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Effect of Herbicides Alone and in Tank Mixture against Complex Flora of Weeds in Wheat

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ABSTRACT

Fenoxaprop, tralkoxydim and clodinafop, being very effective (87-91%) against *Avena ludoviciana* and *Phalaris minor*, were not effective against broadleaf weeds in wheat. Tank mixture of fenoxaprop+isoproturon at 1000 and 1250 g ha^{-1}, and tralkoxydim+isoproturon at 250+375 and 250+500 g ha^{-1} being statistically at par with each other and better than their alone applications, reduced the dry weight of complex weeds to the extent of 72-78%. Tank mixture of metribuzin with reduced dose of clodinafop, fenoxaprop, sulfosulfuron, chlorsulfuron or tralkoxydim increased their efficacy against grassy weeds without any additional grain into grain yield of wheat. Isoproturon and metoxuron being at par with each other proved superior to alone applications of metribuzin and its tank mixed applications with isoproturon or metoxuron.

INTRODUCTION

Evolution of resistance in *Phalaris minor* against isoproturon (Malik and Singh, 1993, 1995) and requirement of 8-11 times more isoproturon to cause 50% growth reduction compared to pristine populations (Yadav *et al.*, 2002) led to recommend four alternate herbicides (clodinafop, fenoxaprop, sulfosulfuron and tralkoxydim) in 1997 in Haryana and other rice-wheat growing states of India. But many growers due to lack of proper knowledge and/or comparatively very high cost of these new herbicides still use isoproturon or any of the alternate herbicides tank mixed with other herbicides like atrazine or metribuzin even without realizing any yield advantage. Few farmers were found to use isoproturon in mixture with alternate herbicides and even two alternate herbicides together probably with an idea to cut the dose and thereby cost or to increase the spectrum of weed kill. Therefore, it was planned to get relevant information on the efficacy of these herbicides in different mixtures against grassy as well as broadleaf weeds in wheat.

MATERIALS AND METHODS

To evaluate the performance of isoproturon, fenoxaprop, clodinafop, tralkoxydim, sulfosulfuron, metribuzin, metoxuron and chlorsulfuron alone and in combination against complex weed flora in wheat, field experiments were conducted during 1997-99 at Research Farm of CCS Haryana Agricultural University, Hisar, India. The soil of the experimental fields was sandy loam in texture, low in available N, medium in P_2O_5 and high in K_2O with slightly alkaline in reaction (pH 8.0). Wheat variety PBW 343 was sown on 26 November in 1997 and 1 December in 1998 at 100 kg seed ha^{-1}.

The weed flora in experiments comprised *Avena ludoviciana, Phalaris minor, Chenopodium album, Melilotus indica, Lathyrus aphaca, Rumex retroflex* and *Coronopus didymus* to the extent of 35, 15, 10, 15, 5, 15 and 5%, respectively.

Table 1. Effect of herbicides alone and in combination on the dry weight of weeds at 90 DAT and grain yield of wheat (Pooled data of 1997-98 and 1998-99)

Herbicide	Dose (g ha^{-1})	Dry weight of grassy weeds (g m^{-2})	Dry weight of broadleaf weeds (g m^{-2})	Effective tillers (No. m^{-2})	Grain yield of wheat (kg ha^{-1})
Clodinafop	60	39.2	167.4	478	5023
Fenoxaprop	120	41.9	156.2	470	5066
Sulfosulfuron	25	22.4	59.7	482	5140
Tralkoxydim	350	28.7	144.3	475	5078
Chlorsulfuron	25	168.6	13.9	405	4273
Clodinafop+ Metribuzin	50+ 100	36.1	63.9	445	4864
Fenoxaprop+ Metribuzin	100+ 100	44.6	58.4	444	4779
Sulfosulfuron+ Metribuzin	20+ 100	38.5	48.6	446	4855
Chlorsulfuron+ Metribuzin	20+ 100	147.2	11.1	437	4675
Tralkoxydim+ Metribuzin	300+ 100	33.6	61.2	448	4564
Metribuzin	200	54.9	31.9	434	4860
Isoproturon	1000	77.4	44.5	482	4897
Weedy check	-	336.4	139.0	360	3354
Weed-free	-	0.0	0.0	519	5482
C. D. (P=0.05)		20.8	13.5	31	305

The experiments were laid out in randomized block design replicated thrice (Tables 1 and 2). All the herbicidal treatments were employed at 35 days after sowing (DAS) with the help of knapsack sprayer fitted with flat fan nozzles using a spray volume of 650 l ha^{-1}.

