Pak. J. Weed Sci. Res. 10(1-2):11-16, 2004

WEED MANAGEMENT STRATEGIES IN WHEAT (*Triticum aestivum* L.)

Muhammad Arif, Inayat Ullah Awan, and Haji Himayat Ullah Khan[1]

ABSTRACT

An experiment to study the impact of integrated weed management strategies in wheat crop was conducted at the Agronomic Research Area of the Faculty of Agriculture, Gomal University, D. I. Khan, Pakistan, during 2001-02. Four post-emergence herbicides in comparison with kasola hoeing, weed free for full season and weedy check were evaluated. 2,4-D Ester and Buctril M40EC @1.25 L ha^{-1} each were applied alone and in combination with Puma Super 75EW @ L ha^{-1}. One, two and three hoeings with kasola were done after first, second and third irrigation, respectively. The data revealed that the application of herbicides and Kasola hoeings significantly affected the fresh and dry weed biomass (g m^{-2}), number of tillers m^{-2}, spike length (cm), number of spikelets spike^{-1}, number of grains spike^{-1} and grain yield (t ha^{-1}). Weed free crop for full season produced the highest grain yield (7.08 t ha^{-1}). Among herbicides, the mixture of Buctril-M40EC and Puma Super 75EW produced the maximum grain yield (5.60 t ha^{-1}), whereas three hoeings with kasola gave the highest grain yield (5.21 t ha^{-1}) among the kasola hoed treatments.

Key words: Wheat, weed control methods, chemical and mechanical control, integrated weed management.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is the basic component of human diet. It is the most widely grown cereal grain crop in the world, except in the rice-eating regions of Asia. Wheat products are the principal cereal foods of an overwhelming majority of the world inhabitants. It is staple food of the people of Pakistan and it is the backbone of the country's economy.

In Pakistan, it ranks first among the cereal crops and occupies about 66% of the annual food cropped area (Anonymous, 1996). A decrease in wheat production severely affects the economy of Pakistan and adds into the miseries of the inhabitants. A better progress has been made in increasing per hectare yield of wheat in the country during the last few years. The bumper wheat harvests of 1999-2000 and 2000-2001 have changed the nation's status from wheat importing to an exporting country. But, still Pakistan harvests lower yield per unit area as compared to advanced wheat growing countries. Besides other factors for lower yield, lack of proper weed control is the most important one. Weeds stress the cultivated crop through interference and by providing habitat for other harmful organisms. Weeds not only reduce the yield of crops but also deteriorate the quality of farm produce by contaminating the seed thereby reducing its market value. They compete with cultivated crops for space, solar radiation, water, soil nutrients and carbon dioxide

1 Department of Agronomy, Faculty of Agriculture, Gomal University, Dera Ismail Khan, NWFP – Pakistan E-mail:iuawan@hotmail.com

The annual losses to wheat crop due to weed infestation in Pakistan and N.W.F.P amount to Rs.28 billions and Rs.2 billions, respectively (Pervaiz and Quazi, 1992). These enormous losses warrant an efficient control of weeds for lucrative economic returns. The control of weeds from the crop field is, therefore, very essential for obtaining good crop and high economic returns.

Now weed technology has entered a scientific phase and even though chemical weed control is important, however, now integrated weed management is emphasized and desired. The use of chemicals is usually easy, time saving, highly effective and most economical approach to weed control. However, it is environmentally less safe as mechanical, cultural and biological methods of weed control.

The combination of chemical and other weed control methods in the form of integrated weed management package is recommended for the sustainability of production and environment. Rao (1983) observed that a combination of chemical, cultural and hand weed control methods was more effective in controlling weeds than their isolated applications. While, Jarwar *et al.* (1999) observed that chemical weed control method is very effective along with cultural method of weed control. Enough work on integrated weed management in N.W.F.P has not been published, hence the present studies were initiated to determine the integrated impact of weed management on the wheat crop production with the following objectives.

1. To determine the impact of different weed management strategies on wheat yield.
2. To determine the economic benefit obtained from the use of different weed control methods.

