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The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(7): 146-152

www.thepharmajournal.com
Received: 24-04-2022
Accepted: 03-06-2022

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Effect of integrated weed management on growth characters of wheat (*Triticum aestivum* L.)

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Abstract
A research trail entitled "effect of integrated weed management on growth characters of wheat (*Triticum aestivum* L.)" was conducted at agronomy research farm of Career Point University, Kota. The experiment was laid out in a Randomized Block Design with three replications. There were ten treatments in 2019-20 and 2020-21. The treatments included pre emergence application of Pendimethalin @ 1.0 a.i. kg/ha + hand weeding, Pendimethalin @ 1.0 a.i. kg/ha + hoeing, Pendimethalin @ 1.0 a.i. kg/ha + post-emergence application of metsulfuron methyl @ 0.3 a.i. kg/ha, pre-emergence application of Metsulfuron methyl @ 0.3 a.i. kg/ha + hand weeding, pre-emergence application of Metsulfuron methyl @ 0.3 a.i. kg/ha + hoeing, Metribuzine @ 0.3 a.i. kg/ha + hand weeding, Metribuzine @ 0.3 a.i. kg/ha + hoeing, pre-emergence application of Metribuzine @ 0.3 a.i. kg/ha + post emergence application of metsulfuron methyl @ 0.3 a.i. kg/ha, Two hand weeding, Two hoeing, Hand weeding + hoeing, Hoeing + Hand weeding, Weed free and Weedy check. It has been observed that effect of integrated weed management has proven to be efficient in controlling weed strength during the growing season in plots treated with tankmixed pre – emergence application of Metribuzin @ 0.3 a. i. kg/ha and Metsulfuron methyl @ 0.3 a. i. kg/ha. This treatment was found superior due move to availability of nutrients to wheat plants and of least emergence of weeds.

Keywords: Metribuzin, pendimethalin, metsulfuron-methyl, hoeing, hand weeding, pre emergence, post emergence and integrated weed management

1. Introduction
Wheat (*Triticum aestivum* L.) is a staple food of the world and falls under Poaceae family. It is primarily grown in temperate regions and also at higher altitude under tropical climatic areas in winter season. It is the single most important cereal crop that has been considered as integral component of the food security system of the several nations.

Major wheat producing countries in the world are China, India, USA, France, Russia, Canada, Australia, Pakistan, Turkey, UK, Argentina, Iran and Italy. These countries contribute about 74.82% of the total world wheat production. As far as India is concerned, about 90% of the total wheat production is contributed by northern states. Among them, Rajasthan ranks fifth with respect to area (3.12 mill. ha) and production (10.92 mill. tonnes) but the productivity is much lower (3501 kg ha^{-1}) than U.P. (3432 kg ha^{-1}), Punjab (5004 kg ha^{-1}) and Haryana (4687 kg ha^{-1}) (Directorate of Economics & Statistics, DAC&FW: 2019-2020).

The demand of wheat by 2030 has been projected to be between 145 to 149 million tonnes in the country. The prominent weeds noted in wheat fields are *Phalaris minor, Chenopodium album, Anagallis arvensis, Avena fatua, Convolvulus arvensis, Lathyrus aphaca, Cyperus rotundus* and *Cynodon dactylon* etc. which alone cause 33 percent reduction in wheat yield.

Weeds compete with crop plants for essential growth factors like light, moisture, nutrients and space. Weeds can also increase harvesting costs, reduce quality of product [Bibi *et al.*, 2008] [5]. Metribuzin (4-amino-6-tert-butyl-3-(methylthio)-1,2,4-triazin-5(4H)-one) is an herbicide used both pre- and post-emergence in crop. It is primary a soil-residual herbicide which can be applied in the fall after the wheat emerges and roots become well established. It is particularly effective on annual bluegrass (*Poa annua*) and has good activity on several annual broadleaves weed species, such as chickweed (*Stellaria media*) and corn buttercup (*Ranunculus arvensis*). Metribuzin is also a critical herbicide in the management of Italian ryegrass (*Lolium perenne* ssp. Multiflorum).

Pendimethalin is an herbicide of the dinitroaniline class used in pre-mergence and post-emergence applications to control annual grasses and certain broadleaf weeds.

Pendimethalin acts both pre-emergence, that is before weed seedlings have emerged, and early post-emergence. In the HRAC classification of herbicides according their mode of action.

Metsulfuron-methyl is a post-emergence herbicide. It is highly active to control broad-leaf weeds in cererals, pasture and plantation crops. Metsulfuron-methyl has been recommended for the control of broad leaf weed in wheat. It is a selective systemic herbicide absorbed through the roots and foliage with rapid translocation both acropetally and basipettally. In susceptible plants it inhibits branched chain amino acid synthesis (ALS or AHAS) and interferes in biosynthesis of valine and isoleucine stopping cell division and plant growth (Singh and Singh, 2005) [17].

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 methy reported to be promising against weeds in wheat at different locations in India.

