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Original Research Article

Effect of Different Weed Management Practices on Growth and Yield of Wheat and Associated Weeds

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A B S T R A C T

Improper weed management is one of the major bottlenecks in realizing the potential of wheat crop under different agro-ecological situations. The experiment was done to evaluate the efficacy of weed management practices against weeds and their effect on growth and yield of wheat crop. It was found that *Avenafatua* was most dominant weed contributing alone 39.0, 17.4 and 13.6 % of total weeds present at 30, 60 and 90 days of crop growth respectively. Among the non-grassy weeds, *Chenopodium album* and *Fumariaparviflora* were the most dominant weed species with respective contribution of 18.9, 23.8, 33.4 and 15.6, 20.7, 12.6 % of total weeds at successive stages. Among the herbicidal treatment isoproturon or 2,4- D applied alone as well as combined from with one hand weeding reduced drastically the population of grassy weeds per meter square. The results were in conformity with the study of Singh *et al* (2002). Non-grassy weeds like *Melilotusindica, Coronopusdidymus* and *Chenopodium album* were controlled by 2,4-D as post emergence. *Chenopodium album* was completely controlled by 2,4-D at 0.5 kg/ai/ha at 30 DAS. The highest grain yield was recorded under weed free conditions though it remained at par with 2,4-D at 0.5 kg a.i. /ha at 30 days after sowing or isoproturon at 30 days after sowing with one hand weeding.

Keywords

Weeds, wheat, growth, yield, weed management

Introduction

In India, wheat is the second most important cereal crops after rice covering an area of 28.07 million hectare contributing 80.7 million tons towards food grain production with the productivity of 28 q/ha during 2009-2010 (The Hindu Survey of Indian Agriculture, 2010). To meet the requirement of the burgeoning population, India will need 109 million tons of wheat by 2020 AD (Nagrajan, 1997). In order to meet the projected demands the present productivity of wheat has to be raised to the level of 4.29 t/ha, as the possibility of expansion in horizontal direction is remote. A yield gap of 1.5 to 2 t/ha between field demonstrations and what the farmers are harvesting indicates the scope for substantial in wheat yields. Improper weed management is one of the major bottlenecks in realizing the potential of wheat crop under different agro-ecological situations. Estimates of losses by weed reveal that weeds alone account for 45% of the annual loss of agricultural produce by pests in India. In wheat, yield losses by weeds may range from 10 to 82% depending upon type of weed species, the

extent of severity, duration of weed infestation, competing ability of the crop plants under different agro-ecological. Conditions (Rao, 1994). With the introduction of high yielding dwarf varieties having heavy demand of inputs, the problem of weed infestation has increased manifolds as if created favourable conditions for invasion as well as luxuriant growth of weeds particularly of *Phalaris minor* and *Avena spp.* Throughout wheat growing area in our country (Gill *et al.,* 1984; Singh and Tripathi, 1986) short stature of dwarf wheat with erectile leaf orientation allows more light penetration through the canopy making the weeds more competitive (Gill and Mehra, 1981).

Different weeds species are known to utilize a significant amount of inputs particularly nutrient and water, rendering them in short supply to the associated crop. More over. They have an upper hand in using natural recourse specie carbon dioxide. This categorically advocated the need for efficient management of weeds. Among the grassy weeds *phalaris minor* accounts for 20-25 per cent infestation, which may be even as high as 90 percent in some specific areas in different states (Singh and Singh, 1981). Weeds like *phalaris minor* and *Avena species* are morphologically similar to wheat up to the heading stages.

Furthermore, their successive emergence in phases with very high density, high reproductive potential and shedding of seeds about 2 to 3 weeks before wheat harvesting are some of the unique features that have rendered it difficult to control them with traditional, means of control. Besides, the traditional and mechanical methods based on manual operations are arduous costly and time taking that necessitates the use of selective herbicides for efficient control of weed flora.

