RESEARCH ARTICLE

PENDIMETHALIN EFFECTS ON WEED DYNAMICS, CROP GROWTH AND YIELD OF WHEAT

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Abstract: A field experiment conducted at Agricultural Research Farm, Division of Agronomy, BHU, Varanasi to evaluate the efficacy of herbicide to control of weeds in wheat crop. Weed flora of the experimental field was dominated by broad leaved weeds like *Solanum nigrum, Anagallis arvensis, Chenopodium album, Vicia sativa, Melilotus indicus, Rumex dentatus*, and *Medicago denticulatum*, narrow leaved weeds like *Cynodon dactylon, Phalaris minor* and sedges like *Cyperus rotundus*. In the experimental field weeds were controlled by pre-emergence application of herbicides *viz*., pendimethalin 30% EC @ 600 g ha^{-1}, pendimethalin 30% EC @ 900 g ha^{-1}, pendimethalin 30% EC @ 1200 g ha^{-1}, pendimethalin 30% EC @ 1500 g ha^{-1}, metribuzin 70% WP @ 210 g $ha^{-1}$and weed free (two hands weeding). All herbicidal treatment compares with Untreated Control (Weedy check). Among all herbicidal treatment pendimethalin 30% EC @ 1200 g ha^{-1} application is effective to control *Phalaris minor* with WCE was 89.21%. Metribuzin 70% WP @ 210 g ha^{-1} have efficacy to control broad-leaf weed effectively and some narrow leaf weed. The highest grain yield observed in hand weeding (5693 kg ha^{-1}) followed by herbicidal treatments, pendimethalin 30% EC @ 1200 g ha^{-1} (5078 kg ha^{-1}). The maximum grain yield, effective weed control was achieved by medium dose of pendimethalin (1200 g ha^{-1}).

Keywords: Weed, Pendimethalin, Grain yield, Wheat, Metribuzin

INTRODUCTION

Wheat is important staple crop and dominant crop in temperate countries. Wheat is heavily infested with narrow leaf weed and broad leaf weed. The yield losses caused by weeds alone account 10 to 80% reduces depending upon weed species, severity and duration of weed infestation in which *Phalaris minor* and *Avena ludoviciana* are major problematic grass weeds causing large scale reductions in wheat grain yield Banerjee *et al*. (2019). Herbicide is effective only for one weed species so various combination of herbicide applied now days which is harmful for human health and decline environment sustainability. The continuous use of the herbicides *Phalaris minor* evolved resistance against herbicide Dhawan *et al*. (2009). Under above situation, the only alternative is that one and two herbicides at different doses should be effectively control the weed density.

MATERIALS AND METHODS

Field trial was carried out at Agricultural Research Farm of Banaras Hindu University, Varanasi, Uttar Pradesh during *Rabi* season of 2018-2019.The farm is situated at sub- tropical zone of Indo-Gangetic plains on 25^0 18' North latitude and 83^0 03' longitude and at an altitude of 75.70 meter above mean sea level. The soil was sandy clay loam type (Inceptisol) at experimental field with pH-7.4. The experiment was laid out in randomized complete block design with three replications having 5.5 x 4.5 m plot sizes. Seven treatments were evaluated in randomized block design with three replications. The treatments comprised of their doses of Pendimethalin 30% EC 600 gha^{-1}, 900 gha^{-1}, 1200 gha^{-1}, 1500 $gha^{-1}$and Metribuzin 70% WP as well as two hand weeding at 20 and 40 days after sowing (DAS) and untreated plot. The wheat variety "*HD 2967*" was sown on 6 December 2018 by using seed rate 100 kg ha^{-1} with the help of *kudal* by maintaining 22.5 cm row spacing. The data on weed density was recorded from four randomly selected spots for each plot at 60 days after sowing (DAS) using 0.5 × 0.5 m quadrat. Weed biomass was recorded at 60 days after spray by cutting the weed plants above the ground by randomly placing the four quadrats of 0.5 × 0.5 m and then the samples were oven dried at 70°C until they reached to a constant weight. The pre-emergence herbicides were sprayed on the next day of sowing using 500 litre water/ha using knapsack sprayer fitted with flan-fan nozzle. The data on crop growth, yield attributes and yields were recorded as per standard parameters.

