Impact of Various Herbicides on Weeds and Timely Sown Triticum Astivum Ll Wheat Productivity

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Abstract

The relative effectiveness of the herbicides sulfosulfuron, isoproturon, and metribuzin at various doses and application periods was determined. All herbicides worked better when applied at higher doses and delayed until after the first watering to reduce weed dry matter after 60 days. Conventional tillage resulted in higher levels of annual and total weeds than Triticum astivum ll did in a weedy environment, but Triticum astivum ll had a higher level of perennial weeds. Maximum grain yields for Triticum astivum ll were 4431 kg/ha and 3924 kg/ha when "sulfosulfuron was applied at 25 g/ha after the first irrigation in 2018–19 and 2019–20", respectively. Successful weed control was at its highest with this treatment (94% in both years of the study). Two conventional tillage hand weedings at the 30- and 45-day stages resulted in the highest yield. Herbicide application under Triticum astivum ll resulted in higher net yields than "manual weeding at 30 and 45 days" after sowing.

Keywords: *Herbicides, Weeds, Timely Sown, Triticum Astivum ll, Wheat Productivity.*

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1. Introduction

The cereal grain Triticum astivum ll, more commonly known as wheat, is an important staple food item for a substantial majority of the world's population. However, wheat's growth may be stunted by weeds, which can affect harvest yields. Wheat plants lose out to weeds in a competition for light, water, and nutrients, costing farmer's money. Herbicides are often used by wheat producers to combat weeds and safeguard their harvests. Weeds may be kept under control by herbicides, enabling the wheat crop to flourish. Careful selection and use of herbicides is necessary for effective weed control, however, to reduce negative effects on wheat harvests. This study examines the effects of several herbicides on weeds and the harvest of timely-planted Triticum astivum ll wheat.[1]

1.1 Impact of Herbicides on Weeds

Herbicides are chemical substances used for the control or elimination of weeds. Based on when they are most effective, herbicides may be classified as either pre-emergence, post-emergence, selective, or non-selective. Herbicides may be classified as either pre- or post-emergence depending on when they are administered in relation to the weeds' emergence. Selective herbicides are developed to eradicate certain weed species while leaving other plant life unharmed.[2]

Wheat's competitiveness might be reduced with the use of herbicides, if they are used correctly. Weeds may be killed by these methods because they either stop the weeds from germinating, slow their growth, or interfere with their important physiological processes. Knowing the weed species at hand, the stage of growth of the weeds, and the herbicide in issue is essential for making an informed herbicide choice. Applying herbicides correctly at the appropriate time, in the right quantity, and in the right method is crucial for maximizing their effectiveness and minimizing their negative effects on wheat crops.[3]

1.2 Impact of Herbicides on Timely Sown Triticum astivum ll Wheat Productivity

Early sowing To provide best circumstances for germination, growth, and development, Triticum astivum ll wheat crops must be sown within the optimal sowing window. Herbicide treatments in promptly seeded wheat attempt to reduce weed interference during the crop's most productive growth periods.[4]

Herbicide usage in promptly planted wheat has several advantages. Wheat plants benefit from efficient weed management because they have less competition for light, water, and nutrients. This promotes healthy growth in wheat plants, which results in more tillers, greater leaf area, and fuller grains. Weed-free wheat fields also have a lower risk of being invaded by pests and illnesses, increasing yields even more.[5]

It's worth noting, too, that herbicides' effects on wheat yields may shift based on a number of conditions. The success of weed management and any possible crop phytotoxicity may be affected by the herbicide used and when, how much, and how it is applied. It is essential to use herbicides that have a low impact on wheat plants while also efficiently reducing weed populations. Herbicide damage to wheat may be reduced with careful application methods such using the right spray nozzles, the right boom height, and preventing drift.[6]

In addition, farmers must not go above the approved dose and application intervals for herbicides. Herbicide residues in wheat grains may have detrimental impacts on human health and marketability, especially if the herbicides were used improperly or in excessive amounts.[7]

2. Literature review

Sharma Peeyush, and Kumar Ravindra. (2020) The climate in northern India is perfect for cultivating both rice and wheat; hence that is the predominant agricultural practice there. The window of opportunity between rice harvest and wheat planting is small, making timing crucial in rice-wheat rotation. Because of this, the farmer's time spent preparing the seed bed is severely limited. Delays in planting and an inadequate seed bed also reduce germination rates and, in turn, crop yields. how weeds react to herbicides, and how timely sowing affects Variables such weed types, herbicides used, when they were applied, weather, and the stage of crop development all affect the yield of Triticum aestivum (wheat). If you want to grow wheat successfully with herbicides, it's in your best interest to speak with local agricultural professionals or extension services and adhere to best management methods. [8]