Among the different herbicides, isoproturon is being used at large scale by farmers for controlling of weeds in wheat field for over last 15 years. Continuous use of isoproturon has shown a trend towards the dominance of *Phalaris minor* and *Avena spp.* Malik *et al.,* (1995) have reported resistance of Palmaris minor against isoproturon in the country. This envisages the need for alternative broad-spectrum herbicides for effective control of grassy and non-grassy weeds in wheat fields. Pendimethalin is pre-emergence herbicide that selectively controls several important non-grassy and grassy weeds but it is less effective against *Avena spp*. (Singh *et al.,* 1982; Pandey and Singh, 1984).Most common herbicide were used like isoproturon and 2, 4-D for control of grassy weeds including Phalaris minor and Avenafatua as well as non-grassy weeds (Panwar *et al.,* 1995). However, meagre information is available on their use under different conditions. Considering the foregoing facts, the present

Materials and Methods

The field experiment was conducted at Agriculture Research farm of institute of Agriculture Sciences, Bundelkhand University, Jhansi, which is located at 25degree N latitude and 78 degree E longitude at an altitude of 271 meters above the mean sea level in semi-arid tract of central India. Jhansi has sub-tropical climate with hot days during summer and cold in winter. The mean maximum temperature of 45^0C to 49^0C is not uncommon during summer while very low temperature (3^0C) accompanied in January. The monsoon rains generally commences during fourth week of the June but some time is delayed to the first week of July and ceases by the end of September. The total rainfall as well as its distribution in this region is subjected to very large variation. About 80 to 90 percent

of it is received during July to September. Few showers of cyclonic rains are also received during December of January of late spring. A composite soil sample to a depth of 0-30 cm was collected from the experimental field prior to sowing of the crop. The sample was analysed for its experimental soil was sandy loam in texture, low in organic carbon and medium in available P and K. The experimental crop was preceded by paddy in *kharif* season.

The experiment consisted of eight treatments including weedy check and weed free conditions. Isoproturon and 2,4-D was applied as post-emergency at 30 days after sowing. The amount of herbicide and water required was computed on the basis of gross plot size. Weedy plots remained infested with native weed population throughout the cropping season.

The treatments as above laid out in randomised block design with three replications. The field was prepared by tractor drawn implement with one deep ploughing by soil turning plough and two cross harrowing by disc harrow followed by levelling.

In order to create ideal condition for good germination, pre-sowing irrigation was given 10 days before sowing. The fertilizer application was given as per recommended dose for the crop. Irrigation were applied on critical growth stages of the crop.

One meter length on both the ends of the plots, leaving 0.5 m buffer strip, was marked for observations on crops and weeds one side was used for crop observation and the other for weeds one row on each of the sides of the plot was also left as border row. Observation weeds were recorded at 30, 60 and 90 days stages of sowing in the area marked for the purpose. Weed count was taken species wise in each plot at different stages of the crop. Total dry matter of weed was also computed. Growth observations were recorded at 30, 60 and 90 days stages of the crop and yield and yield attributes were recorded at harvest. Observations on various yield attributes like number of spikes/m^2, spike length, number of grains per spike, 1000 grain weight were recorded using standard methods. Grain yield and straw yield was recorded at harvest and biological yield was estimated.

Weed index, a measure of yield reduction, was calculated using the following formula-

$$WI\ (\%) = \frac{X-Y}{X} X\ 100$$

Where,

WI = weed index (%)
X= Grain yield in weed free plot (q/ha)
Y = Grain yield in treated plot (q/ha)

Weed control efficiency (WCE), an index to reduction in weed dry matter, was calculated using total weed dry matter with the help of following formula-

$$WCE\ (\%) = \frac{X-Y}{X} X\ 100$$

Where,

WCE (%) = weed control efficiency
X = Dry matter of weeds in weedy plot
Y = Dry matter of weeds in treated plot

The data recorded during the course of investigation were subjected to analysis statistically using analysis of variance techniques (ANOVA) for randomized block design as prescribed by Cochran and Cox (1959). The critical difference at 5 percent level of significance was worked out to compare treatments.