2. Material and Methods

The details of the material used, experimental procedure adopted and statistical analysis followed for estimation of various growth, yield and quality parameters during the course of investigation are discussed below.

3.1. Experimental site

The experimental site is located at the Agricultural farm of school of Agriculture, Career Point University Kota, Rajasthan.

3.2. Experimental details

The experiment was laid out in Randomized Block Design with three replications in the month of May, 2019. The following treatments were applied at 30 DAS, 60DAS, 90 DAS and at Harvest (120 DAS) in three replications.

Variety	HI1077
T1: Pendimethalin + Hand Weeding	
T2: Pendimethalin + Hoeing	
T3: Pendimethalin + Metsulfuron Methyl	
T4: Metsulfuron methyl + Hand Weeding	
T5: Metsulfuron methyl + Hoeing	
T6: Metribuzine + Hand Weeding	
T7: Metribuzine + Hoeing	
T8: Metribuzine + Metsulfuron Methyl	
T9: Two Hand Weeding	
T10: Two Hoeing	
T11: Hand Weeding + Hoeing	
T12: Hoeing + Hand Weeding	
T13: Weed Free	
T14: Weedy Check	

Experimental details

The treatments were allocated randomly in all the plots with three replications. The lay out plan of experimental field are presented in figure 3.4.

Replications : 3
Design : Randomised Block Design
Spacing : 22.5 × 5 cm
Grass Plot size : 5m x 3m^2
Net plot size : 4.6m x 2.8 m^2
Treatments : 14

3.5 Observations to be recorded

3.5.1. Physical parameter

3.5.1.1 Plant height (cm)

The height of the five tagged plants was randomly measured at 30, 60, 90 DAS and at harvest in each plot. The height was measured with the help of meter scale from the base of plant to the tip of the tallest leaf up to emergence of spike and thereafter up to tip of spike. Average plant height was computed and expressed as plant height (cm).

3.5.1.2. Dry matter per plant

Dry matter accumulation at 30, 60, 90DAS and at harvest was recorded by collecting whole plant samples from the randomly selected 0.5 m row length in each plot. There samples were chopped filled in perforated paper begs separately and sun dried for two days. Finally, these samples were kept in an oven at 700 C to obtain constant weight. After there, these were weighed and averaged to workout dry matter accumulation m-1 row length.

3.5.1.3. Crop Growth Rate

The Crop Growth was measured at 30, 60, and 90 DAS for calculating the Crop Growth Rate. The CGR explains the dry matter accumulated per unit land area per unit time (g m^{-2} day^{-1}) CGR of a species are usually closely related to interception of solar radiation.

3.5.1.4 No. of tillers per plant

From the five plants of each plot, the number of shoots were counted per meter row length in each net plot at different growth stages and then the average number of shoots per running meter were determined.

3.5.1.5 No. of Effective tillers per plant

From the five plants of each plot, the number of shoots were counted per meter row length in each net plot at different growth stages and then the average number of shoots per running meter were determined.

4. Results and Discussion

The effect of different treatments on crop were measured on growth characters, yield attributes, grain yield and straw yield while the effect on weeds were measured in terms of intensity of different categories of weeds and their dry weight.

4.2.1. Plant height

The plant height recorded at 30, 60, 90 and 120 days after sowing as effected by different weed control treatments in wheat in the year 2019-20 and 2020-21 have been presented in Table 4.5.

There was no significant effect of different weed control treatments on plant height of wheat at 30 DAS, during both the years of study. However, at 60, 90 and 120 DAS, different weed control treatments had significant effect on plant height during both the years of investigation. The maximum plant height of wheat was observed in plots treated with tankmixed pre emergence application of Metribuzin @ 0.3 a. i. kg/ha and Metsulfuron methyl @ 0.3 a. i. kg/ha. It might be due to least density and emergence of weeds resulted in less crop weed competition and increased availability of nutrients. The least plant height of wheat was observed in unweeded plots during the both years of the investigation.

4.2.2. Plant dry weight (g)

The data pertaining to dryweight at 30, 60, 90 and 120 days after sowing of the crop are presented in Table 4.6.

At 30 DAS, plant dryweight of wheat was not significantly different due to weed control treatments. The maximum plant dryweight of wheat was observed in plots treated with tankmixed pre emergence application of Metribuzin @ 0.3 a. i. kg/ha and Metsulfuron methyl @ 0.3 a. i. kg/ha in the year 2019-20 and 2020-21.

The weed control treatments had significant effect on plant dryweight at 60, 90 and 120 DAS, during both the year of investigation. The maximum plant dryweight of wheat was observed in plots treated with tankmixed pre emergence application of Metribuzin @ 0.3 a. i. kg/ha and Metsulfuron methyl @ 0.3 a. i. kg/ha. It was possibly due to availability of nutrients because of least density and emergence of weeds which resulted in decreased crop weed competition. The minimum plant dryweight of wheat was recorded in unweeded plots.