RESULTS AND DISCUSSION

Effects on weeds

Experimental field was naturally dominated with broad leaved weeds like *Chenopodium album, Rumex dentatus* narrow leaved weeds like *Phalaris minor*. The dominant weed species in wheat field are *Phalaris minor, Chenopodium album* and *Rumex*

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*dentatus*is 43.6, 14.0 and 21.0% of total weed density respectively at 60 days after sowing. The density and dry matter of broad-leaved weeds like *Chenopodium album* and *Rumex dentatus*among herbicidal treatments maximum weed reduction observed in metribuzin 70% WP @ 210 g ha^{-1} was significantly at par with pendimethalin 30% EC @ 1500 g ha^{-1}. The maximum weed density was recorded in untreated control plot at 60 DAS was significantly higher than all other treatment. The minimum weed density recorded in hand weeding twice (20 &40 DAS). In *Phalaris minor* efficacy of herbicide treatment have minimum weed density recorded at application of pendimethalin 30% EC @ 1500 g ha^{-1} which was on par with pendimethalin 30% EC @ 1200 g ha^{-1} and it significantly superior over the untreated control at 60 DAS (Table 1). Minimum weed density of *Phalaris minor* was observed at hand weeded twice at 20 and 40 days after sowing and maximum population occur in weedy check plot. The results also corroborated with the finding of Choudhary *et al*. (2016) and Ghosh *et al*. (2017).

Among broad leaved weeds *Chenopodium album* and *Rumex dentatus* highest weed control efficiency recorded with the application of metribuzin 70% WP @ 210 g ha^{-1} (Table 2). In narrow leaved weeds like *Phalaris minor* maximum WCE observed with the application of pendimethalin 30% EC @ 1500 g ha^{-1}. Grassy weed effectively controls by pendimethalin so highest WCE with this treatment and similar result evaluated by Hundal and Dhillon (2018).

Effect on crop

Maximum number of tillers per meter was recorded with the application of manual weeding treatments which was at par with the application of pendimethalin 30% EC @ 1200 g ha^{-1}. The differences with respect to test weight were found to be non-significant. Number of grains per spike was observed highest in application of hand weeding treatments at 20 and 40 DAS which was closely followed by pendimethalin 30% EC @ 1200 g ha^{-1} which was significantly superior among the herbicidal treatments.

Highest grain yield and straw yield obtained under the application of pendimethalin 30% EC @ 1200 g ha^{-1} which was significantly higher among the herbicidal treatments. (Table 2). Lowest grain yield and straw yield was recorded with weedy control due to highest infestation of grassy and broad-leaved weed and relatively inferior yield attributes as compared to all other herbicidal treatments. Hand weeding treatment was observed highest grain and straw yield (5693kg ha^{-1} and 9109kg ha^{-1}) than all other treatments. Hundal and Dhillon (2018) also reported significantly higher grain yields of wheat with application of pendimethalin 30% EC @ 1200 g ha^{-1}.

With the field analysis, it can be concluded that application of pendimethalin 30% EC @ 1200 g ha^{-1} was effective to control *Phalaris minor* with some broad-leaved weeds. Metribuzin 70% WP @ 210 g ha^{-1}application observed more effective to control broad leaved weed to achieve higher grain yield of wheat.

Table 1. Effect of pendimethalin on weed densityand weed dry matter at 60 days after sowing in wheat

Treatment	g a.i	Formulation dose/ ha	Weed density (no. m^{-2})			Weed dry matter (g m^{-2})		
			Chenopodium album	*Rumex dentatus*	*Phalaris minor*	*Chenopodium album*	*Rumex dentatus*	*Phalaris minor*
Pendimethalin 30% EC	600	2000 ml	3.71 (13.33)	4.41 (19.00)	3.87 (14.67)	2.77 (7.20)	2.36 (5.07)	2.51 (5.87)
Pendimethalin 30% EC	900	3000 ml	3.50 (12.00)	4.30 (18.00)	3.62 (12.67)	2.70 (6.80)	2.22 (4.43)	2.35 (5.07)
Pendimethalin 30% EC	1200	4000 ml	3.42 (11.33)	4.18 (17.00)	3.32 (10.67)	2.63 (6.40)	2.23 (4.53)	2.13 (4.07)
Pendimethalin 30% EC	1500	5000 ml	3.33 (10.67)	3.76 (13.67)	3.20 (10.00)	2.36 (5.07)	2.18 (4.27)	2.10 (4.00)
Metribuzin 70% WP	210	300 g	3.12 (9.33)	3.64 (13.00)	3.63 (12.67)	2.30 (4.80)	2.05 (3.73)	2.42 (5.37)
HW twice (20 &40 DAS)		-	2.53 (6.00)	1.17 (1.00)	1.10 (1.00)	1.32 (1.60)	1.67 (2.40)	0.88 (0.33)
Untreated Control (Weedy check)		-	3.80 (14.00)	4.61 (21.00)	6.65 (43.67)	2.91 (8.00)	2.51 (5.87)	4.24 (17.47)
SEm±			0.26	0.46	0.39	0.30	0.17	0.24
LSD (P=0.05)			0.56	1.00	0.84	0.66	0.36	0.52

