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Efficacy of Clodinafop and Fenoxaprop in Combination with Isoproturon Against *Polypogon monspeliensis* and *Phalaris minor* in Wheat

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Abstract

Clodinafop and fenoxaprop alone and in combination with isoproturon were evaluated against *Polypogon monspeliensis* and *Phalaris minor* along with few broadleaf weeds in wheat during 2005-06 and 2006-07. Maximum reduction in the population of *P. monspeliensis* was due to isoproturon 1,000 g/ha during both years. Fenoxaprop 120 g and clodinafop 60 g/ha being quite effective against *P. minor* did not provide satisfactory control of *P. monspeliensis* and these were also ineffective against broadleaf weeds. In general, fenoxaprop 100 g/ha or clodinafop 50 g/ha tank mixed with isoproturon 500 g/ha proved quite effective against both of the grassy weeds in question besides extending satisfactory control of broadleaf weeds. Consequently, the grain yield of wheat was comparatively higher under these herbicidal treatments. Isoproturon beyond 5,000 g/ha in the tank mix application was not of much use. There was no phytotoxicity due to any herbicidal treatment on wheat.

Key words : *Polypogon monspeliensis, Phalaris minor,* Isoproturon, Clodinafop, Fenoxaprop.

Littleseed canary grass (*Phalaris minor* Retz.) is the most dominant grassy weed of wheat in north-western India under rice-wheat cropping system (1). However, *Polypogon monspeliensis* (L.) Desf., commonly known as foxtail grass is an important weed in scattered fields of wheat particularly where high moisture is retained in soil for a longer period normally along channel sides. Clodinafop, fenoxaprop and sulfosulfuron were recommended in 1998 and widely adopted for the control of isoproturon-resistant *P. minor* in wheat (2). But we have an experience that these herbicides are not quite effective against *P. monspeliensis*; whereas, isoproturon was found effective against *P. monspeliensis*. Moreover, infestation of *P. mospeliensis* is increasing year by year. Any management option for other grassy weeds including *P. mospeliensis* would be viable only when *P. minor* is also controlled effectively. Hence, combinations of fenoxaprop and clodinafop with isoproturon were evaluated against *P. mospeliensis* together with *P. minor* to find out viable herbicidal combination against both weeds in wheat.

Methods

A field experiment was conducted at CCS Haryana Agricultural University Regional Research Station, Karnal during *rabi* of 2005-06 and 2006-07 to evaluate the efficacy of tank-mix combinations of clodinafop and fenoxaprop with isoproturon against grassy weeds particularly *Polypogon monspeliensis* and *Phalaris minor* in wheat. The soil of experimental field was clay loam in texture, low in organic carbon (0.35%), medium in available P_2O_5 (11 kg/ha) and high in K_2O (304 kg/ha) with slightly alkaline in reaction (pH 8.1). The treatments included isoproturon 1000 g/ha, combinations of fenoxaprop alone 100 g/ha and clodinafop 50 g/ha each with varying doses of isoproturon viz. 250, 500, 750 and 1,000 g/ha; fenoxaprop 100 g/ha + S (surfactant), 120 g/ha and clodinafop 60 g/ha along with weed free and weedy checks. The experiment was laid out in randomized block design with three replications. All the herbicides were applied at 35 days after sowing by knapsack sprayer fitted with flat fan nozzle using 500 liter

Table 1. Effect of fenoxaprop and clodinafop in combination with isoproturon on density and dry weight of weeds in wheat. *Original figures in parentheses were subjected to square root transformation (√X+1) before statistical analysis; **S=Surfactant.

Treatments	Dose (g/ha)	Weed density* (No./m^2) *Polypogon monspeliensis* 05-06	*Polypogon monspeliensis* 06-07	*Phalaris minor* 05-06	*Phalaris minor* 06-07	Broad-leaved weeds 05-06	Broad-leaved weeds 06-07
Isoproturon (IPU)	1000	2.6 (6.0)	2.5 (5.3)	1.8 (2.7)	8.1 (64.0)	1.7 (2.7)	1.2 (0.7)
Fenoxaprop (FNP)	100+S**	7.4 (54.7)	6.8 (45.3)	3.3 (10.0)	5.3 (27.3)	5.7 (32.7)	4.3 (18.0)
FNP	120	7.3 (53.3)	6.9 (47.3)	2.3 (4.7)	5.9 (34.0)	6.1 (36.7)	3.9 (15.3)
Clodinafop (CDF)	60	7.6 (56.7)	6.7 (44.0)	2.2 (4.0)	3.6 (16.0)	6.5 (41.3)	4.1 (16.0)
FNP + IPU	100+250+S	4.6 (20.3)	4.4 (18.7)	2.9 (7.3)	5.8 (32.7)	4.0 (15.3)	1.7 (2.7)
FNP + IPU	100+500+S	4.0 (15.3)	3.2 (9.3)	2.3 (4.7)	4.9 (22.7)	4.1 (16.0)	1.8 (2.7)
FNP + IPU	100+750+S	3.6 (12.0)	3.1 (8.7)	2.0 (3.3)	3.6 (16.0)	2.9 (8.0)	1.0 (0.0)
FNP + IPU	100+1000+S	2.8 (7.3)	2.3 (4.7)	2.2 (4.0)	3.2 (11.3)	2.2 (4.7)	1.0 (0.0)
CDF + IPU	50+250	4.5 (19.7)	4.1 (16.0)	1.4 (1.3)	5.9 (34.0)	3.7 (13.3)	1.2 (0.7)
CDF + IPU	20 + 500	3.5 (11.3)	3.2 (9.3)	2.0 (3.3)	4.0 (19.3)	4.0 (15.3)	1.4 (1.3)
CDF + IPU	50 + 750	3.4 (10.7)	3.3 (10.0)	2.6 (6.0)	3.4 (14.0)	3.4 (10.7)	1.0 (0.0)
CDF + IPU	50 + 1000	3.2 (9.3)	2.9 (7.3)	2.0 (3.3)	3.6 (15.3)	2.5 (5.3)	1.0 (0.0)
Weed free	–	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.0 90.0)
Weedy check	–	10.3 (104.7)	6.3 (38.7)	7.1 (49.3)	14.5 (209.3)	6.1 (36.0)	3.4 (10.7)
CD 5%		0.9	0.7	0.9	2.4	1.3	1.0

