European Journal of Applied Sciences 4 (5): 216-219, 2012
ISSN 2079-2077

DOI: 10.5829/idosi.ejas.2012.4.5.1034

Weed Control Efficiency of Bioherbicides and Their Impact on Grain Yield of Wheat (*Triticum aestivum* L.)

Rahamdad Khan and Muhammad Azim Khan

Department of Weed Science Agricultural University Peshawar, Pakistan

Abstract: Among non-chemical weed management techniques, allelopathy (bioherbicides) is considered as an option for weed suppression. To study the potential of allelopathic plants water extracts as a weed management tool in wheat, a field experiment was conducted during Rabi 2010 at Agricultural University Peshawar, Pakistan. Randomized Complete Block (RCB) design was used with split plot arrangement. There were two main plots (pre and post application) of plant water extracts and eight sub-plots containing different weed control techniques i.e., sorghum extract, sunflower extract, Parthenium extract, Common reed extract, Johnson grass extract, Rice straw extract, herbicide (Logran Extra) and a weedy check. The results showed that pre-emergence application of plant water extracts proved to be superior to their post-emergence application in respect of weed control. Pre-emergence application of *Phragmites australis* and *Helianthus annuus* gave 68 and 65% weed control, respectively. Minimum fresh and dry weed biomass of 188 kg ha^{-1} and 94 kg ha^{-1} respectively was recorded under the pre-emergence application of *Phragmites australis*. Sorghum gave maximum grain yield 5015 kg ha^{-1} in comparison to weedy check that gave only 2700.6 kg ha^{-1}. The instant results suggest that *Phragmites australis* and *Helianthus annuus* could be successfully incorporated in weed management approaches in wheat.

Key words: Bioherbicides · plant extracts · pre-emergence · weed control · wheat

INTRODUCTION

Weeds infestation is a serious problem in wheat crop and uncontrolled weeds can reduce wheat yield by 25-30% in Pakistan [1]. Weed infestation negatively affect the growth of wheat due to competition, allelopathy and by providing habitat for other harmful organisms. An annual loss in wheat is more than 28 billion at the national level and 2 billion in Khyber Pakhtunkhwa [2]. Weed management strategies like herbicide application and manual weeding are effective for weed control but in some cases it seems to be uneconomical because of higher costs and herbicides may also cause pollution [3]. Moreover some weeds, which were earlier susceptible, are now herbicide resistant [4]. Such conditions demanding to develop an alternative approach for weed control. Therefore allelopathy could be a viable approach for sustainable crop production. Allelopathic plant water extracts shows potential results in many studies [5]. The use of allelopathic water extracts is inexpensive and environment gracious, reduction in weed biomass is less than herbicides and manual weeding. Allelopathy may be used as a tool in weed management by applying the residues of allelopathic weeds or crop plants as mulches water extracts in the field [6]. Keeping in view, the importance of weeds, deleterious effects of herbicides and the recognized importance of allelochemicals in weed management, a field experiment was conducted under the agro climatic conditions of Peshawar with the objectives to screen different weeds and crop water extracts for herbicidal potential against weeds of wheat.

MATERIALS AND METHODS

An experiment was carried out at Agricultural University Peshawar, Pakistan during Rabi season 2010. The experiment was laid out in randomized complete block design (RCBD) with split plot arrangement having two main plots and eight sub-plots with three replications. One main plot was sprayed with plant water extracts at pre-emergence stage of wheat and weeds while the other was sprayed at post-emergence stage.

Corresponding Author: Rahamdad Khan, Department of Weed Science Agricultural University Peshawar, Pakistan.

Plants (weed and crop) water extracts and herbicides were assigned to sub-plots. The size of each individual treatment was 1.50 x 3. The extracts of *Sorghum bicolor*, *Helianthus annuus, Parthenium hysterophorus*, *Phragmites australis*, *Sorghum halepense*, *Oryza sativa* and herbicide (Logran Extra 64 WG) were sprayed as pre-emergence and post-emergence application for weed suppression. 110 g of the ground sample were soaked in 1 liter of tape water for 24 hours. Then the mixture of plants powder and water were filtered and were stored in glass bottles for further use. All the data were subjected to analysis of variance (ANOVA) and LSD through MSTATC computer programme as outlined by Steel and Torrie [7].