Figures in parentheses are original value and transformed values at $\sqrt{(x+0.5)}$

Table 2. Effect of pendimethalin on weed control efficiency, yield attributed characters and grain yield of wheat

Treatment	g a.i	Weed Control Efficiency (%) at 60 DAS			No. of tillers m^{-2}	Weight of 1000 grain (g)	No. of grains $spike^{-1}$	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})
		Chenopodium album	*Rumex dentatus*	*Phalaris minor*					
Pendimethalin 30% EC	600	9.21	10.48	66.54	212.67	40.33	59.10	4903	7845
Pendimethalin 30% EC	900	14.61	21.00	70.92	233.00	41.33	61.50	4929	7886
Pendimethalin 30% EC	1200	19.12	22.92	76.69	291.33	42.33	64.03	5078	8754
Pendimethalin 30% EC	1500	36.60	26.53	76.95	210.33	40.00	48.00	4891	7826
Metribuzin 70% WP	210	38.92	36.40	69.29	230.33	39.67	54.17	4963	7815
HW twice (20 &40 DAS)	-	78.15	61.48	98.13	311.67	43.00	67.27	5693	9109
Untreated Control (Weedy check)	-	-	-	-	178.33	38.00	43.17	3886	6218
SEm±					20.96	3.38	6.91	540	713
LSD (P=0.05)					45.66	NS	15.06	1075	1553

DAS= Days after sowing

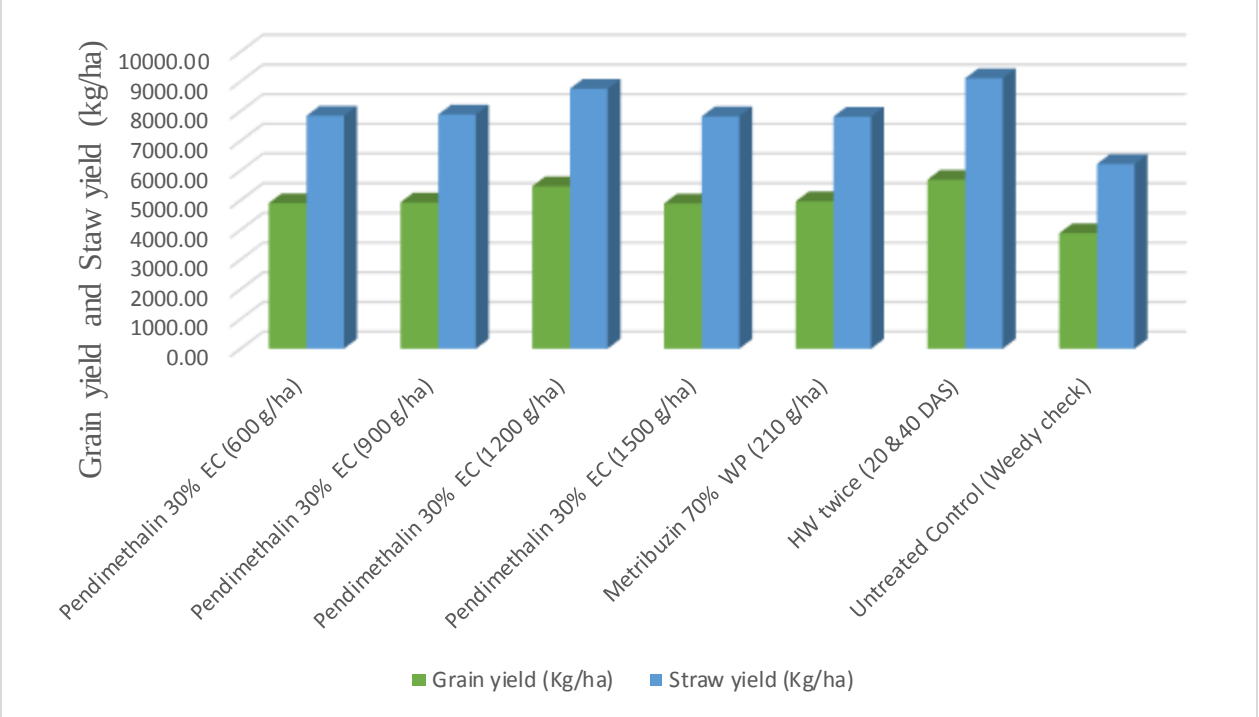

Fig. 1: Effect of pendimethalin on grain yield and straw yield of wheat

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