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Influence of combination of herbicides on mixed weed flora in Wheat (*Triticumaestivum* L.)

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ABSTRACT

An experiment entitled "Influence of combination of herbicides on mixed weed flora in Wheat (Triticumaestivum L.)" was conducted at Birsa Agricultural University Farm, Ranchi, and Jharkhand during Rabiseason during 2021-22.The experiment was led out in randomized block design (RBD) with twelve treatments and replicated thrice with the variety DBW 187 under irrigated conditions. The treatments comprised Pendimethalin @1000g a.i/ha(PE), Pendimethalin@1500g a.i/ha(PE), Pyroxasulfone 85%WG @127.5g a.i/ha(PE), Pendimethalin @1250g a.i.(PE)+Pyroxasulfone 85%WG @127.5g a.i/ha(PE), Pyroxasulfone @ 127.5g a.i/ha + metsulfuron @ 4g a.i/ha (tank mixPE), Results revealed that application of Pyroxasulfone @ 127.5g a.i/ha + metsulfuron @ 4g a.i/ha (tank mix PE) exhibited the lowest total weeddensity (31.3and 47.0/m2), total weed dry weight (11.3 and 31.5 g/m2) and the highest weed control efficiency (80.9 and 79.1 %) at 30 and 60 days after sowingrespectively. Similarly, application of Pyroxasulfone @ 127.5g a.i/ha + metsulfuron @ 4g a.i/ha (tank mix PE) also recorded the highest yield attribute viz; spikes/m2(418), number of grains/spike (44.8), 1000 - grain weight (46.5 g), grain yield (5.81 t/ha), straw yield (6.65 t/ha) and net return (₹ 77696/ha) among herbicidal treatments.

Keywords: *Pendimethalin, Experiment, Triticumaestivum L, Pyroxasulfone, Herbicidal Treatments, Weeddensity.*

INTRODUCTION

Wheat is a crucial staple crop in the Indian diet. It is a rich source of energy and protein. Wheat grains have high bread-making quality, making them a versatile ingredient in a variety of dishes. According to the FAO statistical database, wheat cultivation covered an area of approximately 30 million hectares in India, resulting in a total annual production of 103.5 million tons and an average yield of 3533 kilograms per hectare in 2020 [2].By2051, due to population growth, the production of wheat will need to increase by 110-120million tons. Additionally, it is projected that wheat cultivation will decrease by approximately 5-6 million hectares by that time, due to urbanization and population pressure. Given these circumstances, improving wheat productivity by 5 tons per hectare is a challenging task, as noted by [7] and [9]

Weeds are a significant obstacle in wheat production. Untreated weed infestation can result in a dramatic reduction in wheat yield by 57 percent [10].Weeds imitate the appearance of wheat plants and release their seeds at thesame time and look as the crop. This results in a competition for essential resources such as light, moisture, space, and nutrients, which deprives the crop from these inputs. Wheat varieties that are high-yielding and have a dwarf stature are more vulnerable to weed competition compared to native tall wheat cultivars, which have higher levels of natural competition. This leads to a decrease in wheat productivity in fields dominated by weeds and as a result, an efficient weed management strategy is essential to increase productivity. Chemical weed control can be an efficient and cost-effective method for weed management in wheat crops, particularly in situations where there is a shortage of labor and high wages. However, it is important to ensure that the use of herbicides is carried out safely and responsibly, and that appropriate precautions are taken to minimize the potential risks to the environment and human health. In addition, while chemical weed control may be effective in controlling weeds without causing mechanical damage to crops, it is important to consider the potential impact of herbicide residues on the crop and soil. Careful selection of herbicides, proper application techniques, and appropriate timing can help to minimize the potential risks associated with chemical weed control [1].

