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Research Article

Comparative efficacy of different broad-spectrum weedicides on wheat crop and their impact on yield

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ABSTRACT

Wheat *Triticum aestivum* L. is cereal and the predominant food crop in Pakistan, cultivated on an area of greater than one million hectares. A number of factors, including weeds, have affected the yield in this crop. The weeds are competing with wheat plants for moisture, space, nutrients, light and a number of other growth factors which contribute to low yield and are determental to the quality of produce. A yield loss of 10 to 60% can be attributed to weeds. In fact, the only acceptable method of weed control will be the use of herbicides, due to rising labour and power costs. An experiment was laid out under irrigation system in Tehsil Samundri, to determine the broad and narrow leaf weed population in different area in wheat crop field and efficacy of five different broad spectrum weedicides during Rabi crop season. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications, with plot size of 200x 180 m^2. Five different herbicides were applied as Atlantis 3.6 % WG @100 gm/ Acre, Isoproturan 50 % WP @ 800gm / Acre, Affinity 50 WP @ 800 gm/Acre, Proturon 50 % WP @ 800 gm/Acre and Pallas 45OD @ 160ml/Acre with control treatment. An average of 50.63/ m^2 of weed population was observed. All weedicides significantly decreased weed population over control and maximum grain yield (40.55mon acre-1) was obtained where Affinity was applied @ 800 gm/acre. It was however statistically at par with the grain yield of 38.40mon acre-1 where Atlantis was applied @ 160 gm/ Ac. The control was obtained from all the herbalicidal applications. Therefore, in order to control broad and narrow leaf weeds and increase the yield of wheat it is recommended that Affinity and Atlantis be applied 800 and 160gm @acres respectively.

Keywords: Wheat, Weeds, RCBD, Management.

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INTRODUCTION

Wheat is an important staple food crop of Pakistan and ranked first in world cereal crops. Although many factors have contributed to the poor yields of wheat, weed infestation has become a major problem. Despite repeated application of weed control practices, the population of weeds continues to be present in agriculture. As compared to manual weed eradication, chemical control methods are a good way of controlling weeds because it is easier and shorter in duration. In order to give farmers an efficient way of dealing with this problem, the current trial has been planned for management of resistance weeds in the Agroecology area of district Faisalabad. Wheat is one of Pakistan's most important cereal and staples crops. During 2022-2023, it was cultivated on an area of 9.000 million hectares with an annual production of 26.400 million tons and an average yield of 2.9 tons per hectare (USDA report, 2023). Instead of using improved disease resistant varieties with use of costly inputs and better culture practices, Pakistan's wheat yields are very poor due to the lack of yield relative to neighbouring countries.

Weeds are the most common cause of poor yields in fields. The weed is competing with wheat moisture of plant, space, nutrients, light and a number of further development factors that contribute to the poor yield and degradation in quality (Qureshi, 1982). It is estimated that the crop losses caused by weed competition worldwide are higher, as a result of insect pests and diseases in combination with each other. Weeds can promote the development of fungal diseases, provide shelter for all kinds of pests, and serve as host plants for parasitic nematodes. Therefore, there are many reasons to work towards a complete eradication of the weeds from the agricultural environment. As a matter of fact, herbicides will be the only accepted weed control method in future due to increased labour and resource costs. One of the main obstacles to wheat production is weeds, which decrease yield through competition (Zimdhal, 1980), allelopathy (Hussain, 1983), by giving pathogens an environment to thrive and so acting as a substitute host for a variety of insects and fungus, and by raising the expense of harvesting (Rao, 1983). Generally speaking, both dicot and monocot weeds are present in wheat fields. The major dicot weeds are: *Chenopodium album* (bathua), *C. murale* (Krund), *Cirsium arvense* (Leh), *Convolvulus arvensis* (Lehli) *Cronopus didymus* (Jungli Halon), *Fumaria indica* (Shahtra), *Melilotus indica* (Senji) and *Rumex dentatus* (Jungli Palak) (Hussain et al. 2004), however, described a flora with distinct features in Chitral. Weeds are usually removed by hand. But these days, the expense of labor and labor scarcity have made it challenging. These days, a variety of chemical weedicides are available that work rather well to control weeds in wheat. Manual weed control, as well as the use of animal implements, or manual labour has been practised from time immemorial, but these practices are cumbersome, tedious and expensive due to an increase in wages. Interest in using chemical weed control has been increased by the increasing mechanisation of agricultural operations, as well as higher wages for labour. The easiest and most successful alternative method is chemical weed control. There are reports on the effectiveness of several herbicides in wheat (Khan et al., 2002). In Pakistan, like in other agriculturally developed nations, pesticide usage is not common. While studies by Khan et al. (2001) and Khalil et al. (2015) shown a synergistic effect on combined usage of herbicides, the interest in graminicide testing (Walia et al., 1998) highlights the difficulty faced by grasses. In previous experiments, researchers used pesticides to effectively suppress wheat weeds (Khan et al., 2003: Cheema and Akhtar. 2005). Herbicides are often used in Pakistan to eradicate broad leaf weeds from wheat crops. But unlike other places, Punjab does not use pesticides as frequently. Thus, current research was started to determine the most cost-effective and efficient herbicide as well as how often it should be used to control these Dicot wheat weeds.

