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Performance of paddy straw mulch and herbicides on weeds flora and yield of wheat (*Triticum aestivum* L.) variety HD3086

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Abstract

A field experiment was conducted at experimental farm of Dolphin (PG) Institute of Biomedical and natural sciences, Dehradun during 2021. To study the effect of paddy straw mulch and herbicides on weed and crop yield of wheat. The treatments were weedy check, hand weeding/weed free, pre-emergence application of Pendimethalin and Isoproturon, post emergence application of Clodinafop propargyl, metsulfuron methyl, pinoxoden, 2, 4-D and paddy straw mulch. *Cynodon dactylon*, *Chenopodium album*, *Fumaria parviflora* and *Polygonum aviculare* were the dominant species. The studies envisaged that the wheat crop covered with paddy straw mulch showed better results in terms of weed density at different days, weed control (WCE, WI and Dry weight of weed) and crop growth parameters (spikelet's/tillers, grain yield and straw yield) as compared to the pre-emergence herbicide and post emergence herbicide.

Keywords: Paddy straw, Density, weed flora, WCE, WI, tillers, yield, pendimethalin, clodinafop propargyl, spikelet's

1. Introduction

Wheat (*Triticum aestivum* L.) is the second most important staple cereal food in India, next after rice. The wheat crop is mainly grown in the Northern States and Uttar Pradesh is at top with total production of wheat in India. World wheat production was 731.1 MT. Wheat is sown from the month of September to December in various states of India and harvesting is done from February to May. Weed infestation is very important factor responsible for low yield in wheat. Weeds cause approximately 70% reduction in yield in wheat crop. Weeds not only compete with main crop plants for water, space, nutrients and light but also release some allelochemicals which harm growth of main crop. Weeds not only reduce the yield but also make the harvesting operation difficult. There are many methods like cultural and chemical methods to control weed. But on long term usage they have side effects on the soil and environment. Therefore, the need was felt to study the effect of paddy straw mulch on weed and crop yield of wheat, as they are easy to apply, eco-friendly and cheap.

The objective of this study was to evaluate the effect of Paddy straw mulch in comparison to other weed control strategies like hand weeding, pre-emergence herbicide and post emergence herbicides.

2. Materials and Methods

The mulching experiment was initiated to evaluate its effect on weed control and crop growth parameters of wheat at Dolphin (Pg) institute of Biomedical and natural sciences, Manduwala, Dehradun farm in winter season during 2021-2022. data were collect one year season. The experiment was laid out in RBD with plot size of 5 x 3m and the row spacing 20 cm. The variety use was HD 3086. The seed rate was 125 kg ha⁻¹ due to late sowing. Chemical fertilizer was applied at the rate of Nitrogen (90 kg ha⁻¹), Phosphorus (60 kg ha⁻¹), potash (40 kg ha⁻¹). Nitrogen was given in two split doses of basal and foliar application into two equal halves. The treatment combinations were weedy check, weed free/hand weeding, pre-emergence application of Pendimethalin 30% EC 1 kg ha⁻¹ and Isoproturon 75% WP 1 kg ha⁻¹, post emergence application of Clodinafop propargyl 75% WP @ 0.4 kg ha⁻¹, Methsulfuron methyl 20%WP 0.004 kg ha⁻¹, Pinoxoden 5.1% EC 0.045kg ha⁻¹, 2,4D 58% SL 0.5kg ha⁻¹ and one paddy straw mulch applied @ 5-6 t ha⁻¹. 3-step irrigation was done in the field.

1st irrigation – 30 DAS (rainfall), 2nd irrigation – At the time of late jointing, 3rd irrigation –At the time of milk stage to fulfil the water requirement of wheat.

The dry weed biomass was recorded from 0.25 m² quadrant at 40, 80, and 120 DAS (at harvest). Pre-emergence herbicide application was sprayed after 3 days after sowing (before the emergence of seed) and post emergence herbicide was spray after 35 days after sowing. Herbicides were applied using the help of a knapsack sprayer. Wheat planting was done in 20 December 2021 and harvesting was done in 20 April 2022 respectively. Data was analysed by using OPSTAT created by O.P. Sheoran, Computer Programmer at CCS HAU, Hisar India.

3. Results and Discussion

3.1 Effect on Weed flora

Weeds like *Chenopodium album*, *Fumaria parviflora*, *Polygonum aviculare* were among the broadleaf weeds and *Cynodon dactylon* was the grass weeds in the experimental field.

Weed density (0.25 m² quadrant) observation was taken in 40 and at harvest. Weed density of grasses and broad leaf differed significantly and grasses density were low compare to the density of broadleaved weeds density. Hand weeding was kept weed free till harvesting. It was observed that the highest weed density of grasses was found in weedy check/un-weeded and lowest weed density of grasses was found in pendimethalin @ 1 kg ha⁻¹ followed by paddy straw mulch. And the highest weed density of broadleaf was found

in weedy check/un-weeded and the lowest weed density of broadleaf weed was found in paddy straw mulch (Table 1).

Weed control efficiency (WCE %) observation was taken at harvest. WCE indicates the effectiveness of every treatment in controlling weeds. Lower the WCE % higher the weed interference. Paddy straw mulch had the highest % in WCE followed by Pendimethalin @1 kg ha⁻¹. The least was seen in weedy check which was left undisturbed throughout all the experiment followed by Clodinafop propargyl 0.06 kg ha⁻¹. Hand weeding was kept weed free through all the experiment (Table 2). Weed index (WI %) was taken after the harvesting of the crop. WI is nothing but a measure of the crop yield loss accrued across the treatments in comparison to a weed free plot. So, lower the WI (%) better the treatment. Paddy straw mulch had the lowest WI % among the treatments followed by pendimethalin @1 kg ha⁻¹. The highest WI% was observed in weedy check followed by Clodinafop propargyl @0.06 kg ha⁻¹ (Table 2).