At present, a lot of herbicides are available with post-emergence effects that can be used for weed control. However, when it comes to pre-emergence herbicides, there are only limited options such as pendimethalin and isoproturon. Unfortunately, many weeds, such as phalaris minor, have developed resistance to isoproturon, leaving farmers with little choice. Therefore, there is a need for an efficient pre-emergence herbicide with a different mode of action and sufficient residual activity to manage both established and newly emerging herbicide resistance in weeds. To address this need, a study was conducted to test a new pre-emergence herbicide, pyroxasulfone, and its combination with other herbicides to compare their efficacy in controlling different weed flora of wheat. This herbicide offers an alternative mechanism of action, making it an ideal solution for managing herbicide resistance in weeds [10].

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Keeping this in view, a field experiment will be conducted on entitled, "Influence of herbicides on mixed weed flora and productivity of Wheat (*Triticumaestivum*L.)" at Birsa Agricultural University, Kanke, Ranchi during Rabi 2021-22.

Material and Methods

A field experiment was conducted in Western section of Birsa Agricultural UniversityFarm, Kanke, Ranchi (23°17' N latitude, 85°10' E longitude, and 625 m above mean sea level), Jharkhand, in the rabi season during 2021-22. The soil was clay loam with 32.4% sand, 30.3% silt, and 37.3% clay. The soil was slightly acidic in reaction (pH 5.8), low in inorganic carbon (5%) and available nitrogen (225 kg/ha), and medium in available phosphorus (15.4 kg/ha) and potassium (186.6 kg/ha). The experimental site, Ranchicomes, is under the VII agro-climatic region of India, i.e., the eastern plateau and hills, which is termed as sub-humid with hot summers and cold winters. The source of rainfall is the southwestern monsoon. It receives an average annual rainfall of 1326 mm (based on an 80-year mean), mostly (85%) concentrated during the period of June to September. A few showers are expected during winters and occasionally during summer months. May and June are the hottest months, with average maximum temperatures of 35.6°C and 36.2°C, respectively. January is the coldest month of the year when the temperature falls to 8.1°C. The cold period continues up to the month of February, and the temperature starts rising up from the month of March. The experimental plot was provided with an assured irrigation facility having uniform topography and proper drainage. The experiment was laid out under RBD in three replications. The net plot size was 6.0 m x 2.0 m. Row-to-row distance for wheat was 20 cm. The seed rate used was 100 kg/ha. The recommended dose of fertilizer (N, P, and K) was 150:60:40 kg/ha. The wheat variety 'DBW 187' was used in the investigation. A full dose of phosphorus as DAP (18% N + 46% P_2O_5) and potash as muriate of potash (60% K_2O) was applied at the time of sowing of the wheat crop. Nitrogen was applied through urea in 3 splits as per the recommended practice, in which half was applied at the sowing of wheat. The remaining half of N was top dressed equally after the first and second irrigation. Wheat was sown in lines by opening the furrows with the help of a Dutch hoe. The crop was grown under irrigated conditions. Four irrigations were applied: first at the crown root initiation stage, second at late tillering, third at flowering, and fourth at the milking stage to maintain optimum soil moisture for crop growth. Data on different growth parameters, yield-attributing characters, grain yield, and straw yield were recorded at different growth stages. The protein content in the seed was determined by multiplying the nitrogen content in the seed by a factor of 6.25, as specified by AOAC (1960). The data were analyzed by using the Analysis of Variance Technique for randomized block design (RBD) as per the procedure described by [4].The treatment means were compared at a 5% level of significance.