MATERIALS AND METHODS

Different new chemistry weedicides were applied at their recommended doses in RCBD arrangement having three replications. The weedicides were applied at the crop age of 40-50 days, when all the weeds germinated.
There will be following treatments;
T1: Atlantis 3.6 % WG @160 gm/ Ac
T2: Isoproturan 50 % WP @ 800gm / Acre
T3: Affinity 50 WP @ 800 gm/Acre
T4: Proturon 50 % WP @ 800 gm/Acre
T5: Pallas 45OD @ 160ml/Acre
T6: Control

Location

An experiment was laid out at 140,475,445,476 GB of Tehsil Samundri, District Faisalabad Pakistan during 2013-14, to investigate how recently applied weedicides affect wide leaf weeds in wheat.

Inputs

Fertilizers including nitrogen (N), phosphorous (P), and potassium (K) have been used at base doses of 128–114–62 kg/ha, respectively. Three applications of N fertilizer were made: one third of the N, all of the K, and all of the P were given out during seedbed preparation, and the soil was completely mixed in by plowing and planking. During the first irrigation, the second (1/3) of the N was utilized, and during the third irrigation, the 1/3rd. The irrigation system used canal water. Throughout the duration of the study for every treatment, all other cultural customs were maintained in accordance with departmental recommendations. When the crop reached maturity, it was harvested. The study's three separate replications and $20x^5$ m^2 plot size were organized using a randomized complete block design (RCBD). Table 1 provides particular treatment application details. The weed aspects data was obtained after I month following treatment, and the treatments had been given 40 days after seeding.

Parameters

Data has been collected on characteristics related to wheat yield, growth, and infestation by weeds.

Statistical Analysis

The analysis of variance approach was used to statistically analyze each set of data independently. Using the Least Significant Difference (LSD) test at the 5% significance level, the differences between the treatment's means were examined (Steel and Torrie, 1997).

Table 1. List of broad-Spectrum weedicides treatments.

Trade Name	Common Name	Applied/Acre
Atlantis 3.6 % WG	Mesosulfuron methyl+Florasulam	100 gm
Isoproturan 50 % WP	Isoproturan	800 gm
Affinity 50 WP	Isoproturan+Carfentrazone eethyle	800 gm
Ptrouron 50 % WP	Ptrouron	800 gm
Pallas 45OD	Pyroxulam	160ml

RESULTS AND DISCUSSION

The population of weeds shows that both narrow and wide leaf weeds were present in the experiment. There were no discernible differences between the treatments in terms of the quantity of weeds before spray m2 (Table 2). A comparative analysis of the means revealed that Isoproturan 50% WP had the highest number of weeds (50.63 m^2) before spraying. Affinity 50WP @800 gm (46.95) would be applied after 800 gm/acre, in contrast to (control), which yielded 44.42 m^2.

There were notable variations between the treatments under examination based on data on the quantity of weeds after spray m-2 (Table -3). By comparing the means, it was possible to determine that the minimal weeds number after spraying (7.88 m-2) was counted somewhere Affinity 50WP @800 gm/acre was applied, followed by (8.57 m-2) where Atlantis 3.6 % WG @160 gm was applied as compared to control (44.42 m-2). Other weedicides like Isoproturan 50 % WP, Ptrouron 50 % WP@800gm/acre and Pallas 45OD @160ml/acre were also control the weeds as compared to control. These results exhibit a strong connection to the earlier research conducted by Qureshi et al. (2002), Khan et al. (2002), and Hassan et al. (2003). These researchers found that using different pesticides lowered the number of weeds in wheat. Herbicides' phytotoxic action on weeds is the reason behind the decrease in weed populations in herbicidal treatments.

