Herbicidal Control of Weeds in Wheat Based Oilseeds and Pulses Intercropping.

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ABSTRACT

Field investigations were carried out during *Rabi* 1985-86 and 1986-87 to develop an effective, safe and economical weed control schedule for wheat intercropped with mustard, gram and linseed at C.S. Azad University of Agriculture and Technology, Kanpur. Study revealed that post emergence application of isoproturon (1 kg ai ha^{-1}) proved quite safe, effective and economical in different intercropping systems as it fetched more net return (Rs. 1072 per hectare) than no application of isoproturon. Intercropping of mustard with wheat was found more remunerative by recording rupees 230 ha^{-1} and 379 ha^{-1} higher net returns than Wheat + Linseed and Wheat + Gram, respectively.

INTRODUCTION

Wheat is generally grown with mustard as inter/mix crop over a sizeable area. However, under some situations wheat is also sown mixed with mustard, gram and linseed. Adequate information is available in relation to herbicidal control of weeds in sole cropping of wheat, however, little or no information is available in this regard when wheat is intercropped with above crops. It is, thus, imperative to develop an effective safe and economical weed control shedule for wheat sown with mustard, gram and linseed.

MATERIALS AND METIIODS

Field experiment was conducted for two consecutive years (1985-86 and 1986-87) at Students' Instructional Farm of C.S. Azad University of Agriculture and Technology, Kanpur (U.P.), India. Twelve treatment combinations of three intercropping systems (wheat + mustard, wheat + linseed and wheat + gram) and four weed control measures (untreated, weed free, isoproturn (1 kg ai ha^{-1}) as pre-emergence and Isoproturn (1 kg ai ha^{-1}) as post-emergence were tried in a replicated randomised block design. Soil was sandy loam in texture, deficient in nitrogen and medium in phosphorus and potassium. Wheat variety UP-2003 was sown with a country plough in lines 20 cm apart. The intercrops of mustard (Varuna), linseed (Neelam), and gram (K-850) were sown at 10th; 4th and 5th rows, respectively. Application of nitrogen, P_2O_5 and K_2O at 120, 60 and 40 kg ha^{-1} was made in all intercropping systems except wheat + gram where rows of gram were fertilized with diammonium phosphate (18 kg N and 46 kg P_2O_5 ha^{-1}) only, while wheat received the normal manuring. Nitrogen and potassium were applied as urea (46%

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N) and muriate of potash (60% K_2O) only. Half of the nitrogen and full doses of phosphorus and potassium were applied basally and remaining half of the nitrogen was top-dressed after first irrigation in wheat, mustard and linseed. Isoproturon (N-4-Isopropyl Phenyl-N, N-dimethyl urea) was sprayed by dissolving in calibrated amount of water as pre-emergence (second day after sowing) and post emergence (35 days after sowing) by knapsack sprayer fitted with flood jet nozzle. Manual weeding was done with the help of *khurpi* as per treatment. Weed count values were transformed for the statistical analysis. Transformed values were obtained by following formula

$$\sqrt{X - 1}$$

Where, x is the original values recorded

Gross and net plot size were kept 17.50m^2 and 10.0m^2, respectively. Data recorded related to crop and weed studies were subjected to statistical analysis as per method suggested by Fisher (1947). Wheat equivalent was calculated for the rational comparison of different crop combinations by the following formula.

$$\text{Wheat equivalent } (kg/ha^{-1}) = \frac{R_{(S)} \times Y_{(S)} + R_{(ic)} \times Y_{(ic)}}{R(S)}$$

Where

$R_{(s)}$ = Rate of sole crop (Rs/kg)

$R_{(ic)}$ = Rate of intercrop (Rs/kg)

$Y_{(s)}$ = Yield of sole crop (Kg/ha)

$Y_{(ic)}$ = Yield of intercrop (Kg/ha)

RESULTS AND DISCUSSION

The major weed flora were *Phalaris minor* Retz., *Chenopodium album* L, *Melilotus alba* lank, *Anagallis arvensis* L, *Convolvulus arvensis* L. *and Cyperus rotundus* L. Dominance of *Phalaris minor* was observed during first year (75%) whereas broadleaved weeds dominated (69%) during second year (Table 1).

Table 1. Weed composition of the experimental field.

Type of weeds	Number/m^2		Intensity (%)	
	1985-86	1986-87	1985-86	1986-87
Monocot	166.62	50.32	74.55	30.87
Dicot	56.91	112.67	25.46	69.13

Perusal of data (Table 2) indicated that the weed count and dry matter accumulation of weeds did not differ significantly due to different intercrops except in 1985-86. This could be substantiated with the findings of Singh (1985-86) who did not find any suppression of weeds in wheat intercropped with *raya* and *lentil* at Palampur. Weed control treatments demonstrated significant reduction in weed count and dry weight of weeds. Irrespective of its mode of application, use of isoproturon brought about a significant reduction in weed count and dry weight of weeds like the manual weeding (twice). Inhibition of Hill Reaction, a characteristic of substituted urea herbicides (Moreland et al., 1958), is attributed to be the possible reason for weed mortality following application of isoproturon. Cropping systems did not interact with weed control measures with regard to weed counts and its dry matter accumulation.