Table 1. Treatment details along with the symbol used

Tr.No.	Treatments	Kg a.i./ha
T_1	Pendimethalin@1000g a.i/ha(PE)	**1.00**
T_2	Pendimethalin@1500g a.i/ha(PE)	**1.50**
T_3	Pyroxasulfone 85%WG @127.5g a.i/ha(PE)	**0.1275**
T_4	Pendimethalin@ 1250ga.i/ha+Pyroxasulfone@127.5g a.i/ha(tankmixPE)	**1.250 + 0.1275**
T_5	Pyroxasulfone@127.5ga.i/ha+metsulfuron@4g a.i/ha(tankmixPE)	**0.1275 + 0.004**
T_6	Pyroxasulfone@127.5g a.i/ha(EPoE)	**0.1275**
T_7	Pyroxasulfone@127.5ga.i/ha+metsulfuron@4g a.i/ha(tankmixEPoE)	**0.1275 + 0.004**
T_8	Metribuzin @300g a.i/ha(PE)	**0.300**
T_9	Pendimethalin@1250ga.i/ha+Metribuzin @280ga.i/ha(tankmixPE)	**1.250 + 0.280**
T_{10}	Pyroxasulfone@127.5ga.i/ha+Metribuzin@ 280ga.i/ha(tankmixPE)	**0.1275 + 0.280**
T_{11}	Weedy check	-
T_{12}	Weed free	-

Weed flora of the experimental field

Weed flora present in the experimental plot during rabi (2021-22) were collected from the weedy check plot at 40 DAS, identified, and classified into two categories, i.e., grassy weed and broad-leaved weed. Details about major weed flora present in the field are presented in Table-2. The experimental plot was infested with two categories of weeds, i.e., grassy weeds and broadleaf weeds. Altogether nine weed species were recorded. Dominant weed floras were taken from the weedy checkplot at 40 DAS.

Table-2: Detail study on different types of weed observed in the wheat field during 2021-22

Botanical name	English Name	Family
Grassy weeds		
*Cynodondactylon*L.	Bermudagrass	Poaceae
Avenafatua	Wildoat	Poaceae
Phalaris minor	Littleseedcanarygrass	Poaceae
Broadleaved weeds		
*Coronopusdidymus*L.	Swine	Brassicaceae
Trifoliumrepens	Whiteclover	Fabaceae
Vicia sativa L.	Common vetch	Fabaceae
*Anagallisarvensis*L.	ScarletPimpernel	Primulaceae
Chenopodium album L.	Common lambsquater	Chenopodiaceae
Medicagodenticulata	Rough medic	Fabaceae

RESULTS AND DISCUSSION

Effect of herbicides on weed control efficiency, weed index, and weed dry weight

The herbicide application of pyroxasulfone at 127.5 g a.i./ha + metsulfuron at 4 g a.i./ha (tank mix PE) (T5) consistently showed the lowest grassy weed dry weight and broad-leaved weed dry weight at both 30 and 60 DAS (Table 3). This treatment was found to be on par with Pyroxasulfone at 127.5 g a.i./ha + Metribuzin at 280 g a.i./ha (tank mix PE) (T10), Pendimethalin at 1250 g a.i./ha + Metribuzin at 280 g a.i./ha (tank mix PE) (T9), and Pendimethalin at 1250 g a.i./ha + Pyroxasulfone at 127.5 g a.i./ha (tank mix PE) (T4) but significantly lower than the rest of the treatments. On the other hand, the weedy check recorded the highest weed dry matter compared to all other treatments. The weed-free (T12) treatment consistently showed the lowest weed dry weight throughout the growing period; this could be due to manual weed control at 25 and 50 DAS, which resulted in weeds accumulating less dry matter.

