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Effect of integrated weed management on growth, yield and economics of wheat (*Triticum aestivum* L.)

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Abstract

The current investigation was carried out to study the efficacy of different pre and post emergence of herbicides and their combinations along with weeding and hoeing operation to control the weed in wheat at post graduate research farm, R.C.S.M. College of Agriculture, Kolhapur (MS) in randomized block design with eight treatments and three replication during *Rabi* season of 2016-17 on medium black soil. All the growth attributing characters of wheat crop viz., plant height, number of leaves plant⁻¹, leaf area plant⁻¹, dry matter accumulation plant⁻¹ and number of tillers m⁻² also yield attributes viz. length of spike, number of spikelets spike⁻¹, number of grains spike⁻¹, grain weight spike⁻¹ and weight of 1000 grains and yield of grain (52.78 q ha⁻¹) and straw yield (68.45 q ha⁻¹) were recorded higher in weed free check. Among the integrated weed management treatments, the significantly highest all growth attributing characters, yield attributes characters and yield were recorded with weeding at 20 DAS and + metasulfuron methyl @ 4 g a.i. ha⁻¹ as PoE at 30 DAS which was statistically at par with hoeing at 20 DAS + metasulfuron methyl @ 4 g a.i. ha⁻¹ as PoE at 30 DAS. Significantly the lowest growth and yield was recorded under weedy check (30.70 q ha⁻¹).

Keywords: Metribuzin, metasulfuron methyl, integrated weed management, yield

Introduction

Wheat (*Triticum aestivum* L.) belongs to family "Poaceae" and genus "Triticum". It is a crop of temperate zone with cool winters and hot summers being very conducive for its growth. Among the food crops, wheat is one of the most abundant sources of energy and proteins for the world population and its increased production is essential for food security. It is necessary to sustain the wheat crop production for meet the demand of wheat in India as well as world. Weed infestation during the early stages of crop growth is one of the major factors responsible for low productivity of wheat. The untimely and poor weed management adversely affects proper growth and yield of wheat. Integration of weed controls methods are effective and workable practices that may be used ecologically and economically viable to the farmer. Herbicides have benefited the agricultural community in many ways. However, heavy application of herbicides creates an environment favorable for weed resistance to herbicides, shifts weed flora and off-site movements of herbicides (Rao and Nagmani, 2010) [7]. Under such conditions, integration of hand weeding, hoeing and weed control through herbicides remains the choice for controlling weeds.

Traditional methods of weed control such as crop rotation, manual hoeing or tractor drawn cultivator and costly labour have made the use of herbicides more popular among the Indian farmers. The herbicide like Metribuzine, Metasulfuron methyl reported to be promising against weeds in wheat at different locations in India. However, conclusive information is not available on relative efficacy of such herbicides and economics of different weed control methods such as hand weeding, hoeing etc. in Sub-mountain Zone. Each and every method has advantages and disadvantages by considering these views an experiment was undertaken.

Materials and methods

The field experiment was conducted at Post Graduate Research Farm, R.C.S.M. College of Agriculture, Kolhapur during *Rabi* 2016. The topography of experimental field was fairly uniform and levelled. The soil was vertisol (medium black) in nature and about one meter deep with good drainage. The soil of experimental field has pH 7.7, EC 0.10 d Sm⁻¹, organic carbon 0.57%, available N, P₂O₅, K₂O 132.45, 22.34 and 159 kg ha⁻¹, respectively. The eight treatments comprising of pre and post emergence herbicides and intercultivation operations

viz., hand weeding and hoeing. Application of treatments Metribuzine @ 0.175 kg a.i. ha⁻¹ as PE + Hand weeding at 20 DAS (T₁), Metribuzine @ 0.175kg a.i. ha⁻¹ as PE + Hoeing at 30 DAS (T₂), Metribuzine @ 0.175 kg a.i. ha⁻¹ as PE + Metasulfuron methyl @ 4 g a.i. ha⁻¹ as PoE at 30 DAS (T₃), Hoeing at 20 DAS + Metasulfuron methyl @ 4 g a.i. ha⁻¹ as PoE at 30 DAS (T₄), Weeding at 20 DAS + Metasulfuron methyl @ 4 g a.i. ha⁻¹ as PoE at 30 DAS (T₅), Hand weeding at 20 DAS + Hoeing at 30 DAS (T₆), Weed free check (T₇) and Weedy check (T₈) and these treatments were replicated three times in randomized block design.

Wheat variety 'Phule Samadhan (NIAW-1994)' was grown in the experimental field with recommended package of practices. Fertilizers were applied uniformly at the rate of 120 kg N and 60 kg P₂O₅ and 40 kg K₂O ha⁻¹. All the herbicides were applied by manually operated sprayer with flat fan nozzle as per treatment.

