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Effect Of Mulching And Pre-Emergence Herbicide On Yield And Economic Of Wheat (*Triticum Aestivum* L.)

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Abstract

The experiment was carried out at crop research farm Dev Bhoomi Uttarakhand University Dehradun, Uttarakhand India. The university crop research farm is located near Dehradun in the state of Uttarakhand. The location's coordinates are approximately 77.9326° E longitude and 30.3841° N latitude. At 410 metres above mean sea level, the location of the site is marked. This study aims to investigate the effects of pre-emergence and mulching on the wheat variety PBW-550's yield and economics. The study explores the impact of weed management and mulching on wheat production growth characteristics and financial outcomes. Results show significant impacts on plant height, leaf area, and dry weight, with straw mulching resulting in higher grain and stover yields. The findings showed that the treatment (T-7) combination of straw mulch (Paddy Straw) + (Two hand weeding) was shown to considerably increase grain production (4.41 t/ha), gross returns (Rs. 2,61,491.45 /ha), net returns (Rs. 1,58,190 /ha), and benefit cost ratio (2.42).

Introduction

The most outstanding crop in the world, wheat (Triticum aestivum L.), is referred to as the "king of cereals" since it outperforms all other cereals in terms of area and productivity (Costa et al., 2013). Being one of the most nutrient-dense grains introduced to the human diet, it ranks #1 in terms of global food security. 22,1.12 million hectares of wheat were planted worldwide in 2018–19, yielding 697.8 million metric tonnes of product per year

on average and 3.16 metric tonnes of productivity annually. In India, wheat was planted on 29.58 million hectares in 2018–19, producing 99.70 million metric tonnes of product with an average productivity of 3371 kg ha1, according to Agricultural Statistics at a Glance 2018. Due to the extreme competition that many grassy and broad-leaf weeds create for sunlight, vital nutrients, moisture, and space, wheat yield and quality are reduced **(Chopra *et al*., 2015)**. Depending on their density, unchecked weed development reduced wheat grain output by an average of 7–50% **(Jat *et al*., 2005; Singh *et al*., 2012)**. One of the primary biotic restrictions on wheat output is weeds because they compete with crops for nutrients, moisture, light, and space. **(Chhokar *et al*. 2012)**. One significant component of input expenses in crop production is weed control, and pesticides. Mulching is crucial for increasing productivity since it decreases weeds and improves the soil's capacity to retain water. By producing greenhouse gases (CO2, CH4, and NO2) and particulate matter, burning paddy straw dramatically worsens air pollution and degrades soil quality **(Buttar *et al*., 2022)**. Furthermore, some pre-emergence (PE) herbicides lose some of their potency when straw ash is used (Chhokar et al., 2009). We may use the leftovers as mulch to reduce the density and development of weeds rather than burning them. A number of weed species are prevented from growing and emerging when rice waste is used as mulch. The interaction between common weeds and an integrated herbicide and straw mulching technique has not been thoroughly studied. Given this, the purpose of the current study was to gather information on the development and population dynamics of a few major weed species, as well as the productivity and production economics of late-sown wheat with the integration of herbicides and straw mulching.

MATERIALS AND METHODS

This study examines the effects of mulching and pre-emergence herbicides on yield and economics of wheat. Using a randomized block design (RBD), this study examines the effects of pre-emergence herbicides and mulching on wheat production and development. consists of twelve treatments. T1: Pre-emergence herbicide (25 g/ha), combined with plastic mulching and sulfosulfuron T2: 4 g/ha of metsulfuron, plus plastic mulching T3: Hand weeding and plastic mulching T4: Mulching with plastic + Control T5: 25 grammes per hectare of sulfosulfuron plus straw mulch (paddy straw); T6: 4 grammes per hectare of metsulfuron plus straw mulch (paddy straw); T7: Two-man weeding and straw mulch (paddy straw), T 8: Paddy straw mulch + control, T9: Sulfosulfuron at 25 g//ha pre-emergence + Control, T10: Pre-emergence, Control, and Metsulfuron at 4 g//ha T12: Control and T11: Control plus two-hand weeding. It looks at how mulching and pre-emergence herbicides affect the growth, yield, and dynamics of weeds.