4.2.3. Number of tillers per plant

Number of tillers per plant in wheat as affected by different weed control treatments are presented in Table 4.7. The data revealed that there was significant different in number of tillers per plant of wheat due to treatments existed at all stages of crop growth during both the years of study.

There was no significant effect difference in number of tiller per plant in wheat due to different weed control treatments at 30 DAS, during both the years. However, at 60, 90 and 120 DAS, different weed control treatments had significant effect on plant height during both the years of investigation. The maximum number of tillers per plant was observed in plots treated with tankmixed pre emergence application of Metribuzin @ 0.3 a. i. kg/ha and Metsulfuron methyl @ 0.3 a. i. kg/ha. This treatment was found superior handweeded plots, possibly due move to availability of nutrients to wheat plants and of least emergence of weeds. This finding confirms with the result of Pandey, (2002) [13]. The minimum number of tillers per plant in wheat was recorded in the unweeded plots.

4.2.4. Crop growth rate

The crop growth rate of wheat recorded at 30, 60, 90 and 120 DAS, as effected by different weed control treatments during both the years of investigation have been presented in Table 4.8. The Crop Growth Rate (CGR) of wheat plants in the year of 2019-20 and 2020-21 at 30 DAS, 60 DAS and 90 DAS, was significant due to weed control treatments.

At 30 DAS, plots treated with tank mixed pre-emergence application of Metribuzin @ 0.3 a. i. kg/ha and Metsulfuron methyl @ 0.3 a. i. kg/ha. It can be attributing to maximum plant dryweight and number of tillers. This treatment was found superior than the other treatments during 2019-20 and 2020-21. The minimum crop growth rate of wheat was recorded in the unweeded plots.

4.2.5. Number of effective tillers per plant

Data on number of effective tillers per plant in wheat as affected by different weed control treatments are presented in Table 4.9. The data revealed that a significant different existed in number of effective tillers per plant due to treatments in the year of 2019-20 and 2020-21.

The maximum number of effective tillers per plant in wheat was observed in the year 2019-20 and 2020-21, respectively. The maximum number of effective tillers per plant in wheat was observed in plots treated with tankmixed pre emergence application of Metribuzin @ 0.3 a. i. kg/ha and Metsulfuron methyl @ 0.3 a. i. kg/ha. Possibly due to availability of nutrients, plant dryweight and number of tillers per plant. The least number of effective tillers per plant in wheat was observed in unweeded plots.

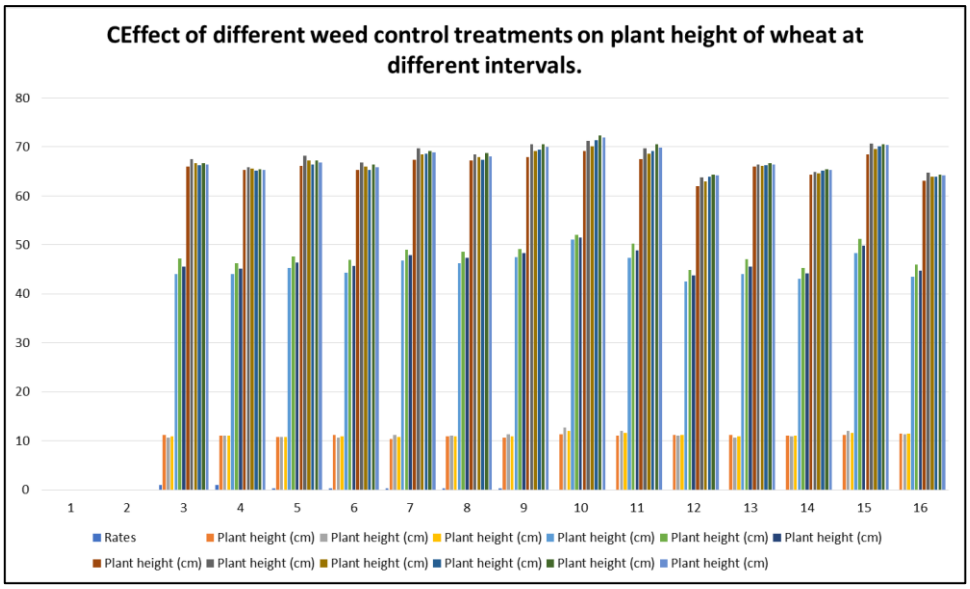

Table 1: Effect of different weed control treatments on plant height of wheat at different intervals

