (L) Hassk and *Cleome viscosa* (L) among BLWs. The pre-dominance of *E colonum* and *E crusgalli* in the experimental field was due to dominance of above grassy weeds in the preceding transplanted rice crop. These weed species were dominant in rice fallows on sandy clay loam soils of Killikulam as reported by Malarvili et al (2002).

Weed control and crop phytotoxicity rating

Application of fenoxaprop-p-ethyl @ 75 and 100 g/ha and cyhalofop butyl @ 100 and 125 g/ha recorded higher weed control rating of 9.0. The least weed control rating was obtained in the treatment receiving imazethapyr @ 50 g/ha. A crop phytotoxicity rating of 0 was recorded at all doses of three post-emergence herbicides (Table 1).

Weed density and dry matter production (DMP)

The data recorded on weed density and DMP at 15 days after application of post-emergence herbicides were grouped under grasses, sedges and BLWs. The three post-emergence herbicides applied at 3 doses exerted a significant influence on weed density and dry matter production (Table 1 & 2).

Effect on grasses

Among different post-emergence herbicides application of fenoxaprop-p-ethyl @ 100 g/ha recorded lower grass weed density and dry matter production of 2.29 plants/ha and 1.83 kg/ha respectively which were comparable with cyhalofop butyl @ 100 g/ha and 125 g/ha and fenoxaprop-p-ethyl @ 75 g/ha. The results are in accordance with the findings of Kurchania et al (1999) who reported that application of fenoxaprop-p-ethyl (70, 100 g/ha) controlled the population of grasses effectively. The effective control of grass weeds achieved by the application of fenoxaprop-p-ethyl and cyhalofop butyl could be due to the inhibitory effect on lipid and/or flavanoid biosynthesis by these herbicides by inhibiting acetyl CoA carboxylase in the susceptible species eventually causing death of tissues and ultimately the whole plant (Rao 2000). Imazethapyr @ 100 g/ha was found to be the next best treatment to reduce grass weed density and dry matter production. The

Table 1. Effect of new generation herbicides on weed control rating, crop phytotoxicity rating and weed density in rice fallow black gram

Treatment	Weed control rating (WCR)	Crop phytotoxicity rating (CPR)	Weed density (number/m ²)		
			Grasses	Sedges	Broad leaved weeds
Fenoxaprop-p-ethyl (50 g/ha)	8.00	0	3.97 (0.776)	13.00 (1.176)	26.00 (1.447)
Fenoxaprop-p-ethyl (75 g/ha)	9.00	0	2.34 (0.637)	12.85 (1.171)	26.50 (1.454)
Fenoxaprop-p-ethyl (100 g/ha)	9.00	0	2.29 (0.632)	12.67 (1.660)	26.25 (1.451)
Imazethapyr (50 g/ha)	7.33	0	24.06 (1.416)	12.50 (1.161)	13.26 (1.183)
Imazethapyr (75 g/ha)	8.33	0	22.47 (1.388)	13.00 (1.176)	11.39 (1.126)
Imazethapyr (100 g/ha)	8.67	0	20.95 (1.360)	12.50 (1.161)	9.87 (1.074)
Cyhalofop butyl (75 g/ha)	7.67	0	4.02 (0.779)	12.67 (1.166)	26.20 (1.450)
Cyhalofop butyl (100 g/ha)	9.00	0	2.35 (0.638)	12.93 (1.174)	26.50 (1.454)
Cyhalofop butyl (125 g/ha)	9.00	0	2.31 (0.634)	12.75 (1.168)	26.30 (1.451)
One manual weeding at 20 DAS			24.28 (1.419)	10.87 (1.109)	14.88 (1.227)
Unweeded check			51.50 (1.728)	12.50 (1.161)	26.25 (1.451)
SED			0.004	0.012	0.005
CD _{0.05}			0.008	0.025	0.012

Figures in parentheses are log (x+2) transformed values

Herbicides effect on weeds, black gram

Table 2. Effect of new generation herbicides on weed dry matter production and weed control efficiency in rice fallow black gram

Treatment	Weed dry matter production (kg/ha)			Weed control efficiency (%)	
	Grasses	Sedges	BLW	Grasses	Total
Fenoxaprop-p-ethyl (50 g/ha)	3.18	11.40	21.80	92.29	52.38
Fenoxaprop-p-ethyl (75 g/ha)	1.87	11.38	21.77	95.45	53.80
Fenoxaprop-p-ethyl (100 g/ha)	1.83	11.40	21.75	95.55	54.33
Imazethapyr (50 g/ha)	19.27	11.35	11.11	53.28	44.79
Imazethapyr (75 g/ha)	17.99	11.45	9.55	56.36	48.07
Imazethapyr (100 g/ha)	16.78	11.42	8.27	59.32	52.00
Cyhalofop butyl (75 g/ha)	3.22	11.40	21.82	92.19	52.49
Cyhalofop butyl (100 g/ha)	1.88	11.38	21.85	95.43	53.70
Cyhalofop butyl (125 g/ha)	1.85	11.38	21.80	95.51	54.17
One manual weeding at 20 DAS	19.44	9.53	12.37	52.85	44.56
Unweeded check	41.25	11.40	21.85	-	-
SEd	0.55	0.99	0.61		
CD _{0.05}	1.08	1.95	1.24		

