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Effect of herbicides on weed control and grain yield of wheat in Kabul, Afghanistan

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ABSTRACT

The field experiment was conducted at the Research Farm, Agronomy Department of Kabul University, Kabul, Afghanistan, to study the efficacy of two different herbicides 2, 4-D and MCPA for weed control and grain yield of wheat during 2019-20. The experiment was laid out in randomized block design with four treatments such as weed free, weedy check, 2,4-D @1 kg ha^{-1} and MCPA@ 1 kg ha^{-1}, replicated five times. The soil of the experimental field was sandy loam with low organic matter and available nitrogen, medium in available potassium, but low in available phosphorus. Soil pH and EC were 8.2 and 0.16 dSm^{-1}, respectively. 2, 4-D herbicide was applied at tillering (3-5 leaves) stage, whereas, the MCPA herbicide was also applied at tillering (3-5 leaves) stage. Urea granules (46% N) and DAP (18% N, 46% P_2O_5) were used for supplying 120 kg N and 60 kg P_2O_5 ha^{-1}. One third N and full dose of P_2O_5 were applied as plough sole placement before sowing. The urea granules (46% N) were applied as 1/3 at the jointing stage and remaining 1/3 at the anthesis stage. The seeds of wheat cultivar Kabul 013 were sown in furrows spaced at 25 cm with the help of had seed drill at the rate of 110 kg seed ha^{-1} on 12th November in the year 2019. Five irrigations were given, the first irrigation was performed after sowing, second irrigation was conducted 20 days after the first irrigation, in order to prevent crust establishment, third at booting stage, fourth at flowering stage, and final irrigation at the soft dough stage, with the help of tube well, coinciding with the critical stages of the growth of wheat crop. Results revealed that 2, 4-D was effective to control weed population and produced a higher number of effective tillers, 1000 grain weight and enhanced the yield up to 43.1% over weedy check.

Key words: Grain yield, herbicides, weed control efficiency, weed density and biomass

INTRODUCTION

Wheat (*Triticum aestivum* L.) is one of the most important cereals and is grown extensively throughout the world. It is the main staple food and largest grain crop of Afghanistan. The area of wheat cultivation in Afghanistan is more than 2.00 million hectares with an average yield of 3.60 million tons (Ahmadi et al., 2021). Regardless of all the other ways of crop yield enhancement, weed control is one of the important key factors in crop yield improvement particularly in Kabul Province to cope with the annual weed population blast. Weeds compete with crops for available moisture, nutrients, space, and light and provide shelter for harmful insect-pests which result in yield reduction (Prasad et al., 2019). Weeds cause yield reduction up to 15-50 per cent depending upon the weed density and weed flora (Jat et al., 2003). Jan and How (2013) reported that weeds reduced wheat production more than 30% in Northern provinces of Afghanistan. Weeds not only

reduce yield but also lower the quality of the produce and increase the cost of harvesting, threshing and cleaning. Apart from improved agronomic practices and plant protection measures, chemical weed control is one of the important key factors to enhance wheat production and productivity. Most of the small, medium and large farmers in Afghanistan are well aware about integrated weed control strategies, even though chemical weed control measures have a prominent place. Therefore, proper selection of herbicide and time of application remains the only resort to check weed population and to improve crop yield. Herbicidal treatments increased grain yield as compared with un-weeded and hand weeding treatments (Amin et al., 2008). But as a part of rat-race among each other, the farmers use excessive chemicals which not only pollute the environment but hazardous human health too. That's why choice of best herbicide and time of application are the important considerations for lucrative returns (Prasad et al., 2019). Keeping in view the importance of the weeds problem in wheat, this study was undertaken to investigate the effectiveness of different herbicides for controlling the weeds in wheat crops.

MATERIALS AND METHODS

The experiment was conducted at Research Farm, Agronomy Department of Kabul University Kabul, Afghanistan during rabi season of 2019-20. Kabul is located at 34° 54' 44.1" N latitude and 70° 10' 9.2" longitudes and altitude 1791 m (5876 Ft) above sea level. The climate of the experimental site in Kabul is cold in winter, with an average temperature in January of -1°C, usually freezing nights and with possible peaks of -20 to -25°C. Snowfalls are fairly frequent and sometimes heavy. Summer is hot during the day but nights remain usually cool. Precipitation in Kabul is 300 mm per year. The rainiest season is spring. In the summer it rarely rains. The soil of the experimental site was sandy loam having pH 8.2, low in organic carbon (0.91%), low available N (150.5 kg ha^{-1}), low available P (150 kg ha^{-1}) and high available K (273 kg ha^{-1}). The seeds of wheat cultivar Kabul 013 was sown in furrows spaced at 25 cm with the help of hand seed drill at the rate of 110 kg seed per hectare on 12th November in the year 2019. The experiment was laid out in randomized block design with four treatments such as weed free, weedy check, 2,4-D 1 kg ha^{-1}, MCPA 1 kg ha^{-1} and replicated thrice. Herbicides were applied with a knapsack sprayer. 2, 4-D and MCPA were applied as post- emergence at tillering (3-5 Leaves) stage. The weed density and dry weight of broad-leaf weeds were analyzed using transformation of square root i.e., ($\sqrt{x+1}$), before carrying out analysis of variance and comparison were made on transformed values.

