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Bio-efficacy of Pendimethalin and Fluchloralin in Mustard

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One of the major causes of low oil seed productivity in West Bengal is high weed pressure in mustard. The weed problem is severe in northern parts of West Bengal due to heavy rainfall and deficiencies of micronutrient in soil leading to aggressive growth of weeds with high invasive potential. The present study was undertaken with the objective to evaluate bio-efficacy of pendimethalin and fluchloralin in mustard in order to achieve control over weeds.

A field experiment was carried out at the farm of Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal during the **rabi** seasons of 2002-03 and 2003-04. The soil was sandy loam with pH 5.8. The experiment was laid out in randomized block design with three replications. Ten treatments comprising four doses of pendimethalin (0.75, 1.00, 1.25 and 1.50 kg ha^{-1}), three doses of fluchloralin (1.00, 1.25 and 1.50 kg ha^{-1}), two hand weedings at 20 and 40 DAS, weedy check and complete weed-free situation (Table 1) were evaluated. Both the herbicides were applied as pre-emergence treatment with the use of flood jet nozzle. Mustard cv. B9 was sown on December 19, 2002 and November 17, 2003. Recommended package of practices other than weed control was adopted to grow the experimental crop. Microbial population count was performed by using dilution plate method with 10-fold dilution at 25 DAS during second year of experimentation. The total bacterial count, fluorescent *Pseudomonas* and total *Azotobacter* population were carried out with Taylors' Soil Extract Agar, Modified Kings' B Agar and Mannitol Sucrose Agar medium, respectively. Colony forming units were counted at 72 h after inoculation.

Polygonum persicaria (35%), *P. pensylvanicum* (23%), *P. orientale* (10%), *Stellaria media* (14%) and *Vicia sativa* (9%) were the major weeds in the experimental field. The other weeds observed in the experiment were : *Cynodon dactylon* (3%) and *Setaria glauca* (2%). Total weed dry weight was reduced significantly due to herbicides

Table 1. Effect of treatments on weeds and the crop

Treatment	Dose (kg ha^{-1})	Weed dry matter weight (g m^{-2})				Mustard plant population (Plants m^{-2}) at 90 DAS		Siliqua (No. $plant^{-1}$)		Seed yield (kg ha^{-1})	
		60 DAS		90 DAS							
		2002	2003	2002	2003	2002	2003	2002	2003	2002	2003
Pendimethalin	0.75	80.33	71.86	132.33	119.99	9.50	10.68	65.67	67.33	280	313
Pendimethalin	1.00	61.40	53.20	106.87	92.87	7.63	8.48	63.67	64.67	223	246
Pendimethalin	1.25	49.80	43.93	86.93	73.14	5.41	6.22	57.67	58.67	162	186
Pendimethalin	1.50	40.33	35.27	75.40	62.00	1.30	2.00	48.33	46.00	024	039
Fluchloralin	1.00	76.07	68.00	157.40	147.14	30.53	36.59	71.33	72.33	890	1067
Fluchloralin	1.25	66.47	58.40	138.40	128.40	31.59	40.00	72.67	72.67	916	1161
Fluchloralin	1.50	54.47	48.20	130.27	120.34	23.64	26.26	69.67	71.67	631	693
HW (at 20 & 30 DAS)	-	73.13	67.00	156.00	146.47	25.93	28.82	61.67	62.67	641	711
Weedy	-	248.47	236.80	372.80	354.20	4.49	4.59	47.67	47.33	077	072
Weed-free	-	0.00	0.00	0.00	0.00	36.92	44.30	71.00	71.33	1086	1288
LSD (P=0.05)		2.06	5.15	4.50	5.19	1.55	1.78	2.53	2.52	321	444

HW–Hand weeding, DAS–Days after sowing.

compared to weedy check (Table 1). Weed control efficiency of pendimethalin was higher than fluchloralin. Pendimethalin at 1.50 kg ha^{-1} had highest weed control efficiency throughout the crop growth (Table 1). Weed control efficiency of fluchloralin ranged from 57.78 to 66.02% depending upon doses which were higher than the hand weeding (Table 1). Hand weeding employed at 20 and 40 DAS failed to minimize the weed growth due to rapid emergence and establishment of *Polygonum* after hand weeding and thus resulting in poor weed control efficiency at later part of crop growth. Both the herbicides were able to control the *Polygonum* and other weeds like *S. media, V. sativa, C. dactylon* and *S. galuca* effectively during the early part of the crop growth. However, rapid emergence of *Polygonum* took place during 6 to 7 weeks after the application of herbicides in the plots treated with pendimethalin at 0.75 kg ha^{-1} and fluchloralin at 1.00 and 1.25 kg ha^{-1}.

Pendimethalin at all the doses was phytotoxic to mustard plants and registered 67% growth reduction at its lowest dose (0.75 kg ha^{-1}). Fluchloralin at its highest dose (1.50 kg ha^{-1}) caused the growth reduction of 37% (Table 1). Fluchloralin at 1.00 and 1.25 kg ha^{-1} was non-phytotoxic to mustard.

Fluchloralin at 1.25 kg ha^{-1} showed highest number of siliqua $plant^{-1}$ (72.67) closely followed by fluchloralin at 1.00 kg ha^{-1} (71.83) without any significant difference. The lowest number of siliqua $plant^{-1}$ was found in weedy plot. Highest seed yield of mustard was obtained in weed-free plot (1187 kg ha^{-1}), which was statistically similar to fluchloralin at 1.25 and 1.00 kg ha^{-1}. The lowest seed yield was obtained in pendimethalin at 1.5 kg ha^{-1} followed by weedy check (Table 1).

Pendimethalin (0.75 and 1.00 kg ha^{-1}) and fluchloralin (1.00 and 1.5 kg ha^{-1}) reduced the total soil bacterial population; however, population of fluorescent *Pseudomonas* and *Azotobacter* was improved with the application of these herbicides compared to control treatment . This was due to the fact that these microbes (fluorescent *Pseudomonas* and *Azotobacter*) utilized the chemicals (pendimethalin and fluchloralin) as their food source.