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Effect of Tillage and Herbicides on Weeds and Wheat in Transplanted Rice-Wheat System

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ABSTRACT

Different tillage practices did not influence the population and dry matter of weeds and yield of wheat. Infestation of weeds caused 65% reduction in wheat grain yield. Post-emergence application of clodinafop at 0.06 kg ha^{-1} fb 2, 4-D at 0.50 kg ha^{-1} significantly reduced the population and dry matter of weeds and increased the grain yield of wheat. This combination proved more effective than isoproturon at 1.0 kg ha^{-1}+2, 4-D at 0.50 kg ha^{-1}.

INTRODUCTION

Zero tillage technology of wheat sowing is becoming increasingly popular in rice-wheat cropping system of Indo Gangetic Plains. Weeds are the major hurdle in the adoption of zero tillage technology in wheat (Keeling, 1995). Though zero tillage in wheat fields reduced the infestation of *Phalaris minor*, it aggravated the problem of *Avena ludoviciana* and some broad-leaved weeds (Yaduraju and Mishra, 2002). Uncontrolled weeds caused 10-50% reduction in wheat yield (Walia *et at.*, 1990). Presently, isoproturon is being used for effective control of susceptible *P. minor* and few broad-leaved weeds in wheat but its activity against *A. ludoviciana* is very less. Hence, there is an urgent need to evaluate alternative herbicide to control this weed in wheat.

MATERIALS AND METHODS

A field experiment was conducted at National Research Centre for Weed Science, Jabalpur (23°90' N, 79°58' E, and 412 m above mean sea level) during the winter seasons of 2003-04 and 2004-05. The soil was clayey in nature, medium in organic carbon (0.66%). low in available nitrogen (239 kg ha^{-1}), medium in available phosphorus (17 kg ha^{-1}) and potassium (298 kg ha^{-1}) with neutral in reaction (pH 7.2). After the harvest of transplanted rice, 12 treatment combinations consisting of four tillage packages viz., zero tillage (ZT) immediately after rice, ZT with pre-sowing application of glyphosate, conventional tillage (CT) and deep tillage (DT) as main-plot treatments and three weed control practices viz., weedy, isoproturon at 1.0 kg ha^{-1}+2, 4-D at 0.5 kg ha^{-1} and clodinafop at 0.06 kg ha^{-1} fb 2, 4-D at 0.5 kg ha^{-1} as sub-plot treatments were laid out in split-plot design replicated four times. DT consisted of disc ploughing once+cultivator twice+rotavator and planting, CT with cultivator twice+leveller and planting and ZT comprised planting directly with zero-till seed drill in the presence of anchored rice stubbles. In ZT with pre-sowing application of glyphosate, emerged weeds were killed with glyphosate at 1.0 kg ha^{-1} before sowing of crop. The sowing of ZT immediately after rice was done on 16 November, whereas sowing of ZT with pre-sowing application of glyphosate, CT and DT was done on 27 November during both the years. Wheat variety WH-147 was sown by tractor mounted zero till seed-cum-fertilizer drill in rows 20 cm apart in ZT but in the plots receiving conventional and deep tillage treatments, the seeds were sown with the normal seed-cum-fertilizer drill at the same row spacing. Isoproturon+2, 4-D was

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Table 1. Effect of tillage packages and herbicides on weed density (No. m^{-2})* at 50 days after sowing (Pooled data for 2003-04 and 2004-05)

Treatment	*A. ludoviciana*	*P. minor*	*M. hispida*	*C. album*	*V. sativa*	*L. aphaca*	Total weeds
ZT	16.02	1.64	5.04	1.66	1.06	1.05	17.54
	(325)	(3)	(30)	(3)	(1)	(1)	(367)
ZT with pre-sowing	14.30	1.40	4.89	1.56	0.98	1.32	16.01
application of glyphosate	(251)	(2)	(33)	(3)	(1)	(1)	(291)
Conventional tillage	14.54	1.64	4.86	2.00	0.97	0.87	16.17
	(259)	(3)	(33)	(4)	(1)	(0)	(300)
Deep tillage	14.69	1.55	5.49	1.78	1.26	1.79	16.75
	(263)	(2)	(38)	(4)	(1)	(4)	(318)
LSD (P=0.05)	NS	NS	NS	NS	NS	NS	NS
Weedy	16.46	1.93	7.33	2.35	1.41	1.78	22.98
	(275)	(4)	(59)	(6)	(2)	(4)	(545)
Isoproturon+2, 4-D	12.71	1.45	1.80	1.31	0.88	0.92	17.57
	(163)	(2)	(3)	(2)	(0)	(0)	(324)
Clodinafop fb 2, 4-D	7.04	1.30	6.08	1.60	0.993	1.08	9.20
	(50)	(2)	(38)	(3)	(0)	(1)	(87)
LSD (P=0.05)	1.63	0.51	1.26	0.66	0.45	0.57	1.71

