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Bioefficacy of herbicides in late-sown wheat (*Triticum aestivum*)

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ABSTRACT

A field study was conducted during winter (*rabi*) seasons of 2000–2002 at Varanasi, to study the bioefficacy of oryzalin (0.05, 0.75, 1.00,1.25 and 1.50 kg/ha), triasulfuron (0.015 and 0.020 kg/ha), pendimethalin (1.0 kg/ha) as pre-emergence and dicamba (0.025 kg/ha) as post-emergence in late-sown wheat (*Triticum aestivum* L. emend. Fiori & Paol.). All the herbicide treatments reduced the density and dry weight of narrow and broad-leaved weeds significantly compared with weedy check. Pre-emergence application of oryzalin at 1.25 kg/ha had minimum population and dry weight of weeds compared with other herbicides and their doses. Dicamba at 0.025 kg/ha was the most effective against broad-leaved weeds compared with other herbicides. Triasulfuron at 0.020 kg/ha proved more effective than its lower dose (0.015 kg/ha) and controlled both narrow and broad-leaved weeds. The maximum weed-control efficiency (76.65%) and grain yield (27.48 q/ha) were recorded with oryzalin at 1.25 kg/ha, followed by pendimethalin at 1.0 kg/ha and triasulfuron at 0.020 kg/ha.

Key words : Oryzalin, Triasulfuron, Dicamba, Weed, Wheat

In rice–wheat sequence, the wheat sowing gets delayed due to cultivation of long-duration rice (*Oryza sativa* L.) varieties. High initial soil moisture and low temperature at sowing lead to severe infestation of grassy and non-grassy weeds in late-sown wheat. Uncontrolled weeds reduced wheat yield to the tune of 20–57% (Singh *et al.*, 1997). Commonly used wheat herbicide isoproturon controls grassy weeds only and had little effect on troublesome broad-leaved weeds. Further, continuous use of isoproturon may lead to development of resistant biotypes of *Phalaris minor* (Malik *et al.*, 1996; Walia *et al.*, 1997). Hence it is essential to identify an alternative herbicide molecules with broad-spectrum activity for sustainable weed management in wheat. Keeping these facts in view, present investigation was undertaken to find out the most effective herbicide to manage weeds in late-sown wheat.

MATERIALS AND METHODS

The investigation was carried out during winter seasons of 2000–2002 at Varanasi. The soil alluvial with medium available potassium (K_2O) (236.7 kg/ha) and low available N (220.2 kg/ha) and phosphorus (P_2O_5) (20.51 kg/ha). The treatments consisted of 5 doses of oryzalin (0.50, 0.75, 1.00, 1.25 and 1.50 kg/ha), 2 doses of triasulfuron (0.015 and 0.020 kg/ha) and 1 dose each of pendimethalin (1.00 kg/ha) and dicamba (0.025 kg/ha) along with hand weedings (30 and 45 days after sowing) and unweeded check. The experiment was laid out in randomized block design, replicated thrice. Oryzalin, triasulfuron and pendimethalin were applied as pre-emergence (2 days after sowing) and dicamba as post-emergence (30 days after sowing). Wheat cv. 'HUW 234' was sown on 28 November in 2000 and 30 November in 2001 with the help of fertiseed drill at a row spacing 20 cm with 100 kg seed/ha.

RESULTS AND DISCUSSION

Effect on weeds

The major weeds observed in weedy check plots 60 days after sowing were : *Rumex spinosus* L. (23.51%), *Chenopodium album* L. (14.30%), *Syndrella noduflora* L. (10.70%), *Melilotus* sp. (11.24%), *Anagallis arvensis* L. (5.30%) and *Vicia hirsuta* L. (2.50%) among broad-leaved weeds; and *Phalaris minor* (Retz.) (18.22%), *Cynodon dactylon* (L.) Pers. (10.90%) and *Cyperus rotundus* L. (3.60%) among narrow-leaved weeds.

The species-wise composition of weeds (Table 1) revealed that oryzalin at 1.25 kg/ha was the most effective herbicide in minimizing the weed population and was comparable to 2 hand-weedings (30 and 45 DAS) having the minimum weed population. Application of dicamba at 0.025 kg/ha was the most effective in controlling broad-leaved weeds, but was less effective than all the pre-emergence herbicides against narrow-leaved weeds.

The weed dry weight was the lowest (2.82 g/m^2) in

Table 1. Effect of herbicides on weed population 60 days after sowing (pooled data of 2000–2001 and 2001–2002)