RESULTS AND DISCUSSION

Weed Density m^{-2}: Statistical analysis of the data showed that there were non-significant differences among all the treatments before the application of weed control techniques, but after the application the analysis of variance revealed significant differences in weed density m^{-2} for different treatments, time of application and their interactions (Fig 1). Results showed that the time of application had greatly affected the weed density m^{-2}. The pre application of the extracts and herbicide showed 61 % control over weed density m^{-2} while the post application of extract and herbicide showed comparatively lesser controlling ability (39 %) over weed density m^{-2}. *Phragmites australis* showed promising results and decreased (68%) weed density m^{-2} when applied at pre application and 51% at post application followed by *Sorgham helepense* and *Oryza sativa* that controlled 63 and 62% weed density m^{-2} at pre application respectively. *Sorghum bicolor* showed the lesser ability (19%) for controlling m^{-2} weed when applied as post application otherwise gave 52% weed control efficacy when applied at pre application. Naseem *et al*. [8] also found better weed control in pre emergence application of sunflower water extract.

Fresh Weed Biomass (kg ha^{-1}): The results showed that the time of application of treatments had non-significant effect on the fresh weed biomass (Table 1). The treatments means showed that minimum fresh weed biomass (219.98 kg ha^{-1}) was recorded in the plots treated with *Phragmites australis,* followed by Logran Extra 64 WG (365.17 kg ha^{-1}). While maximum (885.83 kg ha^{-1}) value for fresh weed biomass was recorded in control plot. In interaction, the lowest (252.0 kg ha^{-1}) value of fresh weed biomass was observed in the combination of *Phragmites australis* x post application and the highest was calculated for the combination *Helianthus annuus* x post application (934.7 kg ha^{-1}). In similar study Razzaq *et al.* [9] stated that weed biomass was significantly influenced by different post emergence herbicides alone and in combination with allelopathic crop water extracts.

Dry Weed Biomass (kg ha^{-1}): Statistical analysis of the data showed that time of application, plant extracts and their interaction had a significant effect on dry weed biomass (Table 2). Means of time of application exhibited that minimum dry weed biomass (207.58 kg ha^{-1}) was recorded in pre application plots and maximum dry weed biomass (246.25 kg ha^{-1}) was recorded in post application (Table 2). Among different plant extracts the minimum dry weed biomass (101.33 kg ha^{-1}) was recorded in *Phragmites australis* treated plots and maximum dry weed biomass (431.83 kg ha^{-1}) was observed in weedy check. Khaliq *et al*. [10] found the same results.

Grain Yield (kg ha^{-1}): The analysis for grain yield showed the non-significant differences for the time of application of the different treatments (Table 3).

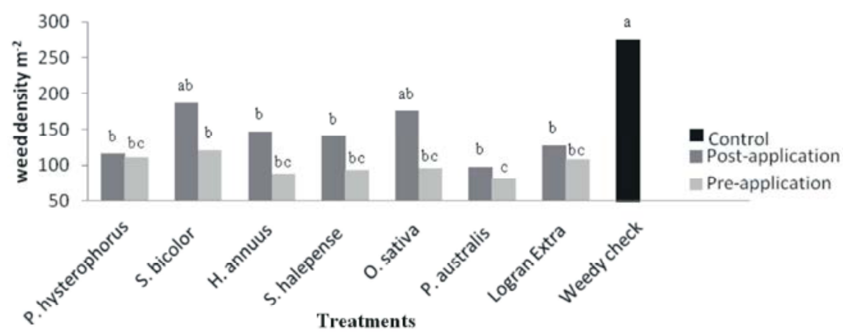

Fig. 1: Comparison between pre and post application of different weed control techniques regarding weed suppression.

Table 1: Impact of weed control techniques on fresh weed biomass (kg ha^{-1}).

