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Relative Composition of Weeds and Wheat Yield as Influenced by Different Weed Control and Tillage Practices

P. K. Bisen, R. K. Singh and R. P. Singh
Department of Agronomy
Institute of Agricultural Sciences
Banaras Hindu University, Varanasi-221 005 (U. P.), India

ABSTRACT

Tillage practices and weed control treatments had marked effect on weeds density and total weed dry matter production in wheat. The lowest density of *Phalaris minor, Cynodon dactylon, Cyperus rotundus, Anagallis arvensis* and *Chenopodium album* was recorded in zero tillage. The maximum density of weed species was observed in conventional tillage. Weed dry matter production was significantly less in zero tillage and more in conventional tillage. Sulfosulfuron at 33.3 g ha^{-1} had minimum density of all the major weeds and dry matter production by weeds. Conventional tillage recorded maximum number of earheads m^{-2}, grains per earhead, test weight and grain yield, which were minimum in zero tillage treatment. Sulfosulfuron recorded maximum values of all the yield attributes and gave highest grain yield.

INTRODUCTION

In India, wheat is one of the important winter cereals contributing approximately 30-35% to total food grain basket of the country. Of the total energy input in agriculture, the major portion of it (25-30%) is utilized for field preparation and crop establishment. The rising cost of diesel, lubricants and unavailability of labourers necessitated a rethinking about optimizing tillage operations. The major problem under high input wheat production system is interference of weeds which alone cause 33% reduction in yield (Anonymous, 1994). The extent of yield reduction largely depends on growth behaviour of individual weed species in relation to agro-ecological conditions (Singh *et al.*, 1997). For the last three decades, isoproturon has been extensively used for managing weed in wheat under high input conditions. However, increased use of isoproturon led to the evolution of resistant *Phalaris minor* Retz. biotypes and also shift in weed flora (Malik and Singh, 1993). In recent years, some new herbicidal molecule like metribuzin 250-300 g/ha and sulfosulfuron 30-45 g/ha have been found quite effective against associated weeds of wheat and other weeds (Dixit and Bhan, 1997). In general, *P. minor, Avena* spp., *Chenopodium album, Melilotus* spp., *Cyperus rotundus* and *Cynodon dactylon* are found to be the major weeds. Keeping the above fact in view, the investigation was carried out to assess the relative composition of weeds as influenced by weed control and tillage practices.

MATERIALS AND METHODS

The study was conducted at Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, U.P. during two consecutive **rabi** (winter) seasons of 1998-99 and 1999-2000. The soil was sandy clay loam, organic carbon (0.32%), available nitrogen (174.0 kg/ha), P_2O_5 (26.0 kg/ha) and K_2O (218.4 kg/ha) contents with a pH of 7.4. The experiment was conducted in split plot design with 18 treatment combinations (i) conventional tillage (two disc followed by two cultivator ploughing), (ii) zero tillage (zero till drill) and (iii) reduced tillage (one disc followed by one cultivator ploughing) were assigned to main plots and weed control treatments viz., metribuzin (250 g/ha), sulfosulfuron (33.3 g/ha), isoproturon (1000 g/ha), isoproturon+2, 4-D Na salt (750+500 g/ha), weed-free (weeds were removed with the help of hand hoe

Table 1. Weed density (No./m^2) of major weeds and total weed dry matter at 60 DAS as affected by treatments (Average data of two years)

Treatment	Dose (g ha^{-1})	*Phalaris minor*	*Cynodon dactylon*	*Cyperus rotundus*	*Rumex denticulate*	*Anagallis arvensis*	*Chenopodium album*	Weed dry matter (g/m^2)
Tillage								
Conventional	-	5.0	4.6	5.2	6.5	8.4	5.8	35.9
Zero	-	2.4	4.1	3.5	6.7	3.7	4.6	30.2
Reduced	-	3.9	4.8	4.6	5.9	5.8	6.4	32.9
LSD (P=0.05)	-	-	-	-	-	-	-	1.7
Weed control								
Metribuzin	250	2.5	4.9	4.1	5.2	8.7	2.5	30.7
Sulfosulfuron	33.3	1.9	3.3	3.8	3.9	7.1	2.1	29.7
Isoproturon	1000	2.7	4.1	5.8	12.6	3.9	4.4	33.1
Isoproturon+2, 4-D	750+500	3.1	3.2	4.3	11.0	4.3	3.9	31.7
Weed-free	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Weedy check	-	13.5	6.2	9.8	24	12.5	10	72.8
LSD (P=0.05)	-	-	-	-	-	-	-	1.3