These findings are consistent with [3].Weed control efficiency was highest in weed-free (T12) at both 30 DAS (92.04%) and 60 DAS (91.39%). Among the different herbicide applications at 30 DAS and 60DAS, Pyroxasulfone @ 127.5g a.i/ha + metsulfuron @ 4g a.i/ha (tank mix PE) (T5)showed the highest weed control efficiency (80.89% and 79.03% respectively)) and was at par with Pyroxasulfone @ 127.5g a.i/ha + Metribuzin@ 280g a.i/ha(tankmixPE)(T10),Pendimethalin@1250ga.i/ha+Metribuzin@280ga.i/ha(tankmix PE)(T9), and Pendimethalin @ 1250g a.i/ha + Pyroxasulfone @ 127.5g a.i/ha (tankmix PE) (T4), because in Pyroxasulfone @ 127.5g a.i/ha + metsulfuron @ 4g a.i/ha (tankmix PE) (T5) A combination of two different type of weed controlling herbicides were mixed that made wider the spectrum of herbicides to control various kind of weed species. [5] also found almost similar results. In the weedy check (T11), the minimal weed control efficiency was reported. Weed control efficiency may be improved as a result of decreasing weed counts and dry weight. Whereas lower weed control efficiency was largely due to higher weed counts and weed dry weight.Application of pyroxasulfone at 127.5 g a.i./ha + metsulfuron at 4 g a.i./ha (tank mix PE) (T5) recorded the lowest weed index (1.80%) over other herbicides treated because it has the lowest weed growth and less loss of grain yield. The highest value of weed index was recorded in weedy check (T11) (30.20%) because it has the highest weed growth and loss of grain yield. The herbicide application of pyroxasulfone at 127.5 g a.i./ha + metsulfuron at 4 g a.i./ha (tank mix PE) (T5) consistently showed the lowest grassy weed dry weight and broad-leaved weed dry weight at both 30 and 60 DAS. This treatment was found to be at par with Pyroxasulfone at 127.5 g a.i./ha + Metribuzin at 280 g a.i./ha (tank mix PE) (T10), Pendimethalin at 1250 g a.i./ha + Metribuzin at 280 g a.i./ha (tank mix PE) (T9), and Pendimethalin at 1250 g a.i./ha + Pyroxasulfone at 127.5 g a.i./ha (tank mix PE) (T4) but significantly lower than the rest of the treatments. On the other hand, the weedy check recorded the highest weed dry matter compared to all other treatments (Table. The weed-free (T12) treatment consistently showed the lowest weed dry weight throughout the growing period; this could be due to manual weed control at 25 and 50 DAS, which resulted in weeds accumulating less dry matter.These findings are consistent with [3].

Effect of weed control measures on weed density

At 30 DAS, among herbicide-treated plots, application of pyroxasulfone at 127.5 g a.i./ha + metsulfuron at 4 g a.i./ha (tank mix PE) (T5) recorded the minimum grassy weed density (8.91/m^2), which was at par with pyroxasulfone at 127.5 g a.i./ha + metribuzin at 280 g a.i./ha (tank mix PE) (T10), pendimethalin at 1250 g a.i./ha + metribuzin at 280 g a.i./ha (tank mix PE) (T9), and pendimethalin at 1250 g a.i./ha + pyroxasulfone at 127.5 g a.i./ha (tank mix PE) (T4) but significantly lower than the rest of the treatments.Table-4 Application of pyroxasulfone at 127.5 g a.i./ha + metsulfuron at 4 g a.i./ha (tank mix PE) (T5) recorded the lowest grassy weed density (13.32/m^2), which was at par with pyroxasulfone at 127.5 g a.i./ha + metribuzin at 280 g a.i./ha (tank mix PE) (T10), pendimethalin at 1250 g a.i./ha + metribuzin at 280 g a.i./ha (tank mix PE) (T9), and pendimethalin at 1250 g a.i./ha + pyroxasulfone at 127.5 g a.i./ha (tank mix PE) (T4) but significantly lower than the rest of the treatments.

Broadleaved weed density (No./m^2)