Singh Govindra and SK Yadav. (2019). Wheat weeds may be effectively controlled using herbicides like isoproturon sulfosulfuron and metribuzin. For the last 15 years, commercial farmers have been using the pesticide isoproturon to reduce weed development in wheat fields. Even though Phalaris minor has been shown to be resistant to isoproturon, its prevalence has been on the rise in our country, along with that of Avena spp. Weeds in wheat fields are a regular problem, although herbicides help. Herbicides have differing degrees of effectiveness on various weed types. Which herbicide to use depends on the kind of weeds in the field and how resistant they are to those chemicals. While some herbicides are effective against a wide variety of weeds, others are more selective and are only effective against certain groups of weeds. [9]

Lohan SK, and Tulsa Rani. (2018). Factors such as the kind of weeds present, the length of time the crop is exposed to weed competition, the weather, the crop's cultural practices, and the emergence pattern of the weeds in relation to the crop may all have an impact on the extent to which weeds reduce wheat yields. Losses in yield due to Phalaris minor L. have been documented between 10% to 50%. Estimates show that weed infestation reduces wheat grain production by 30–40%. Weeds hinder the growth and reduce the yield of wheat, resulting in lower grain output. Wheat plants develop fewer shoots because wild oats have a greater number of tillers (4-12) and are taller (90-120 cm). Wheat plants developed much more slowly when cultivated in a mix of Chenopodium album L. compared to when grown in a mono culture. Weeds caused a dramatic decrease in yield per plant and in grains per ear head.[10]

Malik RS, and Kumar V. (2017). Results showed that the two species competed for phosphorus and, to a lesser extent, nitrogen. The potential of Chenopodium album L. to stunt wheat growth was significantly attenuated by wheat's increased non-competitive interference in restricting the weed's potassium absorption. Due to the weed's growing interference, both wheat grain size and productivity fell dramatically. Competition from Lathyrus aphaca L. during the course of a growing season has been shown to reduce wheat yields by 1723 kg/ha, while competition with wild oat (Avena fatua L.) has been shown to reduce wheat yields by 17%. Weeds are responsible for 33% more economic loss than all diseases and insects put together, according to research. It is estimated that every year in India, Rs. 1980 worth of calories are wasted due to weeds. Wheat yields are reduced by 28 and 39%, respectively, when wild oat (Avena fatua L.) is present at densities of 64 and 188 plants/m2. Over the course of a growing season, Chenopodium album L. and Phylenthus niruri L. were shown to reduce wheat yields by as much as 17.2 percent. [11]

Sharma R. (2016) Metribuzin at a dosage of 200 g/ha proved effective in eradicating Melilotus indica L., while even lower doses controlled Phalaris minor L. and Avena ludoviciana L. well (89 percent).The plots where weeds were removed by hand (at 25 and 45 days after planting) had the highest yield. 100 g/ha of metribuzin was likewise more effective than greater doses. While the herbicides were effective in reducing populations of canary grass and sweet clover (Melilotus sp. L.), the yield was drastically lowered when the herbicides were used at high doses. Hand weeding resulted in the greatest productivity boost. However, the canary grass (Phalaris minor L.) population and wheat yield were analyzed in relation to three distinct Atrazine dosages (50, 75, and 100 g a.i. /ha) and three different Metribuzin doses (100, 150, and 200 a.i. g/ha). Hand weeding resulted in the greatest improvement in yield. [12]

3. Methodology

Metribuzin was applied at 140, 175, and 210 g/ha before, during, and after the first irrigation; sulfosulfuron was applied at 20, 25, and 50 g/ha before, during, and after the first irrigation; and isoprothiuron was applied at 50, 100, and 110 g/ha before, during, and after the first irrigation; all 15 treatments were replicated four times. Triticum astivum ll was also used for weed management, and it was weeded twice, first at 30 days and again at 45 days.

A weedy check was performed, and then conventionally grown Astivum ll wheat was manually weeded twice, at 30 and 45 days. High quantities of organic carbon (0.85 ppm), potassium (201.6 ppm), and accessible phosphorus (21.7 kg/ha P) were found in the silty clay loam soil used for the experiment. Pantnagar Triticum astivum ll ferti seed drills were used to plant cv PBW-343 wheat. The irrigation started, and after the irrigation ceased, we sprayed herbicides using a “Knapsac sprayer with a spray volume” of 300 liters of water per acre. Four days after the isoproturon treatment, 2,4-D was sprayed. We used the following formula to determine how much dry weed material was cut down:

$$WCI = \frac{(X - Y)}{X} \times 100$$

where,

X= dry weight of weeds in overgrown fields

Y= weed dry weight in the treated areas.

