

Weed Management in Zero-till Sown Wheat

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ABSTRACT

Higher weed density and population of *Phalaris minor* were recorded in conventional tillage than zero tillage. Pre-sowing paraquat application had marked effect on weed growth in zero tillage. Maximum reduction in weed density was obtained with the application of 2, 4-D and isoproturon (500 g+1000 g ha⁻¹) as mixture under ZT and CT system. Higher average grain yield was achieved under zero tillage wheat with pre-sowing paraquat (500 g ha⁻¹) application and post-emergence isoproturon (1000 g ha⁻¹) or mixed application of 2, 4-D and isoproturon (500 g+1000 g ha⁻¹). Yield achieved in zero tillage without any herbicide application was comparable to conventional tillage with isoproturon application.

INTRODUCTION

Rice-wheat is the most predominant cropping system of India with an area of about 11.0 m ha. Twenty-five per cent of the total rice area of the country is grown in rotation-involving wheat, whereas 40% of wheat is grown in rotation with rice. The productivity of this system is stagnating or declining, which is causing concern about the sustainability of rice-wheat system. Various diagnostic surveys conducted in the country have identified constraints prevailing at farmer's fields, which are responsible for yield stagnation or decline. The major constraints for wheat are poor crop stand, late planting, poor soil physical conditions due to puddling, problem of *Phalaris minor*, high cost of production due to excess tillage. Based on these constraints, research priorities were set up at G. B. Pant University of Agriculture & Technology, Pantnagar and it developed a Pantnagar zero till-ferti seed drill which plants the wheat crop after the harvest of rice crop in standing rice stubbles. Zero tillage has certain advantages like improved soil conditions due to decomposition of crop residue *in situ* and reduced cost of production. Isoproturon has been recommended for control of weeds in conventional tillage system of wheat whether its performance remains same or

not in zero tillage, needs verification. Therefore, the present investigation was undertaken to assess the efficiency of herbicides in zero tillage wheat.

MATERIALS AND METHODS

On-farm experiments were conducted for four years during winter season, 1997-98 to 2000-01 in district U. S. Nagar of Uttaranchal. The soil varies from sandy loam to silty clay loam with pH ranging from 7.2 to 7.7. The soil classified as Typic Hapludoll mixed hyperthermic, rich in organic carbon, medium in available phosphorus and medium to high in available potassium. The experiments were conducted at 14 locations. Experiments with five treatments during 1997-99 and six treatments during 1999-2001 were laid out treating the locations as replications. Two-tillage treatments viz., conventional tillage (CT) and zero tillage (ZT) were evaluated with 2,4-D, isoproturon and paraquat herbicides (Tables 1 and 2) in 50 m x 20 m plots. Rice was harvested manually by sickle at a height of 10-15 cm from ground surface and all the loose stubbles were removed from the experimental field. The cross bunds of rice plot were harrowed twice followed by planking immediately for smooth running of seed drill and moisture conservation. Zero tillage wheat was sown directly without any

Table 1. Effect of treatments on density of *Phalaris minor* (No. m⁻²) and wheat grain yield

Treatment	30 DAS			60 DAS			Grain yield (kg ha ⁻¹)		
	1997-98	1998-99	Mean	1997-98	1998-99	Mean	1997-98	1998-99	Mean
	ZT no weed control	10.0	21.0	3361	4161	23.0	28.0	3761	
ZT with pre-sowing application of paraquat 500 g ha ⁻¹	5.0	11.0	3500	4650	12.0	21.0	4075		
ZT with pre-sowing application of paraquat 500 g and isoproturon 1000 g ha ⁻¹	2.0	3.5	3710	4911	8.0	12.0	4310		
CT no weed control	88.0	71.0	3215	3610	129.0	126.0	3412		
CT with isoproturon 1000 g ha ⁻¹ 30 DAS	59.0	55.0	3405	4702	33.0	47.0	4053		
LSD (P=0.05)	5.9	4.5	121	181	7.6	7.0	-		

ZT=Zero tilled, CT=Conventionally tilled.