Result and discussion

Effect of integrated weed management on growth parameters of wheat

The different growth attributing characters as influenced by

different treatment were presented in Table No 1. The significantly highest values of all growth characters viz. plant height, number of leaves, leaf area, dry matter accumulation and number of tillers at harvest were recorded in weed free check treatment which was at par with weeding at 20 DAS and + metasulfuron methyl @ 4 g a.i. ha⁻¹ as PoE at 30 DAS (88.86 cm) as well as at par with hoeing at 20 DAS + metasulfuron methyl @ 4 g a.i. ha⁻¹ as PoE at 30 DAS (87.73 cm). This was might be due to effective weed control which reduces the weed crop competition ultimately higher growth of crop. The significantly lowest values of all growth characters were registered in weedy check treatment as weedy check plots having high intensity of weeds which suppressed growth of wheat. These results were in conformity with Singh *et al.* (2002) [9], Punia *et al.* (2008) [6], Sharma (2009) [8], Kumar *et al.* (2011) [4], Tiwari *et al.* (2011) [11] and Paighan *et al.* (2013) [5].

Table 1: Effect of integrated weed management on growth parameters of wheat at Harvest

Treatment	Plant height (cm)	Number of leaves plant ⁻¹	Leaf area plant ⁻¹ (dm ²)	Dry matter plant ⁻¹	Number of tillers m ⁻²
T1 : Metribuzine @ 0.175 kg a.i. ha ⁻¹ as PE + hand weeding at 20 DAS	82.76	26.24	36.23	19.71	125.23
T2 :Metribuzine @ 0.175 kg a.i. ha ⁻¹ as PE + hoeing at 30 DAS	81.60	25.13	35.97	17.84	124.92
T3: Metribuzine @ 0.175 kg a.i. ha ⁻¹ as PE + metasulfuron methyl @ 4 g a.i. ha ⁻¹ as PoE at 30 DAS	79.33	24.99	34.74	17.63	124.30
T4: Hoeing at 20 DAS + metasulfuron methyl @ 4 g a.i. ha ⁻¹ as PoE at 30 DAS	87.73	27.34	40.72	21.97	129.03
T5: Weeding at 20 DAS and + metasulfuron methyl @ 4 g a.i. ha ⁻¹ as PoE at 30 DAS	88.86	27.46	41.64	22.63	129.13
T6: Hand weeding at 20 DAS + Hoeing at 30 DAS	84.40	26.66	37.75	21.18	126.76
T7: Weed free check (minimum competition)	89.46	27.76	41.52	22.83	131.26
T8: Weedy check	71.45	23.09	28.30	12.83	59.90
S.E. m±	1.18	0.15	1.15	0.43	2.39
C.D. at 5%	3.59	0.47	3.50	1.31	7.25
General Mean	84.07	26.08	37.11	19.58	118.81

Effect of integrated weed management on yield parameters of wheat

The data presented in Table 2 indicate that all the weed management practices were significantly affect mean length of spike, number of spikelets spike⁻¹, number of grains spike⁻¹, grain weightspike⁻¹ and weight of 1000 grains. Among the yield contributing characters of wheat crop viz., length of spike plant⁻¹ (10.17 cm), number of spikelet spike⁻¹ (17.85 spike⁻¹), number of grains spike⁻¹ (46.77 spike⁻¹), grain weight spike⁻¹ (5.18 g plant⁻¹), weight of 1000 grains (45.52 g) were significantly higher in weed free treatment which was at par

with weeding at 20 DAS and + metasulfuron methyl @ 4 g a.i. ha⁻¹ as PoE at 30 DAS. However treatment 20 DAS and + metasulfuron methyl @ 4 g a.i. ha⁻¹ as PoE at 30 DAS and hoeing at 20 DAS + metasulfuron methyl @ 4 g a.i. ha⁻¹ as PoE at 30 DAS are at par with each other. This was may be due to good growth of wheat reflects in yield attributing characters as these treatments have controls weeds effectively. Weedy check treatment recorded significantly lowest values of yield contributing characters than rest of treatments. Similar result were recorded by Paighan *et al.* (2013) [5] and Singh *et al.* (2013) [10].

Table 2: Effect of integrated weed management on yield parameters of wheat

Treatments	Mean length of spike	Number of spikelets spike ⁻¹	Number of grains spike ⁻¹	Grain weight spike ⁻¹	Weight of 1000 grains
T1: Metribuzine @ 0.175 kg a.i. ha ⁻¹ as PE + hand weeding at 20 DAS	8.38	16.03	43.85	3.80	43.56
T2: Metribuzine @ 0.175 kg a.i. ha ⁻¹ as PE + hoeing at 30 DAS	8.16	15.77	43.12	3.23	43.49
T3: Metribuzine @ 0.175 kg a.i. ha ⁻¹ as PE + metasulfuron methyl @ 4 g a.i. ha ⁻¹ as PoE at 30 DAS	7.95	15.48	42.85	3.08	43.42
T4: Hoeing at 20 DAS + metasulfuron methyl @ 4 g a.i. ha ⁻¹ as PoE at 30 DAS	9.53	17.23	45.75	4.78	44.63
T5: Weeding at 20 DAS and + metasulfuron methyl @ 4 g a.i. ha ⁻¹ as PoE at 30 DAS	9.90	17.40	45.94	4.89	45.05
T6: Hand weeding at 20 DAS + Hoeing at 30 DAS	8.62	16.35	44.62	4.13	44.28
T7: Weed free check (minimum competition)	10.17	17.85	46.77	5.18	45.22