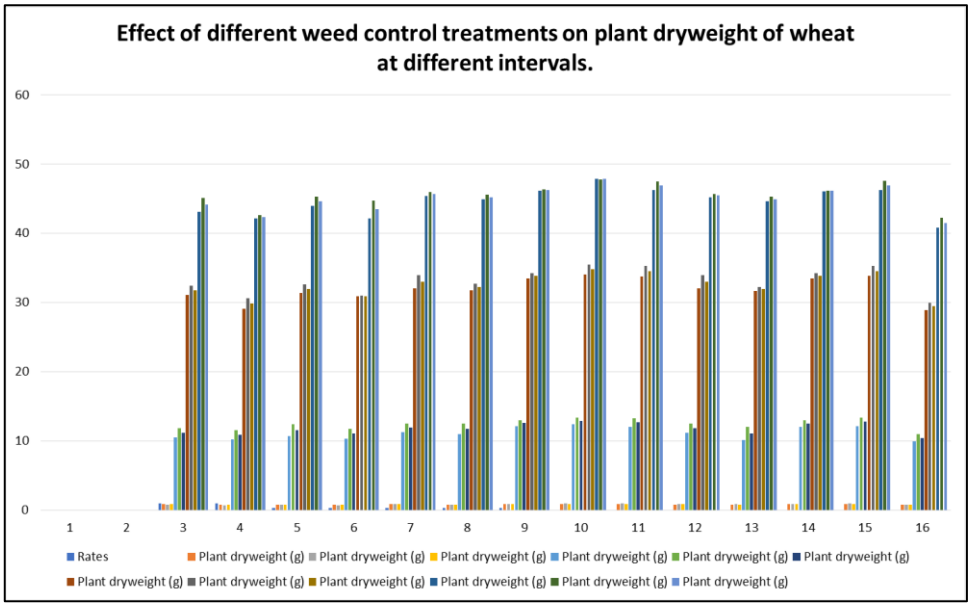

Fig 2: Effect of different weed control treatments on plant dryweight of wheat at different intervals

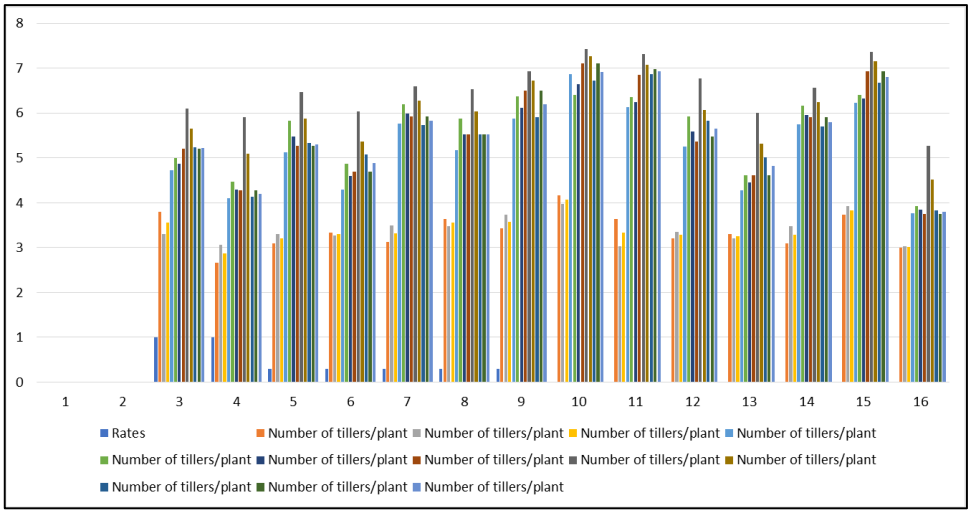

Table 4: Effect of different weed control treatments on number of tillers/plant in wheat at different intervals

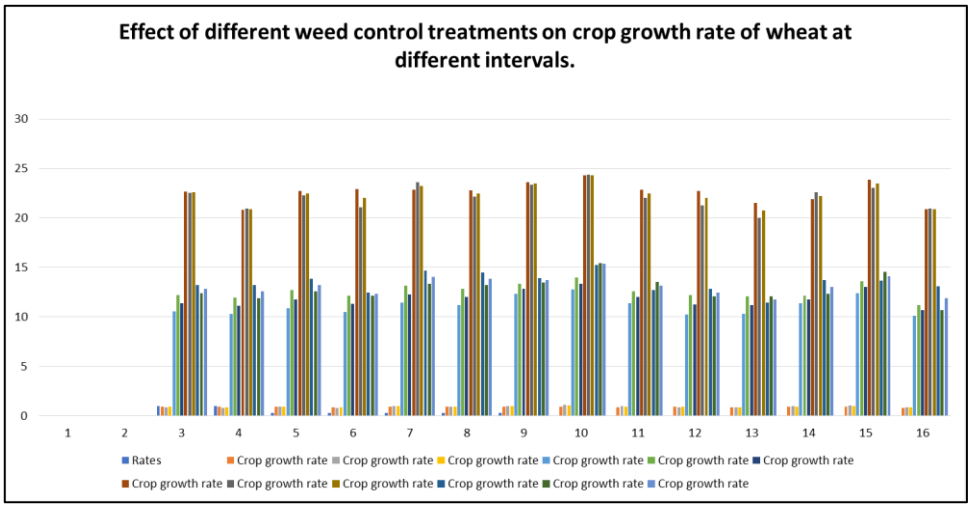

Table 5: Effect of different weed control treatments on crop growth rate of wheat at different intervals

