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Weed Control Efficiency and Grain Yield of Wheat (*Triticum aestivum* L.) under Pre and Post- Emergence herbicides

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ABSTRACT

The present investigation entitled "Weed control efficiency and grain yield of wheat (*Triticum aestivum* L.)" under Pre-and Post-Emergence Herbicides"was carried out at student research farm, Department of Agriculture, Khalsa College Amritsar. The soil of the experimental field was sandy loam texture with normal pH and electrical conductivity, low in organic carbon and available nitrogen, medium in available phosphorus and high in available potassium. The experiment was laid out in randomized block design with 12 treatments comprising T_1 (Control), T_2(Pinoxaden 50 ml at 28 days after sowing (DAS), T_3 (Pinoxaden 50 ml at 42 days after sowing (DAS), T_4 (Pinoxaden 50 ml at 56 days after sowing (DAS), T_5 (Pendimethalin 750 ml), T_6 (Pendimethalin 750 ml + T_2), T_7 (Pendimethalin750 ml + T_3), T_8 (Pendimethalin 750 ml + T_4), T_9 (Pendimethalin 1000 ml), T_{10} (Pendimethalin 1000 ml + T_2), T_{11} (Pendimethalin 1000 ml + T_3), T_{12} (Pendimethalin 1000 ml + T_4) replicated thrice. From the experiment it was observed that T_{10} (Pendimethalin 1000 ml + T_2) was found most effective in controlling weed population, dry matter accumulation of weeds and produced higher grain yield, straw yield and weed control efficiency than T_7, T_8, T_5, T_3, T_4 and least were in T_1. Treatment T_{10} remained at par in terms of growth and yield attributes to T_{11}, T_{12}, T_9, T_6, T_2 and was significantly better than T_3, T_4, T_5, T_7 and T_8. All the weed control treatments produced significantly higher returns than the control.

Key words : *Herbicides, Weed control efficiency, Wheat and Weed control.*

Introduction

Wheat (*Triticum aestivum*) is the most extensively grown cereal crop in the world. It is native of South West Asia. It is second important staple food crops, rice being the first. It is dominant source of food of about one-third population of the world. In India wheat was grown on 29.14 million hectare with the production of 102.19 million tonnes (Anon, 2018). The major wheat producing states in India are Punjab, Haryana, Uttar Pradesh, Tamil Nadu, Maharashtra, Madhya Pradesh, Gujarat, Rajasthan and Karnataka. In Punjab during 2018-2019, it covers 35.20 lakhs hectares with a production of 182.62 lakhs tones and average yield of 51.88 q ha^{-1} (Anon 2019). Wheat is mainly infested with heavy population of *Phalaris minor* (Wild canary grass), *Avenafatua* (Wild Oat), *Chenopodium album* (Bathu), *Anagallis arvensis* (Krishnaneel), *Argemone Mexicana* (Satyanashi), *Conovolvulus arvensis* (Hirankhuri), *Fumaria palviflora* (Pitpapra), *Medicago denticulate* (Maina), *Rumexdentatus* (Janglipalak), *Canabis sativa* (Bhang), *Carthamusoxycantha* (Pohli). Among these, *Phalaris minor* have become problematic weed in Punjab (Ashiq *et al*., 2006). The problem of herbicide resistance in *Phalaris minor* may again pose a serious threat to the sustainability of wheat productivity. Use of both pre and post emergence herbicides are effective in controlling these resistant weeds and enhance grain yield (Shehzad *et al*., 2012a). Pendimethalin is a herbicide of the dinitroaniline class used as pre emergence control of annual grasses and certain broadleaf weeds. This is a herbicides where resistant is recorded till date. Early application of herbicide application plays an important role in achieving effective weed control without causing crop injury. Pinoxaden has been recommended for post emergence control of *Phalaris minor* (Dhawan *et al.,* 2010). These both herbicides are very safe for the present and subsequent crop and is very effective in all weather conditions. In this study we used both pre and post emergence herbicides for chemical weed control.