RESULTS AND DISCUSSION

The data recorded on weed density (number m^{-2}), weed dry matter (g m^{-2}), weed control efficiency (%), effective tillers (number m^{-2}), test weight (g), straw yield (t ha^{-1}) and grain yield (t ha^{-1}) were significantly affected by different herbicides treatments.

Effect on weeds

The density and dry matter of broad-leaved weeds decreased significantly as compared to weedy check. The decline in weed density and weed dry matter was owed to withering of weeds (Table 1). Removing the weeds whenever they appear under the weed free treatment resulted in complete elimination of weed competition as it resulted in lowest total weed dry weight. Among post-emergence herbicide treated plots, the maximum reduction of broad weeds was observed with the application of 2, 4-D followed by MCPA.

The highest weed population and dry matter was observed in weedy check. The results are in line with those of Walia et al. (2012). The weed control efficiency among the weed control management practices ranged from 72.8 to 100%. The highest weed control efficiency was found in weed free plots followed by 2, 4-D (76.9%). The lowest weed control efficiency (72.8%) was recorded in MCPA plots (Table 2).

Effect on crop

Grain and straw yield differed significantly due to different weed control treatments (Table 4). Weed control treatments registered significantly higher grain and straw yield than weedy check.

Table 1. Effect of different weed control treatments on population (number m^{-2}) and dry matter of broad- leaved weeds (g m^{-2}) in wheat

Treatments	Broad leaved weeds			Dry weight of broad-leaved weeds		
	120 DAS	150 DAS	At harvest	120 DAS	150 DAS	At harvest
Weed free	1(0)	1(0)	1(0)	1(0)	1(0)	1(0)
Weedy check	8.7(79.7)	8.7(75.6)	8.3(68.4)	4.4(18.4)	7.8(60.3)	16.5(273.1)
2,4-D	8.7(75.2)	2.5(4.31)	2.5(5.73)	4.1(16.4)	4.7(21.1)	9.9(98.7)
MCPA	8.8(77.2)	2.5(5.26)	2.5(5.11)	4.3(17.5)	4.6(20.8)	10.1(101.1)
LSD(p=0.05)	1.63	0.46	0.44	2.3	1.9	1.3

Original data given in parenthesis was subjected to square root (+1) transformation before analysis.

Table 2. Effect of different weed control treatments on weed control efficiency (%) in wheat

Treatments	Weed control efficiency (%)
Weed free	100
Weedy check	-
2,4-D	76.9
MCPA	72.8

Table 3. Effect of different weed control treatments on effective tillers (number m^{-2}) and test weight (g), grain yield (t ha^{-1}) and straw yield (t ha^{-1}) of wheat

Treatments	Effective tillers per m^2	Test weight (g)	Grain Yield (t ha^{-1})	Straw Yield (t ha^{-1})
Weed free	406.4	38.7	5.88	9.19
Weedy check	347.2	34.4	3.63	6.77
MCPA	365.9	36.9	4.40	7.50
2,4-D	383.7	37.4	5.07	8.23
LSD (p=0.05)	16.02	2.80	0.35	0.42

The higher grain and straw yield were recorded with application of 2, 4-D (5.07 and 8.23 t ha^{-1}), respectively compared to MCPA (4.40 and 7.50 t ha^{-1}, respectively). The higher grain and straw yield in these treatments is 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 of yield components i.e., number of effective tillers per m^2 (383.7 and 365.9, respectively) and the test weight (37.4 g and 36.9 g, respectively. Whereas, lower grain and straw yield was recorded with weedy check (3.63 and 6.77 t ha^{-1}, respectively) owing to severe crop weed competition which resulted in reduction in the expression of yield components such as effective tillers per m^2 (347.2). It was further observed that the lowest test weight (36.9 g) was obtained from MCPA followed by 2,4-D (37.4 g) treated plots, which was statistically equal to the weedy check plots which in turn was statistically lower with the remaining herbicidal treatments. These results are in conformity with the findings of Ali et al. (2004), Chemma et al. (2006), Hussain et al. (2013), and Khalil et al. (2013).

CONCLUSION

On the basis of these results, it can be concluded that application of 2, 4-D as post-emergence is the best weed management practice

in wheat under Kabul agro climate to obtain higher yield and its components. Additional studies should be conducted on 2, 4 –D and MCPA applications to study the duration of its effects on environment and economic benefits for soils fertility and crops.

REFERENCES

Ahiya, K.N. and Yaduraju, N.T. 1991. Optimizing isoproturon application in relation to first irrigation in wheat (*Triticum aestivum*). *Indian J. Agron.* **36** (4): 492-495.