Data on broadleaved weeds m^{-2} as influenced by weed control methods at different growth stages of crops are presented in Table 4.At 30 DAS, weed-free (T12) continued to show a lesser density of broad-leaved weeds. Among herbicide-treated plots, application of pyroxasulfone at 127.5 g a.i./ha + metsulfuron at 4 g a.i./ha (tank mix PE) (T5) recorded the minimum broadleaf weed density (22.36/m^2), which was at par with pyroxasulfone at 127.5 g a.i./ha + metribuzin at 280 g a.i./ha (tank mix PE) (T10), pendimethalin at 1250 g a.i./ha + metribuzin at 280 g a.i./ha (tank mix PE) (T9), and pendimethalin at 1250 g a.i./ha + pyroxasulfone at 127.5 g a.i./ha (tank mix PE) (T4) but significantly lower than the rest of the treatments. The highest density of broadleaf weeds (129.20/m^2) was recorded in the weedy check (T11). At 60 DAS, the highest broadleaf weed density (181.36/m^2) was recorded in the weedy check, and the lowest broadleaf weed density (13.85/m^2) was recorded in weed-free (T12). However, among herbicide-treated plots, application of pyroxasulfone at 127.5 g a.i./ha + metsulfuron at 4 g a.i./ha (tank mix PE) (T5) recorded the lowest broadleaf weed density (33.65/m^2), which was at par with pyroxasulfone at 127.5 g a.i./ha + metribuzin at 280 g a.i./ha (tank mix PE) (T10), pendimethalin at 1250 g a.i./ha + metribuzin at 280 g a.i./ha (tank mix PE) (T9), and pendimethalin at 1250 g a.i./ha + pyroxasulfone at 127.5 g a.i./ha (tank mix PE) (T4) but significantly lower than the rest of the treatments.Among herbicide-treated plots, application of pyroxasulfone at 127.5 g a.i./ha + metsulfuron at 4 g a.i./ha (tank mix PE) (T5) recorded the minimum broad-leaved and grassy weeds at 30 DAS and 60 DAS, which was at par with pyroxasulfone at 127.5 g a.i./ha + metribuzin at 280 g a.i./ha (tank mix PE) (T10), pendimethalin at 1250 g a.i./ha + metribuzin at 280 g a.i./ha (tank mix PE) (T9), and pendimethalin at 1250 g a.i./ha + pyroxasulfone at 127.5 g a.i./ha (tank mix PE) (T4) but significantly lower than the rest of the treatments. This might be due to effective control of both grassy and broad-leaved weeds. Herbicides were used to control emerging weeds before they emerged. These results are similar to those reported by [8].

Effect of weed control measures on yield attributes and yield

The application of pyroxasulfone at 127.5 g a.i./ha + metsulfuron at 4 g a.i./ha (tank mix PE) (T5) is the most effective combination of herbicide treatment in terms of increasing spike m^{-2}, number of grains per spike, and grain yield. It showed the highest values for all these parameters compared to the other herbicide treatments and the weedy check. The treatments Pyroxasulfone @ 127.5 g a.i./ha + Metribuzin @ 280 g a.i./ha (tank mix PE) (T10), Pendimethalin @ 1250 g a.i./ha + Metribuzin @ 280 g a.i./ha (tank mix PE) (T9), and Pendimethalin @ 1250 g a.i./ha + Pyroxasulfone @ 127.5 g a.i./ha (tank mix PE) (T4) were also found to be effective and at par with Pyroxasulfone @ 127.5 g a.i./ha + metsulfuron @ 4 g a.i./ha (tank mix PE) (T5) for these parameters. The weedy check showed the lowest values for all these parameters (Table 5). The maximum 1000-grain weight was recorded under weed-free (T12); this could be related to lower weed density and better crop growth due to decreased crop weed competition, which boosted the availability of nutrients and moisture to the wheat crop. These results are in accordance with the findings of [6]. However, the lowest 1000-grain weight was recorded in the weedy check (T11).

Various weed control strategies significantly boosted grain yield as compared to the weedy control; this could be due to improved weed protection paired with reduced weed population and improved yield-contributing features in these treatments. The pre-emergence herbicides successfully control the various weeds in the wheat crop, resulting in high weed control effectiveness and higher yield in these treatments. The cumulative function of the yield component results in the final yield buildup. Higher grain output in the above treatments may be due to proper use of moisture, nutrients, light, and space by the wheat crop in the absence of weed competition.

Effect of weed control measures on economics.