The data analysis pertaining to plant height revealed remarkably substantial variations across the various treatments (Table 4). The highest plant height of 90.44 cm was attained, according to an examination of the means where Affinity 50WP @800 gm/acre was applied, followed by Atlantis 3.6 % WG @160 gm /acre with 88.62 cm height, as compared to control (81.58cm).

Significant variations between the various treatments were found through data analysis pertaining to grain production, as Table 5 demonstrates. After comparing the means, it was determined that T1 with Atlantis 3.6% WG @160 mg applied had the highest grain production (40.55 mon acre-1). It was, however, statistically comparable with T3 (Atlantis 3.6 % WG @160 gm /acre) with grain yield of 38.40mon acre-1. Among the herbicides, least grain yield of 34.45 mon acre-1 and 31.37 mon acre-1 was obtained from treatments T4 (Ptrouron 50 % WP@800gm/acre) and T5 (Pallas 45OD @160ml/acre), respectively, over control (Table-6). These conclusions are consistent with other studies on wheat conducted by Hassan et al. (2003), Cheema and Akhtar (2005), and Khalil et al. (2008) who detected enhanced wheat grain production by using several herbicides.

Major Broad leaf weeds infesting the trial.

Local Names: Bathu, Leh, Lehli, Shahtra, Palak, Jhangli Palak, Hallo, Maina, Bili booti, Jgangli Jai,Dhumbi siti,Matri

Table 2. Impact of several weedicides on the management of wide leaf wheat weeds (140 GB).

Treatment(T)	T ml/g Ac-1	Weeds T m-2 before spray	Weeds T m-2 after spray	Height of plant (cm)	Grain Yield (mon Ac-1)
T1 Affinity	800 gm	40.33a	6.33bc	88.50a	39.22a
T2 Isoproturan	800 gm	35.00b	10.20bc	82.33a	32.20ab
T3 Atlantis	100 gm	28.44c	6.90d	87.24b	37.40b
T4 Ptrouron	800 gm	42.50a	13.22b	80.77ab	30.33bc
T5 Pallas	1000 gm	38.20bc	11.75bc	76.36b	28.22c
T6 Control		35.44b	35.44a	82.00a	22.50d

Table 3. Impact of several weedicides on the management of wide leaf wheat weeds (476 GB)

Treatment(T)	T ml/g Ac-1	Weeds T m-2 before spray	Weeds T m-2 after spray	Height of plant (cm)	Grain Yield (mon Ac-1)
T1 Affinity	800 gm	32.25c	5.75c	92.52a	40.75b
T2 Isoproturan	800 gm	36.75b	9.50d	75.75b	34.25b
T3 Atlantis	100 gm	31.75d	8.25d	88.50b	38.44a
T4 Ptrouron	800 gm	40.5a	12.33b	80.33b	32.22b
T5 Pallas	1000 gm	35.25c	10.25c	76.20c	30.50b
T6 Control		40.50a	40.50a	82.33a	20.50c

Table 4. Impact of several weedicides on the management of border leaf wheat (475 GB).

Treatment(T)	T ml/g Ac-1	Weeds T m-2 before spray	Weeds T m-2 after spray	Height of plant (cm)	Grain Yield (mon Ac-1)
T1 Affinity	800 gm	44.75d	6.25bc	90.25a	42.50a
T2 Isoproturan	800 gm	65.52a	10.25b	85.50ab	36.25b
T3 Atlantis	100 gm	52.33b	8.75cd	90.25d	39.33c
T4 Ptrouron	800 gm	42.20bc	11.25d	88.20ab	38.50b
T5 Pallas	1000 gm	48.75bc	10.44cd	85.33ab	34.25c
T6 Control		46.50d	46.50a	82.50ab	24.50d

Table-5. Impact of several weedicides on the management of border leaf wheat (445 GB).

Treatment(T)	T ml/g Ac-1	Weeds T m-2 before spray	Weeds T m-2 after spray	Height of plant (cm)	Grain Yield (mon Ac-1)
T1 Affinity	800 gm	70.50a	13.22b	90.50a	39.75a
T2 Isoproturan	800 gm	65.25b	13.25bc	80.96b	35.33b
T3 Atlantis	100 gm	48.40c	10.40cd	88.50b	38.44c
T4 Ptrouron	800 gm	28.33d	12.66cd	81.33b	36.75b
T5 Pallas	1000 gm	48.50c	11.25d	80.25b	32.50c
T6 Control		55.25bc	55.25a	79.50b	21.33d

Table 6. Average impact of several weedicides on the management of border leaf wheat.