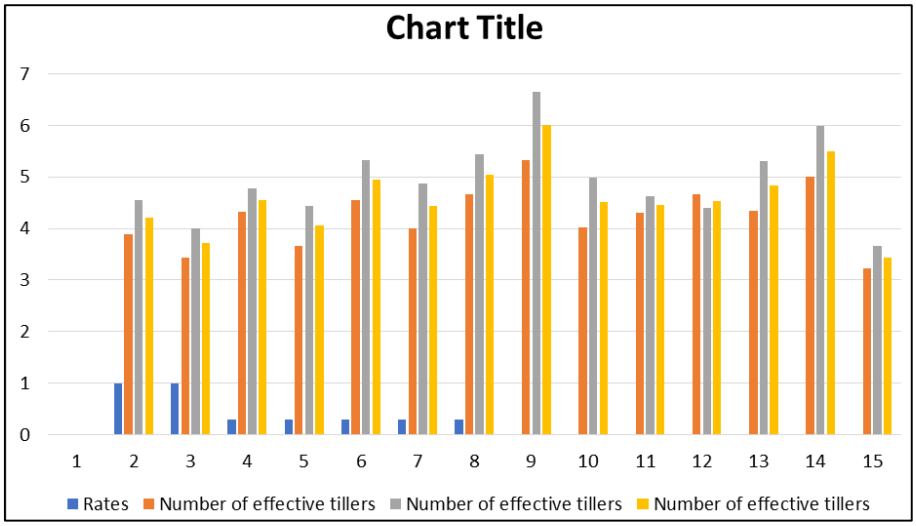

Fig 6: Chart title

Table 1: Effect of different weed control treatments on plant height of wheat at different intervals.

Treatments	Rates (a.i.kg/ha)	Plant height (cm)											
		30 DAS[1]			60 DAS			90 DAS			120 DAS		
		Year		Mean	Year		Mean	Year		Mean	Year		Mean
		2019-20	2020-21		2019-20	2020-21		2019-20	2020-21		2019-20	2020-21	
Pendimethalin + hand weeding	1.0	11.18	10.67	10.93	44.06	47.15	45.61	65.95	67.45	66.70	66.22	66.66	66.44
Pendimethalin + hoeing	1.0	11.02	11.00	11.01	44.07	46.27	45.17	65.28	65.88	65.58	65.10	65.40	65.25
Pendimethalin + metsulfuron methyl	0.3	10.71	10.72	10.72	45.23	47.67	46.45	66.18	68.17	67.18	66.35	67.19	66.77
Metsulfuron methyl + hand weeding	0.3	11.17	10.60	10.89	44.37	47.00	45.69	65.33	66.75	66.04	65.30	66.33	65.82
Metsulfuron methyl + hoeing	0.3	10.41	11.17	10.79	46.80	49.00	47.90	67.32	69.65	68.49	68.56	69.10	68.83
Metribuzine + hand weeding	0.3	10.86	11.00	10.93	46.20	48.57	47.39	67.25	68.52	67.89	67.30	68.76	68.03
Metribuzine + hoeing	0.3	10.65	11.30	10.98	47.43	49.20	48.32	67.89	70.55	69.22	69.41	70.50	69.96
Metribuzine + metsulfuron methyl	0.3 + 0.3	11.36	12.67	12.02	51.08	52.00	51.54	69.15	71.23	70.19	71.39	72.33	71.86
Two hand weeding		11.10	12.00	11.55	47.38	50.25	48.82	67.44	69.70	68.57	69.14	70.58	69.86
Two hoeing		11.16	11.12	11.14	42.53	44.92	43.73	62.03	63.73	62.88	63.90	64.38	64.14
Hand weeding + hoeing		11.16	10.65	10.91	44.04	47.10	45.57	65.93	66.42	66.18	66.20	66.66	66.43
Hoeing + Hand weeding		11.00	10.97	10.99	43.07	45.27	44.17	64.28	64.88	64.58	65.10	65.40	65.25
Weed free		11.16	12.06	11.61	48.38	51.25	49.82	68.44	70.70	69.57	70.14	70.58	70.36
Weedy check		11.46	11.37	11.42	43.53	45.92	44.73	63.03	64.73	63.88	63.90	64.38	64.14
F- test		ns[2]	Ns		s[3]	s		S	s		s	s	
SEd ±		0.38447	1.1326		2.380025	2.0028		1.93897	2.1585		2.32881	2.2521	
CD (5%)					5.00043	4.207798		4.07378	4.5349		4.89284	4.7317	

1. DAS – days after sowing; 2. ns – non significant and 3. s – significant.

Table 2: Effect of different weed control treatments on plant dryweight of wheat at different intervals