T8: Weedy check	7.07	13.39	37.04	2.70	42.07
S.E. m±	0.25	0.37	0.47	0.14	0.21
C.D. at 5%	0.76	1.12	1.44	0.43	0.65
General Mean	8.72	16.19	43.74	3.97	43.97

Effect of integrated weed management on yield of wheat

The data presented in Table 3 indicate that the grain yield, straw yield and harvest index was recorded maximum in weed free treatment (52.78 q ha⁻¹, 68.45 q ha⁻¹ and 43.53%), respectively which was statistically at par with integrated weed management treatment viz. weeding at 20 DAS and + metasulfuron methyl @ 4 g a.i. ha⁻¹ as PoE at 30 DAS (T5) and hoeing at 20 DAS + metasulfuron methyl @ 4 g a.i. ha⁻¹ as PoE at 30 DAS (T4) but significantly superior over rest of treatments. Effective weed control achieved in these treatments resulted in enhancing various growth and yield contributing characters of wheat and finally gave significantly higher grain yield and straw yield over weedy check. However weedy check recorded significantly lowest grain yield, straw yield and harvest index (30.70 q ha⁻¹, 43.93 q ha⁻¹ and 41.13%), respectively. Similar findings were recorded by Chopra and Chopra (2010)^[2], Katara *et al.* (2012)^[3], Vyavahare (2012)^[12] and Chaudhari *et al.* (2016)^[11].

Effect of integrated weed management on economics of wheat

Highest net monetary returns were observed in weed free check treatment (Rs.52033 ha⁻¹) followed by weeding at 20 DAS and + metasulfuron methyl @ 4 g a.i. ha⁻¹ as PoE at 30 DAS (Rs.49865 ha⁻¹) and hoeing at 20 DAS + metasulfuron methyl @ 4 g a.i. ha⁻¹ as PoE at 30 DAS (Rs.47555 ha⁻¹). The lowest net monetary returns was recorded in weedy check (Rs.22793 ha⁻¹). These results were in conformity with Chopra *et al.* (2008), Sharma (2009)^[8], Paighan *et al.* (2013)^[5], Singh *et al.* (2013)^[10], and Chaudhary *et al.* (2016)^[11].

The highest benefit cost ratio was obtained in weed free check treatment (2.29) followed by weeding at 20 DAS and + metasulfuron methyl @ 4 g a.i. ha⁻¹ as PoE at 30 DAS (2.26) and hoeing at 20 DAS + metasulfuron methyl @ 4 g a.i. ha⁻¹ as PoE at 30 DAS (2.23). These results were in conformity with Chopra *et al.* (2008), Sharma (2009)^[8], Paighan *et al.* (2013), Singh *et al.* (2013)^[10], and Chaudhary *et al.* (2016)^[11].

Table 3: Effect of integrated weed management on yield and economics of wheat

Treatments	Grain yield (q ha ⁻¹)	Straw yield (q ha ⁻¹)	Harvest index (%)	Net monetary returns (Rs ha ⁻¹)	B:C ratio
T1: Metribuzine @ 0.175 kg a.i. ha ⁻¹ as PE + hand weeding at 20 DAS	39.15	56.05	41.20	32392	1.89
T2: Metribuzine @ 0.175 kg a.i. ha ⁻¹ as PE + hoeing at 30 DAS	38.21	55.01	40.98	30905	1.85
T3: Metribuzine @ 0.175 kg a.i. ha ⁻¹ as PE + metasulfuron methyl @ 4 g a.i. ha ⁻¹ as PoE at 30 DAS	36.41	52.96	40.74	28742	1.82
T4: Hoeing at 20 DAS + metasulfuron methyl @ 4 g a.i. ha ⁻¹ as PoE at 30 DAS	49.25	64.25	43.39	47555	2.23
T5: Weeding at 20 DAS and + metasulfuron methyl @ 4 g a.i. ha ⁻¹ as PoE at 30 DAS	50.97	66.26	43.47	49865	2.26
T6: Hand weeding at 20 DAS + Hoeing at 30 DAS	45.86	62.30	42.40	41523	2.07
T7: Weed free check (minimum competition)	52.78	68.45	43.53	52033	2.29
T8: Weedy check	30.70	43.93	41.13	22793	1.73
S.E. m±	1.31	1.49	-	-	-
C.D. at 5%	3.97	4.52	-	-	-
General Mean	42.19	58.65	42.10	38226	2.01

Conclusion

To get the higher yield and economics of wheat, wheat crop should be kept weed free. The weeding or hoeing operation combined with metasulfuron methyl @ 4 g a.i. ha⁻¹ as PoE at 30 DAS can better as a integrated weed management measures in wheat.

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