Table 2. Effect of treatments on density of *Phalaris minor* (No. m⁻²) and wheat grain yield

Treatment	30 DAS			60 DAS			Grain yield (kg ha ⁻¹)		
	1999-2000	2000-01	Mean	1999-2000	2000-01	Mean	1999-2000	2000-01	Mean
	ZT 2, 4-D 500 g ha ⁻¹	39.0	27.0	4261	4368	40.0	36.0	4314	
ZT 2, 4-D 500 g and isoproturon 1000 g ha ⁻¹	20.0	30.0	4705	4610	9.0	13.0	4657		
CT 2, 4-D 500 g ha ⁻¹	81.0	87.0	4107	4100	31.0	49.0	4103		
CT 2, 4-D 500 g and isoproturon 1000 g ha ⁻¹	70.0	70.0	4366	4285	26.0	20.0	4325		
ZT no weeding	38.0	31.0	3900	4050	46.0	39.0	3975		
CT no weeding	86.0	100.0	3650	3710	99.0	139.0	3680		
LSD (P=0.05)	3.9	4.8	193	184	4.5	6.7	-		

tillage operation in standing stubbles with Pantnagar zero till ferti seed drill, whereas conventional tillage plots were prepared by five to six harrowings and 2-3 plankings. Conventional tillage plots were sown 6-9 days later than ZT. Wheat variety "UP 2338" was sown on November 22-25 in zero tillage plots and on November 28 to December 1 in conventional tillage plots with 125 kg seed ha⁻¹. Mixture of NPK (12 : 32 : 16) was drilled at 150 kg ha⁻¹ with seed. Pre-sowing application of paraquat at 500 g ha⁻¹ was done in zero till plots as per treatment two days before sowing (DAS), and all other herbicides were applied 30 DAS using 600 litre water with the help of knapsack sprayer fitted with flat fan nozzle. Rest of the nitrogen was used as top dressing in two equal splits one after first irrigation and other at maximum tillering stage of crop.

RESULTS AND DISCUSSION

Effect on Weeds

Weeds in the fields were *Phalaris minor*, *Chenopodium album*, *Melilotus indica*, *Avena ludoviciana*, *Polypogon monspeliensis*, *Cynodon dactylon*, *Anagallis arvensis*, *Fumaria parviflora* and *Lathyrus aphaca* though major weeds were *P. minor* followed by *A. ludoviciana* and *C. album*. Weed density was higher at 30 days after sowing compared to 60 days after sowing. Number of weeds was substantially low in zero tillage treatments compared to conventional treatment. Density of *P. minor* was significantly lower in zero tillage as compared to conventional tillage at both the stages of crop growth. Pre-sowing spray of paraquat at 500 g ha⁻¹ had marked effect on weed growth over no pre-sowing application under zero tillage

treatments (Tables 1 and 2).

Two times application of herbicides, one as pre-sowing (paraquat 500 g ha⁻¹) and other as post-emergence (2,4-D 500 g ha⁻¹ or isoproturon 1.0 kg ha⁻¹ or mixture of both herbicides) at 30 DAS was significantly superior over no herbicide application. Similar findings of maximum reduction in weed density and dry matter were obtained with combined application of diclofop methyl and isoproturon by Singh *et al.* (2001).

Effect on Crop

Grain yield of wheat under zero tillage was significantly higher compared to conventional tillage and the yield increase was around 8% in four years (Tables 1 and 2). The present findings are in conformity with those of Chauhan *et al.* (2000). Application of herbicide as pre-sowing or post-emergence proved to be effective compared to no spray under zero tillage or conventional tillage. Application of isoproturon at 1.0 kg ha⁻¹ mixed with 2,4-D proved best resulting in higher wheat yield under zero tillage. The present findings are in conformity with the findings of Singh *et al.* (2001) who reported best yield advantage by applying mixture of 2,4-D at 500 g and isoproturon at 1.0 kg ha⁻¹.

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