Dry weed material was collected from weedy areas of conventional and zero tilled plots, and used to cultivate Triticum astivum ll. The crop was cultivated using a variety of other method packages.

4. Results

4.1 Weed species' response to treatment

Weed dry matter was drastically decreased after herbicide treatment and two weedings compared to weedy check and one weeding. The area was overrun with various weeds, including Melilotus indica, Phalaris minor, Coronopus didymus, and Cynodon daclyton, to name a few. Dry matter of most weed species was greater in traditional astivum ll wheat weedy check plots than in Triticum astivum ll weedy check plots, with the exception of Cynodon dactylon. The density of all weed species might be reduced most effectively by using herbicides at a greater rate and after the first watering.

When used at greater concentrations, herbicides proved very effective against weeds, and they completely wiped out any weeds that had lingered after the first watering. Isoproturon was more effective against both "grassy and broad-leaved weeds" when applied after the first watering. Wherever there were more weeds in the check plots was where the maximum weed biomass was discovered. "Sulfosulfuron at 25 g/ha after initial irrigation" was more successful at reducing total weed biomass in the first year, whereas isogaurd plus was able to do the same thing in the second year. This was because these chemical sprays were so successful in killing weeds.

4.2 Agricultural Treatment's Impact

The weediness of a field has a negative correlation with the quantity of grain obtained from it. Triticum astivum ll wheat experienced a 21.3% reduction in weed infestation in weed check plots compared to two manually weeded plots (Table 4.1), but conventional astivum ll wheat had a 33.5% reduction in grain yield. It was discovered that Triticum astivum ll had a much lower weed density than regular Astiva ll. Conventionally tilled wheat yielded 4585 kg/ha in two hand-weeded plots the first year, and 4019 kg/ha the second. Increases in harvest yield have been attributed to higher spike density per unit area (Table 4. 2).

Similar results were reported in other studies. When compared to other studied herbicides, 1000 g/ha of sulfosulfuron administered after the first watering resulted in the highest grain yield. Lower dosages of metribuzin decreased shoot population (Table 4.2), but grain output was statistically indistinguishable from higher doses. The loss in spikes per meter was more than made up for by the increases in grain number per spike and 1000-grain weight after 210 g/ha of metribuzin treatments. Metribuzin was also proven to reduce the quantity of shoots. The herbicides caused a noticeable increase in height and weight of the spikes compared to the weed control, by around a thousand grains per cent.

Table 4.1: Analysis of weed species dry matter, total weeds biomass, and weed control efficacy at 60 days after treatment

Treatments	P. minor 2018-19 2019-20		C. didymus 2018-19 2019-20		M. indica 2018-19 2019-20		C. dactylon 2018-19 2019-20		Weed control efficiency (%) at 60 days 2018-19 2019-20		Total weed biomass 2018-19 2019-20	
Metribuzin 140 g/ha	2.6 (11.9)	2.3 (8.9)	0.0 (0.0)	0.1 (0.2)	2.5 (11.1)	2.8 (15.7)	1.9 (5.8)	2.1 (7.3)	77	83	3.5 (32.3)	3.6 (36.9)
1-2 DBFI												
Metribuzin 175 g/ha	2.3 (8.7)	1.9 (5.7)	0.0 (0.0)	0.1 (0.1)	2.0 (6.6)	2.4 (9.6)	1.7 (4.3)	2.0 (6.7)	83	87	3.2 (23.8)	3.3 (27.1)
1-2 DBFI												
Metribuzin 210 g/ha	1.0 (2.0)	1.0 (1.7)	0.0 (0.0)	0.0 (0.0)	1.2 (2.3)	1.7 (4.3)	1.6 (4.2)	1.7 (4.6)	89	92	2.7 (14.6)	2.9 (16.6)
1-2 DBFI												
Sulfosulfuron 20 g/ha	1.3 (2.6)	1.3 (2.8)	1.8 (5.3)	1.9 (5.5)	2.8 (15.6)	2.6 (12.3)	1.6 (4.2)	1.8 (5.0)	80	88	3.4 (28.1)	3.3 (25.6)
1-2 DBFI												
Sulfosulfuron 25 g/ha	0.7 (1.0)	0.3 (0.5)	1.5 (3.6)	1.6 (4.0)	2.0 (6.3)	2.3 (8.8)	1.4 (3.2)	1.6 (4.1)	90	92	2.7 (14.1)	2.9 (17.4)
1-2 DBFI												
Sulfosulfuron 25	0.0 (0.0)	0.0 (0.0	1.4 (3.4	1.5 (3.6	1.3 (2.7	1.7 (4.2	1.2 (2.4	1.7 (4.8	94	94	2.2 (8.6)	2.6 (12.6