Ahmadi, A.Y., Salari, M.W., Arian, M.J. and Mosawer, A. 2021. Effects of seed density on grain yield and agronomic traits of wheat (*Triticum aestivum* L.) under Kabul and Khost Agro-Ecological conditions, Afghanistan. *Int. J. Sci. Res. Biol. Sci.* **8**(2): 24-30.

Ali, M., Sabir, S., Mohy-ud-Din, Q. and Ali, M.A. 2004. Efficacy and economics of different herbicides against narrow leaved weeds in wheat. *Int. J. Agric. Biol*. **6**(4): 647-651.

Amin, A., Khan, M.A., Hassan, G., Marwat, K.B., Rashid, H. and Nawab, K. 2008. Weed control efficacy and economics of pre-emergence herbicides in maize (*Zea mays* L.). *Asian Australas. J. Plant Sci. Biotechnol.* **2**(2): 72-75.

Baghestani, M.A., Zand, E., Soufizadeh, S., Mir-vakili, M. and Jaafarzadeh, N. 2007. Response of winter wheat (*Triticum aestivum* L.) and weeds to tank mixtures of 2, 4-D plus MCPA with clo-dinafop propargyl. *Weed Biol. Manage.* **7**: 209–218.

Cabrera, A., Cox, L., Spokas, K.A., Celis, R., Hermosı ´n, M.C., Cornejo, J. and Koskinen, W.C. 2011. Comparative sorption and leaching study of the herbicides fluometuron and 4-chloro-2-methylphenoxyacetic acid (MCPA) in a soil amended with biochars and other sorbents. *J. Agric. Food Chem.* **59**: 12550–12560.

Cheema, M.S., Akhtar, S. and Iqbal, M.S. 2006. Performance of different herbicides in wheat under irrigated conditions of southern Punjab, *Pakistan. Pakistan J. Weed Sci. Res.* **12**(1-2): 53-59.

Curdy, E.V. and Molberg, E.S. 1974. Effect of the continuous use of 2,4-D and MCPA on spring wheat production and weed population. *Can. J. Plant Sci.* **54**: 241-245.

Deshi, J.S. 1970. Control of weeds in wheat with 2, 4-D. *Indian J. Agron.* **15**: 408-409.

Dixit, A. and Bhan, V.M. 1997. Weed control efficacy of isoproturon applied at different concentration and its combination with 2, 4-D in wheat. *Indian J. Weed Sci.* **29** (142): 11-14.

Hu, J., Yang, T., Yin, S. and Cao, D. 2012. Dissipation and residue of MCPA (4-chloro-2-ethylphenoxy-acetate) in wheat and soil. *Environ. Monit. Assess.* **184**: 5017–5024.

Hussain, Z., Marwat, K.H., Munsif, F., Samad, A. and Ali, K. 2013. Evaluation of various herbicides and their combinations for weed control in wheat crop. *Pakistan J. Bot.* **45**(1): 55-59.

Jan, A. and How, P. 2013. Weed control trainings for agricultural stakeholders is increasing wheat productivity in Northern Afghanistan. https://www.jdainternational.org

Jat, R.S., Nepalia, V. and Chaudhary, P.D. 2003. Influence of herbicide and methods of sowing on weed dynamics in wheat (*Triticum aestivum*). *Indian J. Weed Sci.* **35**: 18-20.

Khalil, M.F., Hussan, G., Ahmad, G., Anwar, S. and Khan, S. 2013. Comparative efficacy of herbicides on yield and yield components of wheat (*Triticum aestivum*). *APRN J. Agric. Biol. Sci.* **8**(1): 76-80.

Miteva, L., Ivanov, S. and Alexieva, V. 2003. Comparative effect of 2,4-D on the glutathione levels, glutathione-s-transferase and glutathione reductase activity in pea (*Pisum sativum* L.) and wheat (*Triticum aestivum* L.). *C. R. Acad. Bulg. Sci.* **56**: 53-58.

Prasad, S.M., Saha, S., Chourasia, M., Sarangi, D.R., Sahoo, T.R., Sethy, S. and Mohanta, R.K. 2019. Effect of integrated weed management in rainfed upland rice of Odisha. *e-planet* **17** (2): 106-110.

Shaktawat, M.S. 1986. Efficacy of herbicides for weed control in wheat. *Indian J. Weed Sci.* **17** (3): 46-49.

Sohail, N.1993. *Efficacy of weedicides to control broadleaf weeds in wheat.* M. Sc. Hons. Agric. Thesis, Dept. of Agronomy, University of Agriculture, Faisalabad, Pakistan.

Walia, U.S., Walia, S.S., Sidhu, A.S. and Nayyar, S. 2012. Bioefficacy of pre-and post-emergence herbicides in direct-seeded rice in Central Punjab. *Indian J. Weed Sci.* **44**(1): 30-33.