Materials and Methods

The experiment was conducted at Students' Research Farm, Khalsa College, Amritsar (latitude 31.63 degree N and longitude 74.87 degree E, at an average elevation of 229 metres above sea level) during *rabi* season of 2019-20, on sandy loam soil having pH 8.4 and electrical conductivity (0.21 EC ds m^{-1}), medium in organic carbon (0.48 %), low available N (168 kg ha^{-1}), high available P (34.9 kg ha^{-1}) and high available K (360 kg ha^{-1}). The wheat variety "*HD 3086*" was sown at 22.5 cm spacing on 21^{th} November 2019. The experiment was laid out in randomized block design with eight treatments such as T_1 (Control), T_2(Pinoxaden 50 ml at 28DAS), T_3 (Pinoxaden 50 ml at 42 DAS), T_4 (Pinoxaden 50 ml at 56 DAS), T_5 (Pendimethalin 750 ml), T_6 (Pendimethalin 750 ml + T_2), T_7 (Pendimethalin 750 ml + T_3), T_8(Pendimethalin 750 ml + T_4), T_9 (Pendimethalin 1000 ml), T_{10} (Pendimethalin 1000 ml + T_2), T_{11} (Pendimethalin 1000 ml + T_3), T_{12} (Pendimethalin 1000 ml + T_4) and replicated thrice. Herbicides were sprayed with knapsack sprayer. Pendimethalin was applied as pre-emergence at two days after sowing while pinoxaden were applied as post-emergence at 21, 42, and 56 DAS. The weed density and dry weight of *Phalaris minor* and other weeds data were analyzed after squareroot ($\sqrt{x+1}$) of transformation by using CPCS-1 method.

Results and Discussion

Statistical analysis showed that different weed control treatments had significant effect on weed population, dry matter accumulation of weeds, weed control efficiency and yield attributes grain yield and straw yield.

Effect on weeds

Weed count and dry matter accumulation of weeds

The data pertaining in the Table 1 a revealed that throughout the crop period, the population and dry matter of *Phalaris minor* and other weeds were influenced by different weed control treatments. The population and dry matter of *Phalaris minor* and

Table 1. Effect of different weed control treatments on population (m^2) and dry matter of *Phalaris minor* (q ha^{-1}) in wheat (*Triticum aestivum* L.) during *rabi* 2019-20 (pooled data).

Treatments	Population of *Phalarisminor* (m^2)	Dry matter of *Phalarisminor* (q ha^{-1})	Population of other weeds (m^2)	Dry matter of other weeds (q ha^{-1})
T_1 Control	12.2(150.6)	5.9(35)	10.1(103.6)	5.5(30.6)
T_2 Pendimethalin (0) + Pinoxaden (28 DAS)	2.7(8.1)	2.6(7.1)	2.5(7.1)	2.8(8.3)
T_3 Pendimethalin (0) + Pinoxaden (42 DAS)	6.4(41.5)	4.3(19)	6.3(40.5)	3.4(12.3)
T_4 Pendimethalin (0) + Pinoxaden (56 DAS)	6.5(43.1)	4.5(20.6)	6.4(42.1)	4.5(20.8)
T_5 Pendimethalin (750 ml) + Pinoxaden (0)	6.1(38.3)	3.9(15.6)	6.0(37.3)	3.2(11.1)
T_6 Pendimethalin (750 ml) + Pinoxaden (28 DAS)	2.6(7.60)	2.6(6.9)	2.4(6.6)	2.7(7.6)
T_7 Pendimethalin (750 ml) + Pinoxaden (42 DAS)	5.5(31.3)	3.1(10.5)	5.4(30.3)	2.9(9)
T_8 Pendimethalin (750 ml) + Pinoxaden (56 DAS)	5.7(33.3)	3.7(13.9)	5.6(32.3)	3.2(10.6)
T_9 Pendimethalin (1000 ml) + Pinoxaden (0)	2.5(7.2)	2.5(6.8)	2.3(6.2)	2.6(6.9)
T_{10} Pendimethalin (1000 ml) + Pinoxaden (28 DAS)	2.2(5.6)	1.4(3.1)	1.9(4.7)	1.2(3.1)
T_{11} Pendimethalin (1000 ml) + Pinoxaden (42 DAS)	2.4(6.6)	2.2(5.0)	2.2(5.8)	2.1(5)
T_{12} Pendimethalin (1000 ml) + Pinoxaden (56 DAS)	2.5(6.9)	2.3(5.7)	2.2(5.9)	2.4(5.9)
CD (P=0.05)	1.42	0.92	1.49	1.1