MATERIALS AND METHODS

An experiment to study the effect of integrated weed management on wheat crop was carried out at the Agronomic Research Area of the Faculty of Agriculture, Gomal University, Dera Ismail Khan, Pakistan, during 2001-02. The experiment was laid out in Randomized Complete Block Design (RCBD) with nine treatments (Table-1) and three replications. The net plot size was kept at 4x2 m^2. Wheat variety Dera-98 was sown on 31st October, 2001 on a well prepared seedbed with a single row hand drill in the rows 30 cm apart. Seeding rate was 120 kg ha^{-1}. The field was fertilized with urea and TSP (Triple Super Phosphate) at the rate of 120 kg N and 75 kg P_2O_5 ha^{-1}, respectively. The full dose of phosphorous and half dose of nitrogen were applied as a basal dose at the time of seedbed preparation and the rest of the nitrogen was applied with first irrigation. All other cultural practices were uniform for all treatments. The crop was harvested on 15th April and threshed manually.

The following data were recorded during the course of studies.

1. Fresh weed biomass per treatment (g m^{-2})
2. Dry weed biomass per treatment (g m^{-2})
3. Plant height (cm)
4. Number of tillers (m^{-2})
5. Spike length (cm)
6. Number of spikelets $spike^{-1}$
7. Number of grains $spike^{-1}$
8. 1000-grain weight (g)
9. Grain yield (t ha^{-1})

Statistical Analysis

The data recorded were analyzed statistically by using the analysis of variance techniques (Steel and Torrie, 1980). Duncan's Multiple Range Test (Duncan, 1955) was used to compare the differences among treatment means.

Table–1 Detail of treatments in the experiment

Treatments	Weed management Strategies	Weeding Method	Time of application
1	Weedy Check (Control)	No weeding	--
2	Weed-free crop all the season	Hand pulling	After every 2 days
3	Kasola hoeing	1 Kasola hoeing	After first irrigation.
4	--do--	2 Kasola hoeings	After 1st and 2nd irrigation.
5	--do--	3 Kasola hoeings	After 1st, 2nd and 3rd irrigation.
6	Buctril – M 40EC alone	1.25 L ha^{-1}	60 days after sowing
7	2, 4-D ester alone	1.25 L ha^{-1}	--do--
8	2, 4-D ester + Puma Super-75EW	1.25 + 1 L ha^{-1}	--do--
9	Buctril M 40EC + Puma Super-75EW	1.25 + 1 L ha^{-1}	--do--

RESULTS AND DISCUSSION

Weed infestation in wheat is a serious problem causing considerable reduction in wheat yield. Herbicides and hand weeding are commonly used to limit weed population. The results of the study as affected by different treatments are presented as under:

Fresh weed biomass (g m^{-2})

Major broad leaved weeds in the field were Convolvulus arvensis (field bind weed), *Chenopodium album* (common lambsquarters), *Medicago denticulata* (common medic), *Melilotus indica* (indian sweet clover), *Rumex dentatus* (prickly dock) and *Anagallis arvensis* (pimpernel). Among grasses, *Avena fatua* (wild oats) and *Phalaris minor* (canary grass) were dominant in the experimental area. Data on the fresh weed biomass (g m^{-2}) of wheat are given in Table–2. The results indicated significant differences for the said parameter. Weedy control plots gave the highest biomass of fresh weeds (69.49 g). Among various herbicides, Buctril-M40 EC treated plot had (8.10 g) of fresh weed biomass higher than 6.6 g of weed free all the season. These findings were in conformity with those of Awan et al (1990), Shahid (1994) and Tunio *et al.*, 2004, who reported that herbicides and hand weeding significantly reduced weed density and weed biomass m^{-2}

Dry weed biomass (g m^{-2})

Data on dry weed biomass indicated that dry weed biomass was markedly affected by different weed management treatments. The highest dry weed biomass (10.56 g ha^{-1}) was recorded in weedy check plot, whereas the lowest dry weed biomass

(0.62 g m^{-2}) was observed in (weed free plot for all season). Among herbicides, maximum dry weed biomass (3.72 g m^{-2}) was recorded in (2,4-D + Puma Super 75EW treated plot), while least dry weed biomass (1.89 g m^{-2}) was produced by Buctril-M treated plot. Among kasola hoeings, three hoeings gave lowest dry weed biomass (1.49 g m^{-2}) [Table-2].