Treatments	Rates (a.i.kg/ha)	Plant dryweight (g)											
		30 DAS[1]			60 DAS			90 DAS			120 DAS		
		Year		Mean	Year		Mean	Year		Mean	Year		Mean
		2019-20	2020-21		2019-20	2020-21		2019-20	2020-21		2019-20	2020-21	
Pendimethalin + hand weeding	1.0	0.85	0.79	0.82	10.47	11.87	11.17	31.07	32.37	31.72	43.10	45.07	44.09
Pendimethalin + hoeing	1.0	0.80	0.71	0.76	10.17	11.57	10.87	29.07	30.60	29.84	42.10	42.57	42.34
Pendimethalin + metsulfuron methyl	0.3	0.81	0.80	0.81	10.67	12.35	11.51	31.33	32.60	31.97	43.93	45.23	44.58
Metsulfuron methyl + hand weeding	0.3	0.79	0.71	0.75	10.33	11.77	11.05	30.87	30.95	30.91	42.17	44.73	43.45
Metsulfuron methyl + hoeing	0.3	0.83	0.90	0.87	11.23	12.53	11.88	32.03	33.97	33.00	45.40	45.90	45.65
Metribuzine + hand weeding	0.3	0.81	0.81	0.81	10.97	12.50	11.74	31.70	32.67	32.19	44.87	45.57	45.22
Metribuzine + hoeing	0.3	0.84	0.90	0.87	12.07	13.01	12.54	33.50	34.23	33.87	46.17	46.33	46.25
Metribuzine + metsulfuron methyl	0.3 + 0.3	0.85	0.97	0.91	12.43	13.37	12.90	34.03	35.50	34.77	47.87	47.73	47.80
Two hand weeding		0.82	0.93	0.88	12.05	13.25	12.65	33.75	35.26	34.51	46.20	47.50	46.85
Two hoeing		0.81	0.89	0.85	11.20	12.50	11.85	32.00	33.97	32.99	45.18	45.65	45.42
Hand weeding + hoeing		0.80	0.82	0.81	10.07	12.00	11.04	31.62	32.17	31.90	44.57	45.27	44.92
Hoeing + Hand weeding		0.83	0.88	0.86	12.01	12.95	12.48	33.48	34.20	33.84	46.07	46.13	46.10
Weed free		0.83	0.95	0.89	12.10	13.35	12.73	33.80	35.30	34.55	46.23	47.53	46.88
Weedy check		0.74	0.77	0.76	9.93	10.93	10.43	28.90	29.97	29.44	40.80	42.20	41.50
F- test		ns[2]	Ns		s[3]	ns		s	s		s	s	
SEd ±		0.04077	0.1389		0.97767	0.8762		1.9580	1.9918		2.2012	1.9225	
CD (5%)					2.05409			4.1139	4.1847		4.6247	4.0391	

1. DAS – days after sowing; 2. ns – non significant and 3. s – significant

Table 3: Effect of different weed control treatments on number of tillers/plant in wheat at different intervals

Treatments	Rates (a.i.kg/ha)	Number of tillers/plant											
		30 DAS[1]			60 DAS			90 DAS			120 DAS		
		Year		Mean	Year		Mean	Year		Mean	Year		Mean
		2019-20	2020-21		2019-20	2020-21		2019-20	2020-21		2019-20	2020-21	
Pendimethalin + hand weeding	1.0	3.80	3.30	3.55	4.73	5.00	4.87	5.20	6.10	5.65	5.23	5.20	5.22
Pendimethalin + hoeing	1.0	2.67	3.07	2.87	4.10	4.47	4.29	4.27	5.90	5.09	4.13	4.27	4.20
Pendimethalin + metsulfuron methyl	0.3	3.10	3.30	3.20	5.13	5.83	5.48	5.27	6.47	5.87	5.33	5.27	5.30
Metsulfuron methyl + hand weeding	0.3	3.33	3.27	3.30	4.30	4.87	4.59	4.70	6.03	5.37	5.07	4.70	4.89
Metsulfuron methyl + hoeing	0.3	3.13	3.50	3.32	5.77	6.20	5.99	5.93	6.60	6.27	5.73	5.93	5.83
Metribuzine + hand weeding	0.3	3.63	3.47	3.55	5.17	5.87	5.52	5.53	6.53	6.03	5.53	5.53	5.53
Metribuzine + hoeing	0.3	3.43	3.73	3.58	5.87	6.37	6.12	6.50	6.93	6.72	5.90	6.50	6.20
Metribuzine + metsulfuron methyl	0.3 + 0.3	4.17	3.97	4.07	6.87	6.40	6.64	7.10	7.43	7.27	6.73	7.10	6.92
Two hand weeding		3.63	3.03	3.33	6.13	6.35	6.24	6.85	7.31	7.08	6.87	6.98	6.93
Two hoeing		3.20	3.35	3.28	5.26	5.92	5.59	5.36	6.77	6.07	5.83	5.47	5.65
Hand weeding + hoeing		3.30	3.21	3.26	4.27	4.62	4.45	4.61	6.00	5.31	5.01	4.62	4.82
Hoeing + Hand weeding		3.10	3.47	3.29	5.74	6.17	5.96	5.90	6.57	6.24	5.70	5.90	5.80
Weed free		3.73	3.93	3.83	6.23	6.40	6.32	6.93	7.37	7.15	6.67	6.93	6.80
Weedy check		3.00	3.03	3.02	3.77	3.93	3.85	3.75	5.27	4.51	3.83	3.75	3.79
F- test		ns[1]	Ns		s[3]	S		s	s		s	s	
SEd ±		0.54329	0.5898		1.01821	0.8281		1.0886	0.7006		0.9089	1.0886	
CD (5%)					2.13925	1.7397		2.2872	1.47189		1.90976	2.2872	