*Original values are in parentheses. Data subjected to square root transformation.
NS–Not Significant.

applied as tank mixed in 500 litres of water ha^{-1} at 25 days after sowing (DAS), while clodinafop and 2, 4-D were sprayed separately at 25 and 30 DAS, respectively, each in 500 litres of water ha^{-1} by knapsack sprayer using flat fan nozzle.

Weed population was recorded at 50 days after sowing and weed biomass was recorded at harvest from randomly selected four places from each plot by using quadrate. Weed data were subjected to square root transformation $\sqrt{x+0.5}$, before statistical analysis.

RESULTS AND DISCUSSION

The major weeds observed in the experimental plots were *Avena ludoviciana* (73.00%), *Phalaris minor* (0.62%), *Medicago hispida* (23.15%), *Chenopodium album* (2.61%), *Vicia sativa* (0.14%) and *Lathyrus aphaca* (0.41%). Tillage packages did not influence population and dry weight of weeds (Table 1). Tomar *et al.* (2002) reported that levels of tillage did not significantly affect the number and biomass of weeds in wheat. The dominance of *A. ludoviciana* in the field suppressed the other weeds resulting in reduced population of *P. minor* and other weeds under all the tillage packages.

Clodinafop fb 2, 4-D had significantly lower weed density than isoproturon+2, 4-D. This was due to better efficacy of clodinafop against *A. ludoviciana*, which accounted for more than 65% of the weed population. The effective control of grassy weeds by clodinafop was also reported by Brar *et al.* (2000). Poor efficacy of isoproturon+2, 4-D in controlling *A. ludoviciana* was also reported by Malik *et al.* (1988). Isoproturon+2, 4-D reduced the population and dry weight of *M. hispida, C. album, V. sativa* and *L. aphaca.*

Tillage practices did not affect yield attributes and yield of wheat. Weeds caused 65% reduction in grain yield of wheat. Herbicidal treatments recorded significantly higher grain and straw yield than weedy check (Table 2). Significantly higher grain and straw yields were recorded under clodinafop fb 2, 4-D (4385 kg ha^{-1}) than isoproturon+2, 4-D (2309 kg ha^{-1}) obviously due to

Table 2. Effect of tillage packages and herbicides on weed dry weight, weed control efficiency, yield attributes and yield of wheat (Pooled data for 2003-04 and 2004-05)

Treatment	Weed dry weight ($g\ m^{-2}$)	Weed control efficiency (%)	Spikes (No. m^{-2})	Grains $spike^{-1}$	1000-grain weight (g)	Grain yield ($kg\ ha^{-1}$)	Straw yield ($kg\ ha^{-1}$)	Harvest index (%)
ZT	3.75 (14)	59.5	183	45.5	40.9	2679	3242	43.1
ZT with pre-sowing application of glyphosate	3.72 (13)	56.5	186	49.5	41.3	2787	3438	43.0
Conventional tillage	3.56 (12)	62.7	189	49.5	41.7	2870	3601	42.8
Deep tillage	3.67 (13)	63.7	184	45.5	41.2	2635	3330	42.4
LSD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS
Weedy check	4.70 (22)	0.0	155	43.5	39.4	1534	2780	36.1
Isoproturon+2, 4-D	3.41 (11)	49.7	180.5	48	41.1	2309	3353	40.1
Clodinafop fb 2, 4-D	2.63 (6)	71.5	220.5	51	43.8	4385	4075	52.2
LSD (P=0.05)	0.36		12.35	4.50	2.2	456	605	4.7

*Original values are in parentheses. Data subjected to square root transformation.
NS–Not Significant.

better weed control.

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