Treatment	Rate (kg/ha)	Broad-leaf weeds								Grassy weeds			
		Chenopodium album	*Syndrella noduflora*	*Rumex spinosus*	*Melilotus alba*	*Melilotus indica*	*Anagallis arvensis*	*Vicia hirsuta*	Total	*Phalaris minor*	*Cynodon dactylon*	*Cyperus rotundus*	Total
Oryzalin	0.50	3.5 (12.0)	4.0 (15.6)	4.2 (18.0)	3.6 (13.0)	2.5 (6.0)	2.8 (8.0)	2.1 (4.3)	8.7 (77.0)	4.9 (23.6)	3.7 (14.0)	3.7 (12.3)	7.0 (50.0)
Oryzalin	0.75	2.0 (8.0)	3.2 (10.0)	3.5 (12.0)	2.7 (7.0)	1.7 (3.0)	2.3 (5.3)	1.7 (2.6)	6.7 (48.0)	4.52 (20.0)	3.22 (10.0)	3.5 12.6)	6.3 40.0)
Oryzalin	1.00	2.3 (5.7)	2.5 (6.00)	3.0 (13.0)	2.1 (4.3)	1.2 (11.6)	2.6 (5.6)	1.6 (2.6)	5.8 (34.6)	3.6 (13.0)	2.8 (8.0)	3.5 (12.3)	5.7 (33.3)
Oryzalin	1.25	1.2 (2.3)	1.8 (3.0)	2.8 (8.0)	0.7 (0.0)	0.7 (0.0)	12.1 (1.0)	0.8 (0.3)	3.7 (13.6)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)
Oryzalin	1.50	0.9 (1.6)	3.5 (12.0)	3.0 (9.9)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (21.6)	4.6 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)
Pendimethalin	1.00	0.99 (0.6)	2.5 (6.0)	3.0 (8.6)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	3.9 (15.3)	3.6 (13.0)	3.4 (12.0)	3.2 (10.0)	5.6 31.6)
Triasulfuron	0.015	2.0 (4.0)	2.7 (7.33)	3.2 (10.0)	2.1 (4.3)	1.9 (3.3)	2.2 (4.6)	0.9 (0.0)	6.0 (37.0)	3.9 (15.6)	3.6 (13.3)	4.5 (20.0)	6.9 (49.0)
Triasulfuron	0.020	1.9 (3.3)	2.5 (6.3)	2.9 (8.6)	2.3 (5.0)	0.8 (0.6)	2.0 (3.6)	0.7 (0.0)	5.3 (27.3)	4.0 (16.0)	3.6 (12.6)	4.2 (18.0)	65.8 (46.6)
Dicamba	0.025	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	4.5 (20.0)	3.6 (12.6)	4.5 (20.6)	7.2 (53.3)
Hand-weeding (30 and 45 DAS)		0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)
Unweeded check		5.3 (28.0)	4.6 (21.0)	6.8 (46.0)	1.7 (13.6)	2.9 (8.6)	2.3 (10.3)	2.31 (5.6)	11.3 (124.0)	5.9 (35.6)	4.6 (21.3)	3.8 (14.6)	8.4 (71.6)
CD (P=0.05)		2.6	0.2	0.1	0.2	0.6	0.4	0.5	3.9	0.6	0.6	0.5	0.7

Figures in parentheses indicate original values

Table 2. Effect of herbicides on weed-control efficiency, grain yield and weed index (pooled data of 2000–2001 and 2001–2002)

Treatment	Rate (kg/ha)	Dry weight of weeds at 60 DAS (g/m²)	Weed-control efficiency (%)	Grain yield (q/ha)	Weed index
Oryzalin	0.50	6.90 (47.33)	19.70	14.03	50.50
Oryzalin	0.75	6.15 (37.48)	32.90	15.86	44.14
Oryzalin	1.00	4.37 (18.72)	40.80	20.78	26.82
Oryzalin	1.25	2.82 (7.50)	76.65	27.48	03.23
Oryzalin	1.50	3.12 (9.42)	71.94	16.43	42.13
Pendimethalin	1.00	3.08 (9.20)	50.75	24.44	13.93
Triasulfuron	0.015	4.35 (18.52)	33.80	18.47	34.95
Triasulfuron	0.020	4.03 (15.8)	37.95	22.37	21.22
Dicamba	0.025	3.17 (9.66)	62.40	18.29	35.58
Hand-weeding (30 and 45 DAS)		0.70 (0.00)	92.91	28.40	
Unweeded check		87.04	9.35	12.88	54.63
CD (P=0.05)		0.44		0.14	

Figures in parentheses indicate

oryzalin at 1.25 kg/ha, followed by pendimethalin (3.08 g/m²) and triasulfuron (4.03 g/m²). Weed-control efficiency was the maximum (76.65%) in oryzalin 1.25 kg/ha due to minimum weed population in this treatment. The poor efficiency of pendimethalin might be due to emergence of weeds at later stages of crop growth because of its shorter persistence effect. Kulshreshtha and Yaduraju (1987) also reported shorter persistence of pendimethalin in wheat.

Effect on crop

Application of oryzalin at 1.25 kg/ha resulted in maximum grain yield (27.48 q/ha) which was comparable to hand-weeding treatment (30 and 45 DAS). This was owing to effective control of both narrow and broad-leaved weeds, as indicated by the minimum weeds population and dry weed weight (Table 2). This treatment was significantly superior to pendimethalin (24.44 q/ha) and triasulfuron (22.37 q/ha) which in turn were significantly superior to post-emergence application of dicamba. The low yield with dicamba could be attributed to its poor efficacy against grassy weeds, particularly *Phalaris minor* which was one of the serious competitors of wheat crop. The maximum reduction in wheat yield (54.63%) due to weeds was recorded in weedy check plot and minimum (3.23%) in oryzalin at 1.25 kg/ha.

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