Table 1. Continued.

Treatments	Dose (g/ha)	Weed dry weight (g/m^2) Grassy weeds 05-06	Grassy weeds 06-07	Broad-leaved weeds 05-06	Broad-leaved weeds 06-07
Isoproturon (IPU)	1000	34.0	36.6	5.4	0.5
Fenoxaprop (FNP)	100+S**	33.1	12.7	13.8	2.7
FNP	120	34.5	18.8	13.2	3.1
Clodinafop	60	34.0	7.1	13.3	2.6
FNP + IPU	100+250+S	33.6	14.5	8.3	0.1
FNP + IPU	100+500+S	32.1	5.5	8.5	0.2
FNP+IPU	100+750+S	30.0	5.9	8.1	0.0
FNP+IPU	100+1000+S	33.6	1.7	8.4	0.0
CDF+IPU	50+250	33.2	17.8	8.5	0.1
CDF+IPU	20+500	29.4	9.8	8.8	0.1
CDF+IPU	50+750	32.7	7.1	8.3	0.0
CDF+IPU	50+1000	33.6	8.3	8.6	0.0
Weed free	–	0.0	0.0	0.0	0.0
Weedy check	–	71.7	161.7	9.2	2.6
CD 5%		6.2	12.4	2.5	0.7

water/ha. Wheat cultivar PBW 343 was sown on 16 November during *rabi* of 2005-06 and PBW 502 on 20 November during *rabi* of 2006-07, using seed rate of 125 kg/ha with row to row spacing of 20 cm. Crop was raised with recommended package of practices of the State University. Continuous moist condition was maintained to induce the emergence of *P. monspeliensis.* Density and dry weight of weeds were recorded at 75 days after sowing (DAS), and yield and yield attributes at harvest. Data on crop phytotoxicity were recorded at 15 and 30 days after treatment. Since there was no phytotoxicity on the crop, data on this issue have not been included. Crop was harvested on 22 April, 2006 and 21 April, 2007.

Results and Discussion

Effect on Weeds

Weed flora of the experimental field was dominated by *Phalaris minor* Retz. and *Polypogon*

Table 2. Effect of fenoxaprop and clodinafop in combination with isoproturon on yield and yield attributes of wheat. *mrl = meter row length; **S=Surfactant.

Treatments	Dose (g/ha)	Plant height (cm)		Effective tillers No./mrl*)		Ear-head length (cm)		Grain yield (kg/ha)	
		05-06	06-07	05-06	06-07	05-06	06-07	05-06	06-07
Isoproturon (IPU)	1000	84.1	85.8	92.7	65.8	9.5	9.3	5501	4572
Fenoxaprop (FNP)	100+S**	84.2	85.9	92.7	69.5	9.5	9.5	5154	5147
Fenoxaprop	120	82.8	87.4	94.3	70.2	9.3	9.9	5265	5090
Clodinafop (CDF)	60	84.1	87.5	95.0	74.5	9.5	9.8	5587	5458
FNP + IPU	100+250+S	84.2	86.8	97.0	73.8	9.7	9.4	5439	5356
FNP + IPU	100 + 500 + S	83.1	86.9	99.3	81.7	9.5	9.8	5476	5572
FNP + IPU	100 + 750 + S	83.5	86.9	102.0	77.7	9.4	9.7	5476	5478
FNP + IPU	100 + 1000 + S	84.7	86.7	93.3	78.3	9.3	9.7	5451	5468
CDF + IPU	50 + 250	83.4	86.7	102.0	75.3	9.5	9.5	5449	5311
CDF + IPU	20 + 500	84.5	86.0	94.3	78.7	9.3	9.6	5640	5606
CDF + IPU	50 + 750	84.5	85.9	97.7	77.7	9.5	9.5	5851	5505
CDF + IPU	50 + 1000	84.2	86.3	96.7	75.3	9.3	9.7	5826	5501
Weed free	–	84.7	87.3	103.0	81.7	9.8	9.9	5850	5760
Weedy check	–	82.5	85.9	79.0	47.3	9.2	9.1	4514	3027
CD 5%		NS	NS	11.4	12.3	NS	0.4	606	512

monspeliensis (L.) Desf. among grasses, and *Melilotus indica* L., *Medicago denticulata* L., *Coronopus didymus* L., *Vicia sativa* L. and *Anagallis arvensis* L. among broad-leaved weeds.