RESULTS AND DISCUSSION

Tank mixture of fenoxaprop+isoproturon at 1000 and 1250 g ha^{-1}, and tralkoxydim+isoproturon at 250+375 and 250+500 g ha^{-1} being statistically at par with each other and better than their alone applications, reduced the dry weight of complex weeds to the extent of 72-78 %. Fenoxaprop at 120 g, tralkoxydim at 350 g and clodinafop at 60 g ha^{-1} being very effective (87-91%) against *A. ludoviciana* and *P. minor* were not effective against broadleaf weeds in wheat (Table 1). On an average of 1997-98 and 1998-99, sulfosulfuron at 25 g, metribuzin at 200 g, isoproturon at 1000 g and chlorsulfuron at 25 g ha^{-1} reduced the dry weight of grassy weeds to the extent of 93, 84, 77 and 50%, whereas these reductions in case of broadleaf weeds (Table 1) were 57, 77, 68 and 90%, respectively. Sulfosulfuron has been reported to provide efficient control of grassy weeds (Malik and Yadav, 1997) alongwith some suppression of broadleaf weeds (Malik *et al.*, 2000). Tank mixture of metribuzin at 100 g with reduced dose of clodinafop at 50 g, fenoxaprop at 100 g, sulfosulfuron and chlorsulfuron each at 20 g and tralkoxydim at 300 g ha^{-1}, increased their efficacy against grassy weeds to the level of their respective higher doses used alone besides significantly improving the spectrum of weed kill of clodinafop, fenoxaprop and tralkoxydim against broadleaf weeds (Table 1). However, it was not reflected in additional gain in terms of grain yield of wheat; possibly due to phototoxic effects of metribuzin. Efficacy of chlorsulfuron and sulfosulfuron against broadleaf weeds was not increased due to metribuzin in tank mixture (Table 1).

Table 2. Effect of isoproturon, metoxuron and metribuzin alone and in combination against weeds at 90 DAT and effective tillers and grain yield of wheat (Pooled data of 1997-98 and 1998-99)

Herbicide	Dose (g ha^{-1})	Dry weight (g m^{-2}) of total weeds	Effective tillers (No. m^{-2})	Grain yield (kg ha^{-1})
Isoproturon	750	93.4	440	4846
Isoproturon	1000	55.3	481	5200
Metoxuron	1600	59.1	479	5192
Metribuzin	100	101.9	430	4650
Metribuzin	200	73.5	428	4573
Metribuzin	400	4.6	413	4252
Isoproturon+ Metribuzin (10 : 1)	1000	45.7	435	4832
Metoxuron+ Metribuzin (10 : 1)	1600	48.8	434	4805
Weedy check	-	201.9	378	3880
Weed-free	-	0.0	536	5606
C. D. (P=0.05)		22.6	43	359

Isoproturon at 1000 g and metoxuron at 1600 g ha^{-1} being at par with each other in terms of effective tillers and grain yield of wheat, were superior to alone applications of metribuzin at 100, 200 and 400 g ha^{-1}, and tank mixtures of isoproturon+metribuzin (10 : 1) at 1000 g or metoxuron+metribuzin (10 : 1) 1600 g ha^{-1}; however, these were statistically at par in terms of weed control (Table 2). This indicated the detrimental effects of metribuzin to wheat when used either alone or in combination with other herbicides. However, due to unsatisfactory control of weeds, none of the herbicidal treatments implied in different experiments could raise the grain yield of wheat statistically at par with weed-free check. Weeds caused a reduction of 32-39% in the grain yield of wheat (Tables 1 and 2).

Based on the results of present investigation, it can be suggested to the growers not to use metribuzin alone or in combination with other herbicides in wheat. Also tank mixed use of isoproturon with fenoxaprop or tralkoxydim, and fenoxaprop with tralkoxydim or such other unconventional mixtures should be discouraged.

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