Plant height (cm)

Data on plant height at maturity (Table-2) revealed that plant height was significantly affected by different herbicides application and hand weedings. The maximum plant height was recorded in weedy control plot (99.06 cm), followed by weed free the entire season plot (96.79 cm), three hoeings (96.6 cm) and Buctril-M treated plot (96.49 cm). The minimum plant height was produced by 2,4-D+Puma Super treated plot (85.35 cm). Among various herbicides, maximum plant height (96.49 cm) was produced by Buctril-M 40 EC. Kasola hoed plots remained at par with each other.

Number of tillers (m^{-2})

The data on the number of tillers m ^{2} (Table-2) indicated that all herbicides and weedings with kasola caused more tillers than control. Weed free for full season plot had maximum number of tillers m^{-2} (504.66), while the minimum tillers (389.66) were observed in weedy control plot. Among herbicidal treatments, Buctril-M 40EC + Puma Super 75EW treated plot has maximum number of tiller m^{-2} (454.33). While kasola hoed plots remained at par with each other. These results are similar to Veleva (1982) who reported increased tillering with the application of herbicides.

Spike length (cm)

The results on spike length (cm) of wheat indicated that all herbicides and kasola weedings produced higher spike length than weedy control plot. Maximum spike length (11.477 cm) was recorded in weed free plot all the season. The minimum spike length (9.120 cm) was found in (weedy control plot). Among various herbicides, the mixture of Buctril-M40EC + Puma Super 75EW gave maximum spike length (11.477 cm). In case of kasola hoeings, the maximum spike length was recorded in single hoed plots (11.08 cm). These findings are in accordance with Jalis and Noor (1980).

Number of spikelets spike^{-1}

The data on number of spikelets per spike indicated that minimum numbers of spikelets per spike were obtained in weedy control plot (15.94) was significantly different from other treatments. The maximum numbers of spikelets per spike (17.57) were recorded in weed free plot all the season, followed by one hand weeding and Buctril-M + Puma Super treated plot with 17.10 and 17.01 spikelets per spike, respectively (Table-2). The results were in conformity with the findings of Khan et al (1999).

Number of grains spike^{-1}

Number of grains spike^{-1} is an important yield component. Its data are given in Table–2. Maximum number of grains (58.87) were recorded in Buctril-M + Puma Super treated plot closely followed by 2, 4-D + Puma Super treated plot (58.81) and weed free crop all the season with 58.23 and grains per spike^{-1}, respectively. The minimum grains per spike were found in weedy control plot (51.45). Among various herbicides, the combination of Buctril-M 40EC + Puma Super 75EW produced highest number of grains per spike^{-1} (58.87). Among kasola hoeings three hoeings produced highest number of grains per spike (57.92). Shahid (1994) and Khan *et al.*, (1999) also reported similar results.

Grain yield (t ha^{-1})

Grain yield data are given in Table-2. The statistical analysis and comparison of treatment means showed that all the treatments caused significantly higher grain yield than weedy check. The maximum grain yield of (7.08 t ha^{-1}) was produced by weed free plot while the minimum grain yield (2.59 t ha^{-1}) was recorded in weedy control plot. Among various herbicides, the plots treated with the combination of Buctril-M40EC and Puma Super 75EW produced maximum grain yield (5.60 t ha^{-1}). In Kasola hoed plots, 3 hoeings gave maximum grain yield (5.21 t ha^{-1}). These findings are similar to Awan *et al.*, (1990) and Tunio *et al.*, 2004.