Among different herbicidal treatments, the density of *P. monspeliensis* was lowest under isoproturon 1,000 g/ha during both the years (Table 1). Fenoxaprop and clodinafop alone did not provide satisfactory control of *P. monspeliensis.* However, the density of *P. monspeliensis* decreased significantly under tank mix application of isoproturon each with fenoxaprop or clodinafop and it decreased with the increasing dose of isoproturon. Isoproturon also provided good control of *P. minor* as well during 2005-06 but not during 2006-07 (Table 1). Clodinafop 60 g/ha provided good control of *P. minor* during both the years. Fenoxaprop 120 g/ha during both the years and fenoxaprop 100 g/ha + S during 2006-07 was also at par with clodinafop in respect of density of *P. minor.* Tank mix applications of fenoxaprop with varying doses of isoproturon provided similar density of *P. minor* except fenoxaprop 100 g + isoproturon 250 g/ha being inferior to fenoxaprop 100 g + isoproturon 1,000 g/ha during 2006-07. Similarly, tank mix treatments of clodinafop were at par with each other in respect of *P. minor* density except clodinafop 50 g + isoproturon 250 g/ha being inferior to clodinafop 50 g + isoproturon 750 g/ha during 2006-07.

All the herbicidal treatments provided similar dry weight of grassy weeds and were superior to weedy check but inferior to weed free check during 2005-06. During 2006-07 clodinafop 60 g/ha, clodinafop 50 g/ha + isoproturon 500—1000 g/ha and fenoxaprop 100 g + isoproturon 500—1,000 g/ha resulted in dry weight of grassy weeds at par with weed free check. Both the treatments of fenoxaprop alone and isoproturon 1000 g/ha were inferior to weed free check in respect of dry weight of grassy weeds. Isoproturon as tank mix with tralkoxydim (ACCase inhibitor) has been reported to be effective against *P. monspeliensis* earlier (3).

Clodinafop and fenoxaprop alone did not reduce the density and dry weight of broad leaved weeds (Table 1). Isoproturon 1000g/ha reduced the density of broad leaved weeds to the level of weed free check during both the years and dry weight during 2006-07. The density of broad leaved weeds decreased with increase in dose of isoproturon in the tank mixed application with either fenoxaprop or clodinafop. Tank mix treatments resulted in density and dry weight of broad leaf weeds lower than fenoxaprop and elodinafop alone during both the years and at par with weed free check during 2006-07. All the tank mix treatments of isoproturon with clodinafop or fenoxaprop were at par with each other in respect of dry weight of broad leaved weeds during both the years.

Effect on Crop

plant height of the crop was not influenced significantly due to different treatments during both the years (Table 2). Ear head length of wheat was also at par under all the treatments during 2005-06. During 2006-07, fenoxaprop 120 g/ha, clodinafop 60 g/ha, fenoxaprop 100 g + isoproturon 500-1000 g/ha and clodinafop 50 g + isoproturon 500-1000 g/ha produced ear head length at par with weed free check. Effective tillers under all the herbicidal treatments were at par with weed free check except isoproturon 1,000 g/ha during 2006-07 being inferior to weed free check. Lowest number of effective tillers was recorded in the plots kept unweeded throughout the crop season.

All the tank mix treatments of isoproturon with clodinafop or fenoxaprop, and clodinafop alone produced grain yield at par with weed free check during both the years (Table 2). As population of *P. monspeliensis* was low and the field was dominated by *P. minor*, hence clodinafop alone also produced similar yields. However, in situations of severe infestation of *P. monspeliensis*, the tank mix treatments will be of much significance. Alone treatment of fenoxaprop resulted into grain yield lower than weed free check except fenoxaprop 120 g/ha during 2005-06. Isoproturon 1,000 g/ha produced grain yield similar to weed free during 2005-06 but lower than it during 2006-07. Among the tank mix treatments, higher grain yield was recorded under fenoxaprop 100 g + isoproturon 500 g/ha during both the years, clodinafop 50 g + isoproturon 750 g/ha in 2005-06 and clodinafop 50 g + isoproturon 500 g/ha in 2006-07. However, all the tank mix treatments were statistically at par with each other in respect of grain yield of wheat. There was no phytotoxic effect of any of the herbicidal treatments on the wheat crop.

Conclusion

Tank mix application of isoproturon 500 g/ha with fenoxaprop 100 g or clodinafop 50 g/ha was adjudged to be better combination for effective control of *P. monspeliensis* and *P. minor* along with broad leaved weeds in wheat.

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