death of susceptible species of grasses by imazethapyr could be due to inhibition of acetolactate synthase (ALS) enzyme which is essential for leucine, valine and isoleucine synthesis in weeds (Stidham and Singh 1991).

Effect on sedges

All the post-emergence herbicides did not show any appreciable effect on the control of sedges in rice fallow black gram. However the sedge population (10.87 plants/m²) and dry matter production (9.53 kg/ha) were considerably reduced under conventional method of one manual weeding given at 20 DAS. But in general manual weeding did not provide satisfactory

control of all types of weeds in the presence of dense rice stubbles. This was confirmed by the findings of Rao et al (2001) who reported that manual weeding was difficult to practice under rice fallow condition because of presence of dense rice stubbles.

Broad leaved weeds

With increase in the dose of imazethapyr from 50 to 100 g/ha the density and DMP of BLWs decreased correspondingly. The lowest density (9.87 plants/m²) and DMP (8.27 kg/ha) of weeds were recorded with the application of imazethapyr @ 100 g/ha. This finding is in accordance with the results of Chandel and Saxena (2001). Manual weeding at 20

Table 3. Effect of new generation herbicides on seed yield and economics of rice fallow black gram

Treatment	Seed yield (kg/ha)	Cost of cultivation (Rs)	Gross returns (Rs)	Net returns (Rs)	B:C ratio
Fenoxaprop-p-ethyl (50 g/ha)	826	6333	16520	10187	2.60
Fenoxaprop-p-ethyl (75 g/ha)	920	6718	18400	11682	2.73
Fenoxaprop-p-ethyl (100 g/ha)	882	7101	17640	10539	2.48
Imazethapyr (50 g/ha)	710	6245	14200	7955	2.27
Imazethapyr (75 g/ha)	765	6607	15300	8693	2.31
Imazethapyr (100 g/ha)	773	6970	15460	8490	2.22
Cyhalofop butyl (75 g/ha)	823	6825	16460	9635	2.41
Cyhalofop butyl (100 g/ha)	889	7250	17780	10530	2.45
Cyhalofop butyl (125 g/ha)	875	7675	17500	9825	2.28
One manual weeding at 20 DAS	695	7036	13900	6864	1.97
Unweeded check	375	5460	7500	2040	1.37
SEd	23				
CD _{0.05}	46				

DAS registered minimum BLW density (14.88 plants/m²) over unweeded check.

application of cyhalofop butyl by Singh et al (1997).

Weed control efficiency (WCE)

Grasses WCE: Higher WCE values were recorded with the application of fenoxaprop-p-ethyl @ 75 and 100 g/ha and cyhalofop butyl @ 100 and 125 g/ha with the values of 95.55, 95.45, 95.51 and 95.43 per cent respectively (Table 2). This might be due to reduction in density and DMP of grass weeds. The results are in confirmation with the findings of Kolhe et al (1998). Similar increase in WCE with the application of fenoxaprop-p-ethyl was also reported by Singh and Tripathi (2001) and by the

Total WCE: Total WCE also followed the similar pattern as that of grass WCE. The WCE of conventional method of one manual weeding at 20 DAS was comparatively less than that of the post-emergence herbicides. This might be due to initial rank weed growth under rice fallow conditions up to the imposing of manual weeding at 20 DAS and subsequent emergence of grasses, sedges and BLWs.

Seed Yield

Post-emergence application of fenoxaprop-p-ethyl @ 75 g/ha resulted in

higher seed yield of 920 kg/ha (Table 3). However it was comparable with fenoxaprop-p-ethyl @ 100 g/ha and cyhalofop butyl @ 100 and 125 g/ha. This might be due to timely control of weeds during critical period of crop weed competition in rice fallow black gram.

Economics

The highest net return of Rs 11682 and B:C ratio of 2.73 were recorded with the application of fenoxaprop-p-ethyl @ 75 g/ha.

CONCLUSION

The investigations conclusively proved that post-emergence application of either fenoxaprop-p-ethyl @ 75 and 100 g/ha or cyhalofop butyl @ 100 and 125 g/ha at 15 DAS effectively controlled the weeds and increased the seed yield of rice fallow black gram. However high monetary return was obtained with application of fenoxaprop-p-ethyl @ 75 g/ha.

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