Table – 2. Effect of integrated weed management on the yield and yield components of wheat

Treatments	Fresh weed biomass (g m^{-2})	Dry weed biomass (g m^{-2})	Plant height (cm)	No. of tillers (m^{-2})	Spike length (cm)	No. of spikelets per spike	No. of grains per spike	Grain yield (t ha^{-1})
Weedy Check (Control)	69.493a	10.56a	99.067a	389.667f	9.12e	15.94f	51.45e	2.593f
Weed-free whole season	6.610d	0.62f	96.790a	504.667a	11.48a	17.57a	58.23ab	7.080a
1 Kasola hoeing	15.003c	2.84c	94.623abc	451.667d	11.08b	17.10b	55.17d	4.633e
2 Kasola hoeings	13.950c	2.51cd	95.580ab	471.333b	9.72d	16.79cd	55.38d	4.490c
3 Kasola hoeings	8.820d	1.49e	96.600a	467.333bc	10.40c	16.82cd	57.92b	5.213c
Buctril M 40EC	8.103d	1.89de	96.490a	469.667b	10.36c	16.78cd	56.72c	4.890d
2, 4-D Liquid	13.933c	2.71c	88.683cd	431.000e	9.63d	16.36e	55.78d	4.633e
2, 4-D + Puma Super-75EW	19.937b	3.72b	85.353d	449.000d	10.38c	16.65d	58.81a	5.307c
Buctril M 40EC + Puma Super-75EW	12.427c	2.31cd	89.377b-d	454.333cd	11.06b	17.01bc	58.87a	5.600b

* Means followed by different letters are significantly different at 5% level of probability.

REFERENCES CITED

Ahmad, S.Z., A. Cheema, R.M. Iqbal and F.M. Kundi. 1991. Study of different weedicides for the control of broad-leaved weeds in wheat. Sarhad J. Agri., 7(1): 1-9.

Anonymous. 1996. Agricultural Statistics of Pakistan, Government of Pakistan, Ministry of Food and Agriculture and Cooperative, Food and Agricultural Division (Planning unit), Islamabad.

Awan, I. U., M. Iqbal and H. K. Ahmad. 1990. Screening of different herbicides for the control of weeds in wheat crop. Gomal Univ. J. of Res. 10(2):77-83.

Duncan, D.B. 1955. Multiple Range and Multiple F-Test. Biometrics 11: 42.

Jalis, A. and M. Noor. 1980. Comparison of cultural and chemical weed control in wheat. Annual Abridged Res. Dep. of Plant Physio. Sec AARI, Faisalabad. PP:17.

Jarwar, A. D., S.D. Tunio. H.I. Majeedano and M. A. Kaisrani. 1999. Efficacy of different weedicides in controlling weeds of wheat. Pak. J. Agric. Agric. Engg, and Vet. Sci. 15 (2): 17-20.

Khan, M.A., M. Zahoor, I. Ahmad, G. Hassan, and M.S.Baloch. 1999. Efficacy of different herbicides for controlling broad leaf weeds in wheat *(Triticum aestivum* L.*)*. Pak. J.Biol. Sci.2(3):732-734.

Pervaiz, K. and M.H. Quazi. 1992. Status of food production in Pakistan. Progr. Farming, 12:5.

Rao, V. S. 1983. Principles of Weed Science. Oxford and IBH Publishing Co. New Delhi. P-487.

Shahid. I. 1994. Screening of different herbicides for controlling weeds in wheat crop M. Sc. Thesis, Faculty of Agric. Gomal Univ. D.I.Khan.

Steel, R.G.D. and J.H. Torrie. 1980. Principles and procedures of Statistics. McGraw. Hill Book Co. Inc. New York.

Tunio, S.D., S.N.Kaka, A.D.Jarwar and M.R.Wagan. 2004. Effect of integrated weed management practices on wheat yield. Pak. J. Agric. Agric. Engg. Vet. Sci. 20 (1):5-10.

Veleva, V. 1982. Effect of herbicides on weeds and yield of winter wheat cultivar Sadovo. Restitelni Resursi, Sadovo, Bulgaria. Weed Absts., 32(10): 2347; 1983.