Weed-free treatment resulted in the highest yields of grain and straw, leading to higher gross returns. However, due to higher labor charges, the net return was estimated to be lower than herbicidal treatments. Among the herbicidal treatments, Pyroxasulfone at 127.5 g a.i./ha + metsulfuron at 4 g a.i./ha (tank mix PE) (T5) was found to have a significantly more positive impact on yield-attributing characters, resulting in greater yields and higher gross returns as compared to other treatments (Table 5). Almost similar results were also reported by Kumar et al. (2021). Similarly, due to enhanced growth, yield-attributing character application of pyroxasulfone at 127.5 g a.i./ha + metribuzin at 280 g a.i./ha (tank mix PE) (T10), pendimethalin at 1250 g a.i./ha + metribuzin at 280 g a.i./ha (tank mix PE) (T9), and pendimethalin at 1250 g a.i./ha + pyroxasulfone at 127.5 g a.i./ha (tank mix PE) (T4) also recorded better yield of wheat. Benefit-cost ratio is the ratio of net returns and cost of cultivation; hence, its higher values have been recorded in pyroxasulfone at 127.5 g a.i./ha + metsulfuron at 4 g a.i./ha (tank mix PE) (T5), also reported by [5]. The minimum gross return, net return, and B:C ratio were estimated in weedy check due to the lowest grain and straw yields.

Conclusion

Application of pyroxasulfone at 127.5 g a.i./ha + metsulfuron at 4 g a.i./ha (tank mix PE) (T5) proved to be effective in suppressing weeds and recorded maximum grain yield (5.81 t/ha) and net return (₹ 77696/ha) with a B:C ratio (1.82) of wheat under irrigated conditions in Jharkhand.

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Table 3: Weed dry weight, weed control efficiency and Weed index of wheat as influenced by weed control methods

Treatments	Weed Dry weight(g/m2)						WCE (%)		Weed Index
	30DAS			60DAS			30DAS	60DAS	
	Broad leaved	Grasses	Total	Broad leaved	Grasses	Total			
T1	5.29 (27.65)	3.11	6.1	-37.32	4.29	7.45	37.3	63	18.8
		-9.25	-36.9		-17.9	-55.1			
T2	5.24	3.01	6.01	6.01	3.83	7.08	39.4	66.8	17.25
	-27.13	-8.65	-35.8	-35.77	-14.24	-49.8			
T3	4.56	2.73	5.28	5.68	3.65	6.69	53.6	70.2	15.31
	-20.6	-6.97	-27.6	-31.8	-12.86	-44.4			
T4	3.59	2.25	4.2	5.05	3.4	6.01	71	75.8	8.79
	-12.58	-4.64	-17.2	-25.15	-11.18	-35.8			
T5	2.93	1.91	3.43	4.76	3.08	5.64	80.9	79	1.8
	-8.13	-3.18	-11.3	-22.31	-9.06	-31.5			
T6	4.75	2.83	5.5	5.74	3.73	6.8	49.9	69.2	16.1
	-22.29	-7.57	-29.9	-32.53	-13.47	-45.8			
T7	4.27	2.61	4.97	5.63	3.61	6.67	58.7	70.5	14.74
	-17.99	-6.37	-24.4	-31.6	-12.64	-44.2			
T8	5.34	3.38	6.29	7.52	4.95	8.94	32.9	46.5	19.06
	-28.53	-10.98	-39.5	-56.25	-23.99	-79.6			
T9	3.58	2.18	4.13	4.95	3.37	5.91	72	76.8	7.06
	-12.48	-4.32	-16.8	-24.15	-10.94	-34.6			
T10	3.27	2.04	3.79	4.89	3.31	5.85	76.3	77.4	2.93
	-10.38	-3.7	-14.1	-23.5	-10.51	-33.7			
T11	6.85	3.65	7.74	11.03	5.38	12.2	0	0	30.2
	-46.55	-12.9	-59.5	-121.24	-28.4	-149.7			
T12	2.08	1.15	2.27	3.1	1.99	3.63	92	91.4	0
	-3.86	-0.84	-4.7	-9.28	-3.5	-12.7			
SEm+_	0.32	0.17	0.28	0.27	0.17	0.25	-	-	-
CD(0.05)	0.95	0.5	0.83	0.8	0.5	0.74	-	-	-