Table 2. Weed population/ m^2 and dry matter (DM) accumulation of weeds as influenced by different treatments.

Treatments	Weed counts/m^2				Dry matter yield (kg/ha)	
	1985-86		1986-87		1985-86	1986-87
	Monocot	Dicot	Monocot	Dicot		
(A) *Cropping systems*						
Wheat + mustard	32.40	45.36	14.81	102.16	251	377
	(5.77)	(6.80)	(3.97)	(10.15)		
Wheat + gram	29.16	29.16	14.31	69.80	380	326
	(5.49)	(5.49)	(3.91)	(8.41)		
Wheat + linseed	28.25	36.67	14.86	112.50	296	368
	(5.40)	(6.05)	(3.98)	(10.65)		
CD 5%	NS	NS	NS	0.47	19	NS
(B) *Weed Control Methods*						
No weeding	63.58	56.90	20.47	130.47	560	495
	(8.03)	(7.60)	(4.63)	(11.46)		
Manual weeding	26.54	37.65	10.59	52.98	237	282
	(5.24)	(6.21)	(3.40)	(7.34)		
Isoproturon Application	14.43	33.33	13.65	78.70	242	311
(Pre-emergence)	(3.92)	(5.85)	(3.82)	(8.92)		
Isoproturon Application	14.19	20.37	13.93	73.72	195	341
(Post-emergence)	(3.89)	(4.62)	(3.86)	(8.64		
CD 5%	1.85	1.27	0.27	0.54	22	80

Figures in parenthesis shows transformed values ($\sqrt{X + 1}$)

Data reveal (Table 3) that raising mustard in association with wheat recorded highest wheat equivalent (4057 kg ha^{-1}) and net return (Rs. 3090.00 ha^{-1}) followed by wheat + linseed intercropping. Sidhu *et al.* (1984) reported similar results.

Weed control measures demonstrated significant response in increasing the yield of component crops as well as wheat equivalent during both the years. On an average, wheat equivalent and net return were increased by 847 kg ha^{-1} and Rs. 1072.00 ha^{-1}, respectively, when

Table 3. Grain yield of component crops (kg ha^{-1}) and wheat equivalent (kg ha^{-1}) obtained under different weed control methods.

Parameters	Year	Cropping systems			Weed conrol methods			
		Wheat + mustard	Wheat + gram	Wheat + linseed	No weeding	Manual weeding twice	Isoproturon (kg ha-1) pre	post
Grain yield	1985-86	3421 (317)	2909 (580)	3544 (232)	2642	3316	3506	3618
	1986-87	3274 (315)	2935 (488)	3210 (232)	2842	3420	3090	3206
	Mean	3347.5	2922	3377	2742	3368	3298	3412
Wheat yield equivalent (kg/ha)	1985-86	4228	3856	4153	3331	4176	4273	4533
	1986-87	3886	3705	3670	3353	4090	3724	3845
	Mean	4057	3780.5	3911.5	3342	4135	3998	4189

Selling rate of Wheat Rs. 176/q
Gram Rs. 250/q
Linseed Rs. 600/q
Mustard Rs. 700/q

Table 4. Economic analysis of the cropping systems and weed control measures.

Cropping systems	Cost of cultivation (Rs/ha)	Gross income (Rs/ha)	Net income (Rs/ha)
Wheat + mustard	4050.00	7140.32	3090.32
Wheat + gram	3960.00	6671.20	2711.28
Wheat + linseed	4023.50	6884.24	2860.74

Weed control methods	Cost of treatment (Rs/ha)	Additional income over control (Rs/ha)	Net return over control (Rs/ha)
No weeding	–	–	–
Manual weeding twice	460.00	1385.68	925.68
Isoproturon (1kg ha^{-1}) (pre-emergence)	419.00	1154.56	735.56
Isoproturon (1kg ha^{-1}) (post-emergence)	419.00	1490.72	1071.72

Rate of isoproturon 75% WP (Isoproturon Rs. 311.35/kg)
Manual labour Rs. 11.50/day.

isoproturon was used as post-emergence. Application of isoproturon as pre-emergence failed to equate with post emergence treatment (Table 4). Some phytotoxicity following post emergence application was noticed on mustard leaves which disappeared very shortly. However, this herbicide was found quite safe for all the component crops under test. Tosh and Jena (1983) recommended methabenz-thiazuron (2 kg ha^{-1}) and nitrofen (2 kg ha^{-1}) for wheat + mustard intercropping. Cropping system could not interact with weed control measure in increasing the grain yield of component crops as well as wheat equivalent, Thus, use of isoproturon was found safe, effective and economical for any cropping system as stated above.

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