Results and Discussion

Yield attributes of wheat crop

Highest ear length was recorded under weed free condition though it was at par with most of the treatments except weedy check. Use of 2,4 –D at 0.5 kg a.i./ha at 30 days after sowing with one hand weeding increased the ear length as compared to other treatments. Number of spikelets per ear exhibited significant variation owing to weed control measures. Perusal of the data revealed that ear of the crop grown under weed free condition had highest number of spikelets/ ear though it remained at par with 2,4 –D at 0.5 kg a.i/ ha at 30 days after sowing or isoproturon at 30 days after sowing with one hand weeding and significantly superior to rest of the treatments differing rest of treatments among themselves (Table 1).

Number of spikelets per ear, number of grains/ear was also influenced significantly by weed management practices in wheat. Adoption of any of the weed control option resulted in significant increase in number of grains per ear when compared with weedy check. The highest number of grains per ear were observed in crop grown under weed free conditions though it remained at par with rest of yields (q/ha) and harvest index (%) of wheat as affected by weed management practices in wheat.

The treatments except weedy check and isoproturon alone a marginal decline was noticed. The effect of weed management practices on grain weight per ear was recorded to be significant. Weed control measure resulted in significant improvement in grain weight per ear over weedy check. The crop grown under weed free conditions had highest ear weight followed by that applied with integrated option (T8) and proved superior to those applied alone. 1000- grain weight increased significantly with the adoption of weed control measure as compared to weedy check. Maximum value of test weight was recorded in 2,4-D at 0.5 kg a.i./ha at 30 days after sowing or isoproturon at 30 days after sowing with one hand weeding. The differences among control measures were however, non-significant.

Yield of wheat crop

Grain yield of wheat was influenced significantly by weed control measure. It indicates that controlling weeds resulted in significant increase in grain yield compared to weed check. The increase ranged from 24.4 % under hand weeding at 30 days and 50 DAS to 44.5 % under weed free conditions. The highest grain yield was recorded under weed free conditions it remained at par with 2,4-D remained at par with 2,4 –D at 0.5 kg a.i./ha at 30 days after sowing or isoproturon at 30 days after sowing with one hand weeding. Weed control measure had significant effect on straw yield of wheat. Crop grown with any of the weed control practice gave significantly higher straw yield than that grown under weedy conditions (Table 2). The highest straw yield (53.8 q/ha) was obtained from crop grown weed free treatment. 2,4-D at 0.5 kg a.i./ha at 30 days after sowing with one hand weeding also produce to similar straw yields of weed free. It remained at par with all the herbicidal treatments and weed free conditions. The effect of weed management practices on biological yield of wheat was found significant. The data indicates that issoproturon at 0.75 kg/ha treated plots produced significantly higher dry matter of wheat and it was closely following by 2,4 –D at 0.75 kg/ha and weed tree conditions. Difference among the herbicidal treatments were non-significant.

Table.1 Yields attributes of wheat as affected by different weed management practices in wheat

Treatments	Ear length (cm)	No. of spikelets/ ear.	No. of grain/ear	Grain weight/ ear(g)	1000-grain weight (g)
Weedy (no control)	9.0	14.2	30.5	1.31	39.4
Weed free	10.3	16.8	41.7	155	43.4
Hand weeding at 30 DAS	9.6	15.1	40.1	1.50	43.3
Hand weeing at 30 and 50 DAS	9.9	15.3	38.9	1.47	43.2
2,4-D @0.5 kg a.i/ha at 30 DAS	9.7	15.2	37.7	1.50	42.8
Isoproturon @0.75 kg/ha at 30 DAS	9.6	15.1	38.4	1.42	42.8
2,4-D @0.5 kg a.i/ha + Isoproturon @0.75 kg/ha at 30 DAS	9.8	16.0	39.5	1.43	43.0
2,4-D @ 0.5 kg a.i./ha + Isoproturon @ 0.75 kg/ha at 30 DAS + one hand weeding 45 DAS	10.1	16.3	40.3	1.46	42.4
SEm±	0.2	0.3	1.1	0.03	0.6
CD (P=0.05)	0.6	0.9	3.1	0.09	1.7

Table.2 Yields (kg/ha) and harvest index (%) of wheat as affected by different weed management practices in wheat