Treatment(T)	T ml/g Ac-1	Weeds T m-2 before spray	Weeds T m-2 after spray	Height of plant (cm)	Grain Yield (mon Ac-1)
T1 Affinity	800 gm	46.95b	7.88c	90.44a	40.55a
T2 Isoproturan	800 gm	50.63a	10.8b	80.96b	34.51bc
T3 Atlantis	100 gm	40.23bc	8.57bc	88.62ab	38.40b
T4 Ptrouron	800 gm	38.38c	12.66bb	81.67b	34.45bc
T5 Pallas	1000 gm	41.92b	10.9b	79.53c	31.37c
T6 Control		44.42b	44.42a	81.58b	21.70d

CONCLUSION

The comparative efficacy analysis of various broad-spectrum herbicides on wheat crops revealed distinct differences in weed control effectiveness. While some herbicides demonstrated superior weed suppression, others showed varying impacts on wheat yield. Understanding the specific herbicide's performance and its influence on crop yield is crucial for optimizing weed management strategies in wheat cultivation.

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COMPETING OF INTEREST

The authors declare no competing interests.

REFERENCES

Cheema, M. S and M. Akhtar. Efficacy of different post emergence herbicides and their application methods in controlling weeds in wheat. Pak. J. Weed Sci. ,Res., 11: 23-29, 2005.

Hassan, G., B. Faiz, K.B. Marwat and M. Khan. Effects of planting methods and tank mixed herbicides on controlling grassy and broad leaf weeds and their effects on wheat cv Fakhr-e-Sarhad. Pak. J. Weed Sci. Res., 9:1-11, 2003.

Hussain, F. 1983. Biochemical inhibition - a less understood ecological factor in agro-ecosystem. Progressive Farming 3: 33 - 37.

Hussain, F., A. Murad and M.J. Durrani. Weed communities in the wheat fields of Mastuj, District Chitral, Pakistan. Pak. J. Weed Sci. Res., 10(3-4): 101- 108, 2004.

Khalil, M.F., G. Hassan, G. Ahmad and N.H. Shah. Individual and combined effect of different herbicides on weed

control in wheat. Pak. J. Weed Sci. Res., 14 (3-4): 131-139, 2008.
Khan, I., Z. Muhammad, G. Hassan and K.B. Marwat. Efficacy of different herbicides for controlling weeds in wheat crop-1. Response of agronomic and morphological traits in wheat variety Ghaznavi-98. Scientific Khyber, 14 (1): 51 57, 2001.
Khan, M.A., M. Zahoor, I. Ahmad, G. Hassan and M.S. Baloch. Efficacy of different herbicides for controlling broad leaf weeks in wheat (Triticum aestivum L.) Pak. J. Biol. Sci., 2(3): 732-734, 1999.
Khan. 1., G. Hassan and K.B. Marwat. Efficacy of different herbicides for controlling weeds in wheat crop-II. Weed dynamics and herbicides. Pak. J. Weed Sci. Res., 8 (1-2): 41-47, 2002.
Khan. M. H., G. Hassan, N. Khan and M.A. Khan. Efficacy of different herbicides for controlling broadleaf weeds in wheat. Asian J. Plant Sci., 2 (3): 254-256, 2003.
Qureshi, F. A. Weed problem of Pakistan. Identification and Control of Weed Manual, PARC, Islamabad. P. 5- 8, 1982.
Qureshi, M.A., A.D. Jarwar, S.D. Tunio and H. I. Majeedano. Efficacy of various Weed Management practices in wheat. Pak. J. Weed Sci. Res., 8(1-2): 63-69, 2002.
Rao, V.S. Principles of Weed Science. Oxford Publishing Co. New Delhi. pp. 540, 1983.
Shah, M.L., A. Jalis, M. Ramzan and J.Iqbal. Chemical weed control in broadcast sown wheat under irrigated conditions. J. Agric. Res., 27(3): 195-199, . 1989.
Steel, R., J.H. Torrie and D.A. Dickey. Principles and Procedures of Statistics. A Biometrical Approach, 3rd Ed. McGraw Hill Book Co., New York, 172-177, 1997.
USDA report 2022. Area, Production and Yield Per Hectare of Agricultural Crops. https://ipad.fas.usda.gov/countrysummary/Default.aspx?id=PK&crop=Wheat
Walia, U.S., L.S. Brar and B.K. Dhaliwal. Performance of clodinafop and fenaxaprop-ethyl for the control of Phalaris minor in wheat. Indian J. Weed Sci., 30:(1-2) 48-50, 1998.
Zimdhal, R.L. Weed - crop competition. A Review. International Plant Protection Center, Oregon State University, U.S.A. pp. 196, 1980.