g/ha		)	)	)	)	)	)	)				)
1-2 DAFI Isoprotur om 750 g/ha	2.6(13.1)	1.9 (5.5)	2.5 (11.5)	3.0 (19.7)	3.0 (18.5)	3.0 (19.8)	1.7 (4.4)	2.7 (13.6)	71	80	3.7 (40.7)	3.8 (43.4)
1-2 DBFI Isoprotur om 1000 g/g/ha	1.8 (4.9)	1.4 (2.9)	2.1 (7.4)	2.8 (14.9)	2.6 (12.4)	2.8 (15.9)	1.5 (3.4)	2.2 (8.3)	83	86	3.2 (23.9)	3.4 (30.1)
1-2 DBFI Isoprotur om 750 g/ha	1.7 (4.6)	1.4 (2.9)	1.7 (4.4)	2.1 (7.4)	2.0 (6.7)	2.7 (14.6)	1.2 (2.4)	2.2 (7.6)	88	87	2.9 (16.3)	3.3 (27.2)
1-2 DAFI												
Isogaurd plus 1000 +2,4-D	2.5 (12.2)	1.7 (4.8)	0.0 (0.0)	0.0 (0.0)	0.6 (1.3)	0.6 (1.1)	1.8 (4.3)	2.2 (7.6)	88	94	2.9 (16.7)	2.7 (14.7)
500 g/ha 1-2 DAFI												
Manual weeding	2.4 (10.5)	2.6 (12.5)	1.8 (5.2)	2.6 (12.5)	3.2 (22.3)	3.2 (24.6)	2.2 (8.3)	3.6 (34.0)	60	57	4.1 (56.6)	4.5 (93.9)
at 30 DAS												
Manual weeding	2.0 (6.4)	2.2 (8.4)	0.9 (1.5)	1.8 (5.1)	1.2 (2.4)	2.0 (6.1)	0.8 (1.2)	2.0 (6.3)	90	87	2.6 (12.9)	3.3 (26.9)
at 30 and 45 DAS												
Unweeded (check)	2.9 (16.8)	2.8 (15.9)	3.2 (23.8)	3.3 (27.4)	3.8 (45.8)	4.0 (52.1)	2.6 (12.3)	4.3 (76.6)	0	0	5.0 (143.2)	5.4 (219.1)
CT + manual weeding	1.2 (2.5)	2.5 (11.	0.4 (0.6	1.0 (1.7	1.2 (2.4	1.3 (2.5	0.0 (0.0	1.8 (5.3	95 0	93 0	2.2 (7.6)	2.8 (15.5

at 30 and 45 DAS CT + unweeded (check)	2.4 (27.5)	5) 3.9 (50.5)	) 3.6 (34.0)	) 3.7 (37.6)	) 3.9 (50.8)	) 4.1 (60.3)	) 1.4 (3.1)	) 1.3 (2.1)			5.1 (163.0)	) 5.0 (209.5)
LSD (P= 0.05)	0.2	0.2	0.3	0.2	0.3	0.3	0.1	0.2			0.2	0.1

4.3 Crop and weed absorption of nutrients

The crop absorbed more nutrients in the entirely weed-free treatment than in the one-hand weeding and weedy control groups. Although there was no statistically significant difference, nutrient absorption was higher in conventionally tilled wheat than in Triticum astivum ll wheat in two hand weeded plots. Triticum astivum ll wheat showed no statistically significant variations in N P K absorption compared to ordinary astivanum ll wheat. Weeds' total field biomass was used to calculate their nutrient intake (Tables 4.1 and 4.3).

Conventionally tilled wheat lost more nitrogen, phosphate, and potassium to weeds than Triticum astivum ll wheat did. Whether or not a pesticide was used, water and nutrients were less available to the weeds after the first watering. An efficient approach of weed management has been shown to lessen the impact of nutrient, phosphorus, and potassium (NPK) depletion.