Treatments	Grain yield (kg/ha)	Straw yield (kg/ha)	Biological yield (kg/ha)	Harvest index (%)	Weed index (%)
Weedy (no control)	2720	4360	7080	38.4	30.8
Weed free	3930	5300	9230	42.6	-
Hand weeding at 30 DAS	3420	5010	8430	40.6	12.9
Hand weeding at 30 and 50 DAS	3380	4910	9300	40.7	14.0
2,4-D @0.5 kg a.i./ha at 30 DAS	3760	5220	9080	41.4	4.3
Isoproturon @0.75 kg/ha at 30 DAS	3680	5190	8870	41.5	6.4
2,4-D @0.5 kg a.i./ha + Isoproturon @0.75 kg/ha at 30 DAS	3730	5070	8800	42.7	5.0
2,4-D @ 0.5 kg a.i./ha + Isoproturon @ 0.75 kg/ha at 30 DAS + one hand weeding 45 DAS	3860	5380	9240	41.8	1.8
SEm±	150	140	150	0.7	-
CD (P=0.05)	430	400	440	2.1	-

Harvest index, the ratio at economic yield to biological yield, varied significantly under different weed control measures. Weed control measures led to better diversion of photosynthates towards grain and thereby high harvest index when compared with weedy check.

The highest harvest index of 42.7 was noticed in crop grown under weed free conditions though it remained at par with other treatments. Weed index, a measure of the extent of yield reduction by weeds, varied greatly under different treatments being minimum of 1.8% with 2,4-D at 0.5 kg a.i./ha at 30 days after sowing + isoproturon at 30 days after sowing with one hand weeding differences among the treatments involving isoproturon or 2,4-D at 30 days after sowing were just marginal. However two hands weeding also reach the levels of weed free.

There were thirteen weed species (1 grassy and 9 non grassy) in the experiment field. Percent density of grassy weeds increased from 30-90 DAS while relative density of non-grassy weeds decreased after 60 days stage of crop growth. This trend was mainly due to the fact that non-grassy weeds like *Fumariapariflora, Chenopodium album* and *Melilotusindica* were suppressed by other weed species and the crop due to their poor competitive ability. This indicates that grassy weeds were more competitive than non-grassy weeds. The large proportion of weeds emerged during first 30 days after sowing and therefore weed control should be adopted to take care of weeds during this period to avoid maximum weed completion. *Avenafatua, Fumariaparviflora* and *Chenopodium album* were the predominant weeds at 60 days stage under weedy check. This indicates the dominance of *Phalaris minor* over other weed species. This is probably due to the fact that dwarf wheat varieties with stature and erect leaf orientation allowed more light penetration through the canopy and was less competitive against grassy weeds like *Phalaris minor*.

The highest average weed dry matter was recorded in weedy check at 90 days stage of crop growth which indicates that rate of dry matter production increased with advancement of crop growth and weed crop completion during 30 to 90 days period. All the herbicides caused significant reduction in total weed density and weed dry weight as compared to weedy control at all the stages while none of the treatment could reach to the level of weed fee conditions. This reduction was due to their phytotoxic effect on grassy and non-grassy weeds. Similar results have been obtained by Singh (2002). Grain yield of wheat was highest under weed free conditions that reduced by 30.7 % due to uncontrolled weed growth. The reduction in yield was attributed to severe competition by weeds with the crop plants as evident from weed density, weed dry matter, nutrient removal by weed and crop. Reduction in wheat yield by uncontrolled weed growth has also been noted by Panwar *et al.,* (1995) and Singh (2002). Reduction in yield under as compared to weed free condition was proportionate to respective reduction in weed dry matter. The increase in wheat yield over weedy check was attributed to reduction in weed dry matter and consequently better availability of inputs to wheat crop. Grain yield of wheat was in harmony with yield attributing character viz. number of grains/spike and 100-grain weight. All the attributes were of lowest order under weedy condition and highest under weed free conditions.