Dry weight of weed observation was taken at 40 DAS and at harvest. The result revealed that the maximum dry weight of weed was observed in weedy check plot. And the minimum dry weight of weed was observed in paddy straw mulch followed by Pendimethalin @1kg ha⁻¹. Hand weeding was kept weed free throughout the whole experiment (Table 2)

Therefore, it can be concluded that both the grass and broadleaf weeds were suppressed by the paddy straw mulch and it was more effective than the applied herbicidal treatments.

Table 1: Performance of treatments on weed density after seedling of wheat crop

Treatments	Dose (kg ha-1)	Grass leaf (No.0.25m ²)		Broad leaf (No.0.25m ²)	
		40 DAS	At harvest	40 DAS	At harvest
Metsulfuron methyl	0.004	74.400	85.867	77.33	67.733
Pinoxoden	0.045	35.467	39.600	198.667	233.067
Pendimethalin	1	0.000	0.000	28.000	41.333
Hand weeding / weed free	-	0.000	0.000	0.000	0.000
Weedy check	-	50.133	61.067	251.467	81.867
Isoproturon	1	4.000	4.000	34.933	52.533
Clodinafop	0.06	0.000	8.000	255.467	281.867
2,4- d	0.5	62.133	62.667	164.000	170.133
Mulching	5000	4.000	4.000	8.000	16.000
CD (P=0.05)	-	0.652	0.534	0.772	0.712

DAS = Days after sowing #Weed data were observed with quadrat size (0.5 x 0.5 m =0.25m²) and were converted per meter square meter by multiplying factor 4 (data of one year)

Table 2: Performance of various treatment on Weed control efficiency, weed index and dry weight of weed of wheat

Treatments	Dose (kg ha-1)	Weed dry weight (g)		WCI%	WI%
		At 40 DAS	At harvest		
Metsulfuron methyl	0.004	21.760	10.120	87.45	15.337
Pinoxoden	0.045	67.813	29.280	63.016	21.956
Pendimethalin	1	3.600	2.480	96.868	8.096
Hand weeding / weed free	-	-	-	100.000	0.000
Weedy check	-	158.280	79.160	0.000	37.240
Isoproturon	1	9.240	5.880	92.557	10.568
Clodinafop	0.06	79.173	32.667	58.723	19.525
2,4 d	0.5	28.307	13.253	83.50	18.597
Mulching	5000	1.320	0.600	99.242	3.264
CD(P=0.05)	-	2.215	1.838	-	-

DAS = Days after sowing, weed data were observed with quadrat size (0.5 x 0.5 m =0.25m²) and were converted per meter square meter by multiplying factor 4 (data of one year)

3.2 Effect on crop growth parameters

Hand weeding recorded higher values of yield attributes like number of spikelet's per plant followed by mulching and the lowest was recorded in the weedy check. Among the herbicidal treatments, pendimethalin @1kg ha⁻¹ recorded the maximum numbers of spikelet's per plant and the lowest was observed in Clodinafop propargyl @0.4kg ha⁻¹ (Table 3).

The weed control practices significantly influence the grain yield of wheat. The highest grain yield was recorded in the hand weeding followed by mulching and the lowest was observed in the weedy check/un-weeded. Among the herbicidal treatments, pendimethalin @1kg ha⁻¹ recorded the highest yield followed by isoproturon @1kg ha⁻¹ and the

lowest was recorded in Clodinafop propargyl @0.4 kg ha⁻¹ (Table 3).

The highest straw yield was recorded in Hand weeding followed by mulching and the lowest was observed in weedy check / un- weeded. Among the herbicidal treatments, Pendimethalin @1kg ha⁻¹ recorded the highest straw yield and the lowest was observed in Clodinafop propargyl @0.4 kg ha⁻¹ (Table 3).

So, in conclusion it can be said that the highest yield was recorded in Hand weeding which was statistically at par with mulching and both these treatments prove significantly superior to rest of the weed control treatments.

Table 3: Performance of various treatments on No. of spikelet's Effective tillers, grain yield and straw yield of wheat

Treatments	Dose (kg ha-1)	No. of spikelet's/effective Tillers*	Grain Yield (q ha-1)	Straw yield (q ha-1)
		At harvest	At Harvest	At harvest
Metsulfuron methyl	0.004	21.867	20.667	43.333
Pinoxoden	0.045	19.000	18.667	40.333
Pendimethalin	1	25.333	22.667	46.800
Hand weeding / weed free	-	27.733	25.200	50.400
Weedy check	-	16.467	15.000	32.433
Isoproturon	1	23.867	21.933	45.667
Clodinafop	0.06	18.133	17.667	38.133
2,4 d	0.5	20.533	19.667	41.867
Mulching	5000	26.833	24.200	48.933
CD (P=0.05)	-	0.619	1.085	0.834

*effective tillers were count from five sample plants in each treatment then got mean

4. Conclusion

The experiments comprising of 9 treatments, 1 Hand weeding, 1 un-weeded treatment, 1 mulch, 2 pre emergence herbicide and 4 post emergence herbicide in Randomized Block Design with three replication. weed density significantly decreased in Mulch followed by pendimethalin treatment as compared post and pre emergence herbicides. WCI % was highest in hand weeding(100%) due to complete weed free plot followed by mulch(99.0%) treatment. weed index lowest in hand weeding(0.0) due to weed free plot followed by mulch treatment(3.0). Grain yield and straw yield significantly increased in the Hand weeding followed by Mulch. So that performance of mulch was very significantly in all respect.

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