**Data in parenthesis were transformed to $\sqrt{x+0.5}$ before analysis*

Table 4: Weed density of different weed flora of wheat as influenced by weed control methods

Treatments	Weed density (no./m2)					
	30 DAS			60 DAS		
	Grasses	Broad leaved	Total	Grasses	Broad leaved	Total
T1	5.08(25.0)	8.75(76.7)	10.11(102.2)	5.17(26.3)	7.51(56.0)	9.09(82.3)
T2	4.95(24.2)	9.08(82.0)	10.32(106.2)	4.67(21.4)	7.30(52.9)	8.64(74.3)
T3	4.47 19.5)	7.53(57.1)	8.75(76.6)	4.41(19.03)	6.90(47.2)	8.16(66.3)
T4	3.64(12.0)	5.91(34.9)	6.95(47.9)	4.08(16.21)	6.12(37.2)	7.32(53.4)
T5	3.05(8.9)	4.76(22.4)	5.63(31.3)	3.70(13.3)	5.83(33.6)	6.87(47.0)
T6	4.60(20.8)	7.9(62.4)	9.14(83.2)	4.53(20.1)	6.97(48.2)	8.29(68.3)
T7	4.22(17.5)	7.05(50.0)	8.23(67.5)	4.38(18.8)	6.86(47.1)	8.13(65.9)
T8	5.57(30.7)	8.85(79.2)	10.45(109.9)	5.96(35.1)	9.17(83.7)	10.92(118.8)
T9	3.53(12.1)	5.85(34.1)	6.80(46.2)	4.04(15.9)	6.01(35.7)	7.21(51.6\)
T10	3.26(10.2)	5.38(29.0)	6.26(39.2)	3.97(15.3)	5.95(35.0)	7.13(50.3)
T11	5.99(35.6)	11.38(129.2)	12.85(164.8)	6.53(42.1)	13.48(181.3)	14.96(223.5)
T12	1.68(2.3)	3.39(11.1)	3.72(13.4)	2.36(5.2)	3.76(13.8)	4.41(19.0)
SEm+_	0.29	0.53	0.46	0.2	0.33	0.31
CD(0.05)	0.85	1.55	1.34	0.6	0.98	0.9

**Data in parenthesis were transformed to $\sqrt{x+0.5}$ before analysis*

Table 5: Yield attributing character, yield and economics of wheat as influenced by weed control methods

Treatments	Effective tillers/m²	Grains /Spike	1000 grain weight (g)	Grain yield t/ha	Straw yield t/ha	Gross return (Rs/ha)	Net return (Rs/ha)	B:C ratio
T_1	352	37.7	43.1	4.85	5.54	100499	60451	1.51
T_2	356	38.3	43	4.93	5.59	102066	60684	1.47
T_3	363	39	43.2	5.02	5.72	103944	61561	1.45
T_4	400	42.9	44.8	5.39	6.24	111730	66014	1.44
T_5	418	44.8	46.5	5.81	6.65	120329	77696	1.82
T_6	360	38.5	43.1	4.96	5.61	102818	60435	1.43
T_7	368	39.4	43.3	5.05	5.8	104592	61959	1.45
T_8	347	37.3	42.8	4.81	5.47	99725	61662	1.62
T_9	410	43.4	45.4	5.51	6.38	114215	72864	1.76
T_{10}	414	43.6	46.2	5.78	6.54	119804	76785	1.78
T_{11}	313	35	42.2	4.13	4.68	85494	48812	1.33
T_{12}	419	44.9	46.5	6.04	6.74	125076	67394	1.17
SEm±	16.14	1.72	1.08	0.24	0.28	4866	4866	0.1
CD (P=0.05)	47	5	NS	0.7	0.81	14271.6	14271.6	0.3

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