other weeds were higher under control plot (T_1) and lowest under T_{10} plot where 1000 ml pendimethalin and 50 ml pinoxaden applied at 28 days after sowing (DAS). Treatments T_{11}, T_{12}, T_9, T_6 and T_2 were very effective in weed management.The population and dry matter accumulation of weeds was recorded under all treatments significantly lower than T_1 (control) plot. At harvest the lowest population of *Phalaris minor* and other weeds were observed in T_{10} plot where both the herbicides were applied at recommended dose and appropriate time of application (28 days after sowing) followed by T_{11}, T_{12},T_9, T_6 and T_2. The maximum population and dry matter was observed in control plot (T_1). The density and dry matter of *Phalaris minor* and other weeds decreased significantly as compared to control plot (T_1).

Weed control efficiency

Weed control efficiency is a measure of the ability of a technique to control weeds. The data showed that there were significant effects of different herbicides on weed control. The data regarding weed control efficiency is presented in Table 2 showed that maximum weed control efficiency (90.1) was recorded where both the herbicides pendimethalin 1000 ml and 50 ml pinoxaden 28 DAS was applied at recommended dose and appropriate time of application (T_{10}) followed by T_{11} (81.7), T_{12} (78.7), T_9 (75.7), T_6 (73.8) and T_2 (71.7). This means pendimethalin 1000 ml and 50 ml pinoxaden at 28 DAS have effectively controlled weeds that resulted in increased yield.

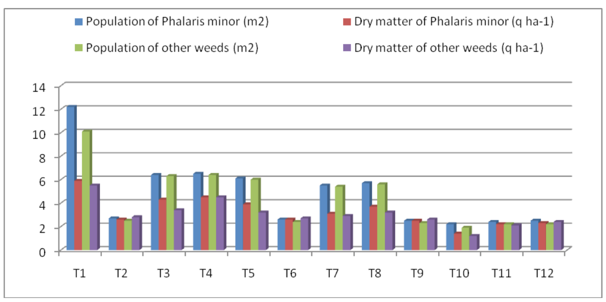

Fig. 1. Effect of different weed control treatments on population (m^2) and dry matter of *Phalaris minor* (q ha^{-1}) in wheat (*Triticum aestivum* L.)

Effect on crop

Grain and straw yield differed significantly due to different weed control treatments (Table 2). The highest grain and straw yield was recorded with application of pendimethalin 1000ml + 50ml pinoxaden at 28DAS in T_{10} plot (53.4 q ha^{-1} and 78.5 q ha^{-1} respectively) which was at par with

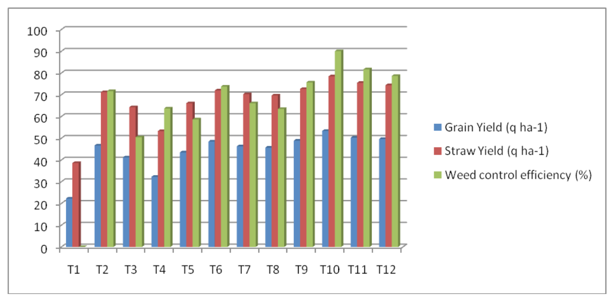

Fig. 2. Effect of different weed control treatments on grain yield (q ha^{-1}), straw yield(q ha^{-1}) and weed control efficiency (%) of wheat (*Triticum aestivum* L.)