Table 4.2: Yield attribution characteristics, grain yield, and economics (net return Rs/ha, averaged over two years) will vary in 2018-19 and 2019-20

Treatment	**Number of spikes** **2018-19 2019-20**		**Spike length (cm)** **2018-19 2019-20**		**Number of grainspike** **2018-19 2019-20**		**1000-grain weight (g)2018-2018-19 2019-20**		**Grain yield (kg/ha)** **2018-19 2019-20**		**two years** **(Rs/ha)**
Metribuzin 140 g/ha 1-2 DBFI	363.8	337.0	10.0	10.3	44.8	45.5	39.5	34.3	3832	3644	13324
Metribuzin 175 g/ha 1-2 DBFI	372.8	323.0	10.0	10.4	44.5	45.5	39.1	35.0	4087	3733	14332
Metribuzin 210 g/ha 1-2	365.5	303.2	9.7	10.2	43.7	44.5	39.9	35.0	3851	3610	13539

DBFI											
Sulfosulfuron 20 g/ha 1-2 DBFI	379.0	340.2	9.8	9.2	44.4	43.8	39.2	34.6	40.04	3517	12360
Sulfosulfuron 25 g/ha 1-2 DBFI	380.0	338.5	10.0	10.3	44.7	44.4	39.1	34.2	4286	3724	13986
Sulfosulfuron 25 g/ha 1-2 DAFI	386.5	341.5	9.9	9.9	43.9	45.3	39.5	35.1	4431	3924	15240
Unweeded (check)	277.0	264.8	8.8	9.8	41.0	45.3	39.7	34.8	3166	3130	9508
CT + manual weeding at 30 and	403.0	352.0	9.9	10.0	45.3	45.5	40.2	35.1	4585	4019	12858
45 DAS											
CT + unweeded (check)	294.0	230.0	9.7	9.9	41.6	44.8	38.8	34.7	3013	2707	5915
LSD (P = 0.05)	11.40	6.8	0.5	NS	2.70	NS	NS	NS	295	338	

Table 4.3: Treatment effects on crop and weed N, P, and K absorption (g/m2) at harvest in 2018-19 and 2019-20

Treatment	Crop						Weeds					
	N P K						N P K					
	2018-192019-20		2018-192019-20		2018-192019-20		2018-192019-20		2018-192019-20		2018-192019-20	
Metribuzin140g/ha	121.15 114.15		23.92 21.95		149.6 138.1		15.46 1		4.50 4.73		14.84 15.50	

1-2DBFI										
Metribuzin175g/ha	115.45 115.14		24.35 22.45		152.4 140.2	12.40 1		3.61 3.62		11.72 11.90
1-2DBFI										
Metribuzin210g/ha	116.90 116.40		24.10 22.30		156.1 139.3	5.80 6		2.10 1.50		5.10 4.10
1-2DBFI										
Sulfosulfuron20g/ha	112.35 115.20		23.44 22.07		148.4 135.1	8.71 9		2.10 2.05		6.91 6.60
1-2DBFI										
Sulfosulfuron25g/ha	112.57 118.17		24.35 22.45		150.4 139.1	5.73 5		1.40 1.40		4.70 4.60
1-2DBFI										
Sulfosulfuron25g/ha	121.67 124.07		24.95 23.30		158.6 144.1	3.11 3		0.86 0.91		1.21 0.98
1-2DAFI										
Isoproturom750g/ha	114.97 121.12		22.57 22.20		148.6 136.1	14.81 1		3.92 3.50		12.87 11.40
1-2DBFI Isoproturom1000g/ha	117.10 119.05		23.90 22.77		150.4 139.1	9.93 9		2.50 2.30		8.25 7.40
1-2DBFI										
Isoproturom750g/ha	110.15 117.42		24.15 22.97		154.5 143.6	6.90 7		1.53 1.20		5.01 3.80
1-2DAFI										
Isogaurdplus1000+2,4-D	117.72		23.97		157.3	4.52 4		0.81		2.72

	116.42		21.87		144.6			0.70		2.40
500g/ha1-2DAFI										
Manualweedingat30DAS	97.67 1 02.45		20.27 19.42		118.1 114.1	24.71 3		14.30 14.70		38.93 48.24
CT+unweeded(check)	84.68 72.96		16.30 16.00		91.2 90.5	68.00 72.10		38.60 38.60		89.67 85.70
LSD(P=0.05)	8.39 14.65		1.43 1.27		15.3 10.8	3.8 2.14		0.62 0.56		2.90 2.09

5. Conclusion

Herbicides have variable impacts on weeds and the yield of Triticum aestivum (wheat) when sown at the proper time. Herbicides, on the other hand, are vital for weed control and, when applied correctly, may significantly boost wheat yields. Weed management was also used using Triticum astivum ll, which was weeded twice at 30 and 45 days. A weedy check as well as two manual weedings was performed on conventionally grown Astivum ll wheat at 30 and 45 days. Weeds such as “Phalaris minor, Coronopus didymus, Cynodon daclyton, and Melilotus indica” were present.

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