RESULTS AND DISCSSION

The maximum growth features, which were determined by W3 (two-hand weeding at 25 and 45 DAS) and M2 (straw mulching using paddy straw), were significantly impacted by mulching and weed control approaches, according to a thorough examination of the mean data.

The leaf area index, crop growth rate, relative growth rate, and net assimilation rate were among the growth analytical aspects that were significantly impacted by mulching and weed control strategies. Using M2 (staw mulching with paddy staw) and W3 (two-hand weeding at 25 and 45 DAS), maximum growth analytic characteristics were measured.

However, data analysis also demonstrated that W3 (two-hand weeding at 25 and 45 DAS) and W2 (sulfosulfuron at 25 a.i./ha) were equivalent. The growth and growth analytical properties of mulching treatments M1 (plastic mulch) and M2 (straw mulching) were found to be equal.

Table 1: Effect of mulching and pre-emergence herbicide on yield and economics of wheat

	Treatments							
		Plant Height	**Dry weight**	**L.A. I**	**Leaf area**	**C.G.R.**	**R.G.R.**	**N.A. R**
	Pre-Emergence herbicide							
W_1	Sulfosulfuron at 25g a1/ha pre-emergence	83.46	78.75	3.14	314.00	105.12	11.49	36.56
W_2	Metsulfuron at 4g al/ha as pre-emergence	81.86	73.79	3.12	312.11	94.53	10.90	29.76
W_3	Two hand Weeding	83.90	75.50	3.20	319.56	112.28	11.71	38.84
W_4	Control	73.59	69.42	2.86	285.78	87.88	9.90	31.07
	F test	S	S	S	S	NS	NS	S
	SEd (±)	1.54	0.44	0.09	8.87	2.33	0.08	3.03

	CD (P= 0.05)	3.19	0.92	0.18	18.39	4.83	0.18	4.11
	Mulching							
M_1	Plastic Mulching	84.19	75.56	3.03	303.00	100.26	10.90	37.77
M_2	Straw Mulching (Paddy Straw)	82.56	75.76	3.22	322.08	101.09	11.71	38.17
M_3	Control	72.36	65.56	1.99	298.50	95.51	9.49	32.99
	F test	S	S	S	S	S	S	S
	SEd (±)	1.33	0.38	0.08	7.68	2.02	0.07	2.06
	CD (P= 0.05)	2.77	0.79	0.16	15.93	4.19	0.15	4.43

Yield:

Grain yield (t/ha)

Out of all the treatments, treatment (T-7) with straw mulch (Paddy Straw) plus two hand weedings had the significantly greatest grain production (4.15 t/ha). But the treatments (T-1) of plastic mulching and sulphur sulfuron at 25 grammes per hectare at pre-emergence (4.00 t/ha) were found to be statistically equivalent to two-hand weeding and straw mulch (Paddy Straw). The treatment with the lowest grain yield, T-12 control, was 3.69 t/ha.

Stover yield (t/ha)

Notably The treatment designated as T-7, which consisted of straw mulch (Paddy Straw) and two hand weeding operations, yielded the highest stover output (5.27 t/ha). The treatments (T-1) consisting of plastic mulching and 25g of sulphur sulfuron per hectare at pre-emergence (5.15 t/ha) were shown to be statistically comparable to the combination of straw mulch (Paddy Straw) and two hand weeding. The lowest stover output, 45.39 t/h, was obtained for the treatment (T-12) Control.