Table 2. Yield attributes and grain yield of wheat as affected by treatments (Average data of two years)

Treatment	Dose (g ha^{-1})	Earheads m^{-2}	Grains earhead^{-1}	1000-grain weight (g)	Grain yield of wheat (kg ha^{-1})
Tillage					
Conventional	-	212	43	42.3	4620
Zero	-	187	40	40.8	4323
Reduced	-	208	41	42.1	4457
LSD (P=0.05)	-	2.7	0.8	1.3	150
Weed control					
Metribuzin	250	212	43	42.4	4542
Sulfosulfuron	33.3	224	45	42.8	4781
Isoproturon	1000	183	39	41.3	4133
Isoproturon+2, 4-D	750+500	199	31	41.8	4376
Weed-free	-	232	46	43.7	5339
Weedy check	-	167	36	40.3	3828
LSD (P=0.05)	-	2.6	0.7	0.5	165

during entire crop period) and weedy check were allocated to sub-plots. All herbicides were applied as post-emergence (35 DAS) with the help of flat nozzle foot sprayer. The experiment consisted four replications. Wheat variety HUW-234 was sown at row spacing of 20 cm apart during December and uniform basal dose of 40 kg N, 60 kg P_2O_5 and 60 kg K_2O was applied at the time of sowing and remaining 80 kg N was top dressed after first irrigation. The experimental crop was grown adopting recommended package of practices. The total weeds present in randomly selected quadrates were counted species-wise and weed samples were sun-dried and put in the electric oven at 70°C for 48 h for complete drying to obtain constant weight.

RESULTS AND DISCUSSION

Effect on Weeds

The major weed species were *Phalaris minor, Cynodon dactylon, Cyperus rotundus,* *Anagallis arvensis, Rumex denticulate* and *Chenopodium album* in all the tillage and weed control treatments.

At 60 days stage, population of *P. minor*, one of the most serious weeds of wheat, was less in zero tillage when compared with conventional tillage and reduced tillage (Table 1). This might be due to the fact that *P. minor* seeds remained buried in deeper soil layer and could not come to top soil layer favourable for seed germination (Sen *et al.*, 2002). The mean density of all the weeds, except *R. denticulate* was also minimum in zero tillage. Singh (2000) also reported decreased infestation of *P. minor* and increased infestation of *Rumex acetosella* in zero tillage wheat crop.

The total weed dry matter production was significantly less in zero tillage and more in conventional tillage treatment (Table 1). This can be attributed to reduced density of major weeds under this treatment.

Herbicides application significantly reduced the density of major weeds and their dry matter production when compared with weedy check. Sulfosulfuron had significantly lower density of major weed species and total dry matter production of weeds. This treatment was significantly superior to metribuzin, isoproturon and isoproturon+2, 4-D. Chauhan *et al.* (2000) also reported that sulfosulfuron and metribuzin were effective against both grassy and non-grassy weeds in wheat.

Effect on Crop

The grain yield of wheat and yield attributes differed significantly due to tillage and weed control treatments. Conventional tillage had significantly higher number of earheads m^{-2}, grains per earhead and test weight resulting in higher grain yield (Table 2). This might be due to increased availability of NO_3-N in conventional tillage that resulted to better growth, development of yield attributes and finally grain yield (Arshad *et al.*, 1995). Singh *et al.* (1998) also observed higher grain yield of wheat in conventional tillage than zero-till wheat crop.

All the herbicide treated plots produced grain yield significantly higher than weedy check. Sulfosulfuron applied at 33.3 g ha^{-1} yielded significantly higher than metribuzin, alone application of isoproturon and its mixture with 2, 4-D (Table 2). The higher yield in this treatment was due to lower weed density, weed dry matter production and higher values of yield attributes.

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