Table 2. Effect of different weed control treatments on grain yield (q ha^{-1}), straw yield(q ha^{-1}) and weed control efficiency (%) of wheat (*Triticum aestivum* L.) during *rabi* 2019-20 (pooled data)

Treatments	Grain Yield (q ha^{-1})	Straw Yield (q ha^{-1})	Weed control efficiency (%)
T_1 Control	22.3	38.6	-
T_2 (Pinoxaden 50 ml at 28 DAS)	46.7	71.2	71.7
T_3 (Pinoxaden 50 ml at 42 DAS)	41.2	64.3	50.5
T_4 (Pinoxaden 50 ml at 56 DAS)	32.3	53.3	63.7
T_5 Pendimethalin (750 ml)	43.5	66.1	58.7
T_6 (Pendimethalin 750 ml + T_2)	48.5	72.0	73.8
T_7 (Pendimethalin 750 ml + T_3)	46.3	70.3	66.1
T_8 (Pendimethalin (750 ml + T_4)	45.7	69.7	63.5
T_9 (Pendimethalin 1000 ml)	48.9	72.7	75.7
T_{10} (Pendimethalin 1000 ml + T_2)	53.4	78.5	90.1
T_{11} (Pendimethalin (1000 ml + T_3)	50.3	75.5	81.7
T_{12} (Pendimethalin (1000 ml + T_4)	49.7	74.4	78.7
CD (P=0.05)	6.1	7.2	

pendimethalin 1000 ml + 50 ml pinoxaden at 42 DAS in T_{11} (50.3 q ha^{-1} and 74.4 q ha^{-1} respectively), T_{12} where pendimethalin 1000 ml + 50 ml pinoxaden at 56 DAS (49.7 q ha^{-1} and 74.4 q ha^{-1} respectively), T_9 where pendimethalin 1000 ml applied (48.9 q ha^{-1} and 72.7 q ha^{-1} respectively), T_6 where lower dose of pendimethalin 750ml + 50 ml pinoxaden applied at 28 DAS (48.5 q ha^{-1} and 72.0 q ha^{-1} respectively) and T_2 where alone 50 ml pinoxaden applied at 28 DAS (46.7 q ha^{-1} and 71.2 q ha^{-1} respectively). The higher grain and straw yield in these treatments was mainly due to better control of weeds and higher weed control efficiency during early stage of crop growth which resulted in effective utilization of resources such as nutrients, moisture, space and light resulted in better expression yield components whereas lower grain and straw yield was recorded in control (22.3 q ha^{-1} and 38.6 q ha^{-1}) owing to severe crop weed competition which resulted in reduction in the expression of yield components.

(Alvi *et al*. 2010) and Singh *et al.* (2017) presented similar results with respect to population of weed. The result of weeds dry matter accumulation was in close agreements with the findings of (Walia *et al.* 2012). Weed control efficiency is also confirmed by Kondap and Upadhyay, (1985). Rasool *et al.,* (2017) reported the same result of grain yield. Khali *et al* (2013) and Cheema *et al.* (2006) also proposed the similar results with respect to straw yield.

Conclusion

Results from field experiment concluded that among all the chemical treatments, T_{10} (Pendimethalin 1000 ml + Pinoxaden 28 DAS) gave higher grain yield (53.4 q ha^{-1}) and straw yield (74.2 q ha^{-1}). The treatment T_{11} (50.3 q ha^{-1}), T_{12} (49.7q ha^{-1}), T_9 (48.9 q ha^{-1}), T_6 (48.5 q ha^{-1}) and T_2 (46.7 q ha^{-1}) which were observed at par with T_{10}. Application of higher dose of Pendimethalin (1000 ml) as pre-emergence and 50 ml pinoxaden at 28 DAS was the best weed management practice in wheat to obtain greater yield with more efficient weed control.

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