Economics

Cost of Cultivation (Rs/ha)

Data in Table 2 showed that, across all treatments, the treatment (T-7) of straw mulch (Paddy Straw) + two hand weeding had the highest cultivation costs (Rs. 1,03,195 /ha). However, the treatments (T-1) Plastic mulching + Sulfosulfuron at 25g a.i./ha pre-emergence (Rs 97,111 /ha) which were found to be statistically at par with Straw mulch (Paddy Straw) +Two hand weeding. The treatment (T-12) Control was recorded lowest cost of cultivation i.e. Rs 61,195 /ha.

Gross Returns (Rs/ha)

Table 2 data showed that the treatment (T-7) of straw mulch (Paddy Straw) + two hand weeding had the highest gross returns (Rs. 261491.45 /ha) among all the treatments. However, the treatments (T-1) Plastic mulching + Sulfosulfuron at 25g a.i./ha pre-emergence (Rs 240803 /ha) which were found to be statistically at par with Straw mulch (Paddy Straw) +Two hand weeding. The treatment (T-12) Control was recorded lowest gross returnsi.e. Rs 142888.5/ha.

Net return (Rs/ha)

Table 2 data showed that the treatment (T-7) of straw mulch (Paddy Straw) + two hand weeding had the highest net return (Rs. 158190 /ha) among all the treatments. However, the treatments (T-1) Plastic mulching + Sulfosulfuron at 25g a.i./ha pre-emergence (Rs 143692 /ha) which were found to be statistically at par with Straw mulch (Paddy Straw) +Two hand weeding. The treatment (T-12) Control was recorded lowest net return i.e. Rs 142888.5/ha.

Benefit cost ratio

Table 2 data showed that the treatment (T-7) of straw mulch (Paddy Straw) + two hand weeding had the highest benefit cost ratio (Rs. 2.42) among all the treatments. However, the treatments (T-1) Plastic mulching + Sulfosulfuron at 25g a.i./ha pre-emergence (Rs. 2.20) which were found to be statistically at par with Straw mulch (Paddy Straw) +Two hand weeding. The treatment (T-12) Control was recorded lowest net return i.e. Rs.1.27.

Table 2. Effect of mulching and pre-emergence herbicide on yield and economics of wheat

Treatment	Treatment combination	Grain yield	Stover yield	Cost of cult.	G. return	N. return	B. cost ratio
T_1	Plastic mulching + Sulfosulfuron at 25g a.i./ha pre-emergence	4.08	5.15	97111	240803	143692	2.20
T_2	Plastic mulching + Metsulfuron at 4g a.i./ha	3.87	4.98	97064	239138	142074	2.00
T_3	Plastic mulching +Two hand weeding	3.95	4.85	119695	256701	137000	2.17
T_4	Plastic mulching +Control	3.78	5.06	94695	221158	126463	1.47
T_5	Straw mulch (Paddy Straw) +Sulfosulfuron at 25g a.i./ha	3.99	4.61	80611	197436	116825	2.14
T_6	Straw mulch (Paddy Straw) + Metsulfuron at 4g a.i./ha	4.00	5.11	80564	188931	108367	1.53
T_7	Straw mulch (Paddy Straw) +Two hand weeding.	4.15	5.27	103195	261491.45	158190	2.42
T_8	Straw mulch (Paddy Straw) +Control	3.84	4.86	78195	188495	110300	1.41
T_9	Control + Sulfosulfuron at 25g a.i./ha pre- emergence	3.79	4.74	58611	13378.25	81693.5	1.28
T_{1O}	Control + Metsulfuron at 4g a.i./ha as pre- emergence	3.75	4.82	58564	133751	75197	1.33
T_{11}	Control +Two hand weeding	3.91	4.64	83195	185846.25	102651	1.23
T_{12}	Control	3.69	4.53	61195	142888.5	75170.25	1.27

4. CONCLUSION

It has been demonstrated that the treatment (T-7) combination of two hand weeding operations and straw mulch (Paddy Straw) increased grain production (44.10 t/ha), gross returns (2,61,491.45Rs /ha), net returns (1,58,190 Rs /ha) and benefit cost ratio (2.42) significantly.

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