Among the herbicidal treatments the yield attributes were recorded to be at their best with isoproturon +2, 4-D at 0.5 kga.i./ha (45 DAS). Though it was at par with use of 2,4-D at 0.5 kg a.i./ha (30 DAS)/ isoproturon at 45 DAS. Equity with isoproturon has also been noticed by Balyan (2001). They are known to give better control the resistant biotype of *Avenafatua* against isoproturon. Since the experimental field was not having resistant biotypes, they could not establish their superiority over isoproturon at 1.0 kg a.i./ha at 35 days after sowing. Moreover, isoproturon is also capable for supressing some of the grassy weeds. The highest dry matter accumulation was recorded with isoproturon at 0.5 kg a.i./ha (30 DAS) + 2,4-D at 0.5 kg a.i./ha (30 DAS) though it was at par with other treatments involving at 30 DAS. The highest dry matter accumulation by weeds under wheat these treatments might have been attributed to larger canopy size and thus better utilization of light, water and nutrients. Better availability of nutrients is evidenced from reduction in removal by weeds. Similar findings has also been reported by Banga *et al.,* (2003).

The crop grown with post-emergence application of isoproturon + 2,4-D at 0.5 kg a.i./ha at 30 days after sowing with one hand weeding recorded significantly higher grain yield and reduce weed population and dry matter in wheat crop. However, weed free condition produce maximum yield as compared to other treatment. But, weed free condition is not economical during whole period of crop. Thus post emergence application of isoproturon + 2,4-D at 0.5 kg a.i./ha at 30 days after sowing followed proved most economic for controlling weeds in wheat field under Jhansi conditions.

References

Balyan, R.S. (2001). Evaolution of New herbicides against mixed weed flora in wheat, Indian J. weed Sci.; 33(3&4): 104-106.

Banga, R.S., Malik, R.K., Yadav, A. and Malik R.S. (2003). Compatibility of Clodinafop with Metsulfuron and 2, 4-D against wild oat in wheat. In: Pro. Biennial Conf., Indian Society of weed Science, Pantanagar; p: 17.

Cochran, G.M. and Cox, W.G. (1959). Experimental Design. Asia Publications House, New Delhi.

Gill, H.S. and Mehra, S.P. (1981). Control of wild oat with diclofopmethyl in irrigated wheat. In: Proc. 8th Asian-Pacific weed Sci. Conf., Banglore, India, p: 17-22.

Gill, H.S., Singh A. and Walia, U.S. (1984). Tolerance of weed cultivars to metoxuron, *Indian J. Weed Sci*.; 16: 176-181.

Malik, R.K., Singh, S. and Singh S. (1995). Little seed canary grass (*Phalaris minor*) resistance to isoproturon in India. *Weed Technology*; 9: 419-425.

Nagarjan, S. (1997). All out effect needed in survey of Indian agriculture, *Indian Wheat*; 3: 11.

Pandey, J. and Singh, S.J. (1984). Effect of herbicides on *Phalaris minor*, *Avenafatua* and yield of wheat. *India J. Weed Sci*.; 16: 190-193.

Panwar, R.S., Malik, R.K. and Rathi, S.S. (1995). Effect of isoproturon and its combination with tralkoxydim on control of weeds in wheat. *HAU J. Res*.; 25: 181-186.

Rao, V.S. (1994). Principles of weed science, Oxford and IBH publishing Co. Pvt. Ltd., New Delhi, p: 540.

Singh, G. and Singh D. (1981). Control of Phalaris minor in wheat. *Indian Farmer Digest*; 14(10): 9-12.

Singh, G., Bhan, V.M. and Singh, D. (1982). Effect of post-emergance application of herbicides on control of *P. minor* in wheat. In: Ann. Conf. ISWS, Pantnagar, Abstr. Of Paper. G.B. Pant Unv. Of Agri. & Tech., Pantnagar, Uttarakhand; *Weed abstr*; 33:2768.

Singh, G., Singh, M. and Singh, V.P. (2002). Effect of Metsulfuronmethyl alone and in combination with 2,4-D and surfactant on non-grassy weeds and wheat yield, Indian J. weed Sci.; 34(3&4):175-177.

Singh, P.P. and Tripathi, S.S. (1986). Broad-spectrum weed control in wheat by use of combination of herbicides. *Indian J. of Agronomy*; 31: 273-279.