1. DAS – days after sowing; 2. ns – non significant and 3. s – significant

Table 4: Effect of different weed control treatments on crop growth rate of wheat at different intervals

Treatments	Rates (a.i.kg/ha)	Crop growth rate											
		30 DAS[1]			60 DAS			90 DAS			120 DAS		
		Year		Mean	Year		Mean	Year		Mean	Year		Mean
		2019-20	2020-21		2019-20	2020-21		2019-20	2020-21		2019-20	2020-21	
Pendimethalin + hand weeding	1.0	0.94	0.87	0.91	10.58	12.19	11.39	22.66	22.55	22.61	13.24	12.40	12.82
Pendimethalin + hoeing	1.0	0.88	0.78	0.83	10.30	11.95	11.13	20.79	20.94	20.87	13.24	11.87	12.56
Pendimethalin + metsulfuron methyl	0.3	0.89	0.88	0.89	10.85	12.71	11.78	22.73	22.27	22.50	13.86	12.56	13.21
Metsulfuron methyl + hand weeding	0.3	0.87	0.79	0.83	10.50	12.16	11.33	22.92	21.10	22.01	12.43	12.16	12.30
Metsulfuron methyl + hoeing	0.3	0.91	0.99	0.95	11.45	13.13	12.29	22.88	23.58	23.23	14.70	13.31	14.01
Metribuzine + hand weeding	0.3	0.89	0.89	0.89	11.18	12.86	12.02	22.81	22.18	22.50	14.48	13.19	13.84
Metribuzine + hoeing	0.3	0.92	0.99	0.96	12.35	13.32	12.84	23.58	23.35	23.47	13.93	13.45	13.69
Metribuzine + metsulfuron methyl	0.3 + 0.3	0.94	1.07	1.01	12.74	13.97	13.36	24.28	24.35	24.32	15.22	15.46	15.34
Two hand weeding		0.86	0.99	0.93	11.40	12.57	11.99	22.87	22.05	22.46	12.68	13.56	13.12
Two hoeing		0.88	0.87	0.88	10.25	12.21	11.23	22.73	21.27	22.00	12.86	12.06	12.46
Hand weeding + hoeing		0.86	0.82	0.84	10.30	12.06	11.18	21.52	20.00	20.76	11.43	12.06	11.75
Hoeing + Hand weeding		0.90	0.95	0.93	11.35	12.13	11.74	21.88	22.58	22.23	13.70	12.31	13.01
Weed free		0.91	1.04	0.98	12.40	13.57	12.99	23.87	23.05	23.46	13.68	14.56	14.12
Weedy check		0.81	0.84	0.83	10.11	11.18	10.65	20.86	20.94	20.90	13.09	10.67	11.88
F- test		s[2]	S		S	s		s	s		s	s	
SEd ±		0.0432	0.1562		1.0432	1.8036		3.3537	2.3819		2.5790	2.3776	
CD (5%)		0.090917	0.328276		2.19180	3.7894		7.046279	5.0043		5.4186	4.995304	

1. DAS – days after sowing; 2. s – significant

Table 5: Effect of different weed control treatments on number of effective tillers of wheat

Treatments	Rates (a.i.kg/ha)	Number of effective tillers		
		Year		Mean
		2019-20	2020-21	
Pendimethalin + hand weeding	1.0	3.88	4.55	4.22
Pendimethalin + hoeing	1.0	3.44	4.00	3.72
Pendimethalin + metsulfuron methyl	0.3	4.33	4.77	4.55
Metsulfuron methyl + hand weeding	0.3	3.66	4.44	4.05
Metsulfuron methyl + hoeing	0.3	4.55	5.33	4.94
Metribuzine + hand weeding	0.3	4.00	4.88	4.44
Metribuzine + hoeing	0.3	4.66	5.44	5.05
Metribuzine + metsulfuron methyl	0.3 + 0.3	5.33	6.66	6.00
Two hand weeding		4.02	4.99	4.51
Two hoeing		4.30	4.62	4.46
Hand weeding + hoeing		4.66	4.40	4.53

Hoeing + Hand weeding		4.35	5.30	4.83
Weed free		5.00	5.99	5.50
Weedy check		3.22	3.66	3.44
F- test		s[1]	s	
SEd ±		0.791127	0.9399	
CD (5%)		1.662159	1.974669	

1. s – significant

5. Conclusion

On the basis of present investigation, it can be concluded that in wheat tank mixed pre-emergence application of Metribuzine @ 0.3 a.i. kg/ha + post emergence application of metsulfuron methyl @ 0.3 a.i. kg/ha found superior over other treatments on growth and yield parameters.

6. References

1. Pandey AK, Gopinath KA, Gupta HS. Evaluation of sulfosulfuron and metribuzin for weed control in irrigated wheat (*Triticum aestivum*), Indian Journal of Agronomy. 2006;51(2):135-138.
2. Ali M, Sabir S, Kumar M, Ali MA. Efficacy and economics of different herbicides against narrow leaved weeds in wheat. International Journal of Agriculture & Biology. 2006;4:647-651.
3. Anonymous. project Directors Report, *ICAR-IIWBR, Karnal Haryana*., pp.1-3 Ansari, M.A., Verma, S.K., Sharma, R., Sharma, U.C., Kumar, G. and Singh, S.B. 2008. Wild canary grass as influenced by IWM in wheat. Pesticide Research Journal. 2020;20(2A):46-49.
4. Barla S, Prasad K. Integrated weed management in wheat (*Triticum aestivum* L.). J. Res. 2017;16(2):231-234.
5. Bibi S, Khan BM, Gul H, Khan NM. Effect of herbicides and wheat population on control of weeds in wheat. Pakistan Journal of Weed Science Research. 2008;14(3&4):111-119.
6. Chopra NK, Chopra N, Singh H. Bio-efficacy of herbicide mixture against complex weed flora in wheat (*Triticumaestivum* L.). Indian J Agron, 2008;53(1):62-65.
7. FAOSTAT (Food and Agriculture Organization Statistics). 2020 Crop harvested. Food and Agricultural Organization Statistical Service. (htt://www.fao.org/faostat /en/home).
8. Fisher RA, Yates YE. Report on coordination of fisher's statistics in India. A. Handbook of Agricultural statistics. 1958;17:47.
9. IIWBR, Director's report, AICRP on Wheat and Barley. Improved technologies for higher income of farmers. Indian Institute of Wheat and Barley Research, Karnal (Haryana). 2019-20;pp:2
10. Jena T, Singh RK, Bisen N. Surfactant influence on efficacy of herbicides in barley. Indian Journal of Weed Science. 2018;50:56-58.
11. Negi SC, Chopra P. Management of mixed weed flora in barley with tank-mix application of isoproturon with metsulfuron and 2,4-D. Indian Journal of Weed Science. 2015;47:28-30.
12. Pal S, Sharma R, Sharma HB, Pankaj. Bio-efficacy and selectivity of different herbicides for weed control in wheat. International Agronomy Congress. 2012;2:48-49.
13. Pandey IB, Dwivedi DK. Effect of planting pattern and weed control methods and weed growth and performance of wheat (*Triticum aestivum* L.). Indian J. Agron, 2007;52(3):235-238.
14. Paswan AK, Kumar R, Kumar P, Singh RK. Influence of metsulfuron- methyl and carfentrazone-ethyl either alone or in combination on weed flora, crop growth and yield in wheat (*Triticum aestivum* L). Madras Agric. J. 2012;99(7/9):560-562.
15. Pisal RR, Sagarka RK. Integrated weed management in wheat with new molecules (*Triticum aestivum* L). India J. Weed Sci. 2013;45(1):25-28.
16. Sasode DS, Gupta V, Joshi E, Arora A, Dixit JP, Panse R. Management of diverse weed flora of wheat by herbicide combinations. Indian Journal of Weed Science. 2017;49:147-150.
17. Singh J, Singh KP. Effect of organic manures and herbicides on yield and yield attributing character of wheat Indian J Agron. 2005;50(4):289-291.
18. Singh S, Singh AK, Yadav Shivam A, Harikesh. Assess the effect of different combinations of herbicides on weed population and economic feasibility of treatments in late sown wheat crop. Journal of Pharmacognosy and Phytochemistry. 2017;6:648- 651.
19. Patil SK, Suryavanshi GB, Dr. Patil JB, Kusale SP. Effect of integrated weed management on growth, yield and economics of wheat (*Triticum aestivum* L.). Int J Chem Stud. 2018;6(6):51-54.
20. Umbarkar Rohit B, Pandhure Narayan B. Influence of integrated weed management on growth, productivity and economics of wheat (*Triticum aestivum* L.), Crop Research. 2018;53(6):206-208. DOI: 10.31830/2454-1761.2018.0001.20
21. Yadav DB, Punia SS, Yadav A, Balyan RS. Evaluation of tank-mix combination of different herbicides for control of phalaris minor in wheat. Indian Journal of weed science. 2010;42(3&4):193-197.