	Time of Application		
Treatments	Pre-emergence	Post-emergence	Means
Parthenium hysterophorus L.	324.3 f	623.0 d	473.67 d
Sorghum bicolor (L.) Moench	598.1 d	505.0 e	551.57 c
Helianthus annuus L.	756.7 c	934.7 b	845.67 a
Sorghum halepense (L.) Pers	883.3 b	582.3 d	732.83 b
Oryza sativa L.	323.4 f	588.7 d	456.05 d
Phragmites australis (Cav) Trin	188.0 g	252.0 fg	219.98 f
Logran Extra 64 WG	273.0 f	457.3 e	365.17 e
Weedy check	1032.0 a	739.7 c	885.83 a
Means	547.36	585.33	

Table 2:Impact of weed control techniques on dry weed biomass (kg ha^{-1}).

	Time of Application		
Treatments	Pre-emergence	Post-emergence	Means
Parthenium hysterophorus L.	109.67 gh	222.00 cd	165.83 de
Sorghum bicolor (L.) Moench	191.33de	184.67 ef	188.00 d
Helianthus annuus L.	246.3 c	419.00 a	332.67 b
Sorghum halepense (L.) Pers	332.33 b	182.33 ef	257.33 c
Oryza sativa L.	141.33 fg	212.33 cde	176.83 de
Phragmites australis (Cav) Trin	94.00 h	108.67 gh	101.33 f
Logran Extra 64 WG	130.67 gh	192.33 de	161.50 e
Weedy check	415.00 a	448.67 a	431.83 a
Means	207.58 b	246.25 a	

Table 3:Impact of weed control techniques on grain yield (kg ha^{-1})

	Time of Application		
Treatments	Pre-emergence	Post-emergence	Means
Parthenium hysterophorus L.	5246.9	4321.0	4784.0 ab
Sorghum bicolor (L.) Moench	4629.6	5401.2	5015.4 a
Helianthus annuus L.	3240.7	5246.9	4243.8 ab
Sorghum halepense (L.) Pers	3549.4	4629.6	4089.0 abc
Oryza sativa L.	3086.4	3549.4	3317.9 bc
Phragmites australis (Cav) Trin	4166.7	5401.2	4783.9 ab
Logran Extra 64 WG	3395.1	4166.7	3780.9 abc
Weedy check	2469.1	2932.1	2700.6 c
Means	3723.0	4456.0	

The treatment means showed that maximum grain yield of 5015.4 kg ha^{-1} was recorded in *Sorghum bicolor* treated plots and the lowest yield was recorded in weedy check as 2700.6 kg ha^{-1} (Table 3). The interactions between time of application and weed control techniques gave non-significant differences and maximum grain yield was recorded in respect of both post application x *Phragmites australis* and post application x *Sorghum bicolor* as 5401.2 kg ha^{-1}. Jabran *et al.* (2008) also stated that the increase in grain yield over control was due to control of weeds, moreover probably the allelopathic effects of crop water extracts also promoted the wheat growth which ultimately increases grain yield.

CONCLUSION

Herbicide exposure is at high risk in developing countries like Pakistan where there is no awareness about the safe use of agro-chemicals. Thus bioherbicides (allelochemicals) seems to be environment friendly, cost-effective, easy and acceptable to farming community. The results of the instant study revealed that *Phragmites australia* and *Helianthu annus* are the stronger and potential candidates to be used for weed control in wheat. Therefore this approach should be popularized.

REFERENCES

1. Bansal, G.L., H. Nayyar and Y.S. Bedi, 1992. Allelopathic effect of *Eucalyptus macrorrhyncha* and *E. youmanii* on seedling growth of wheat (*Triticum aestivum*) and radish (*Raphanus sastivus*). Indian J. Agric. Sci, 62(11): 771-772.
2. Hassan, G. and K.B. Marwat, 2001. Integrated weed management in agricultural crops. National Workshop on Technologies for Sustainable Agriculture, NIAB, Faisalabad, Pakistan, pp: 24-26.
3. Cheema, Z.A., A. Khaliq and M. Mubeen, 2003. Response of wheat and winter weeds to foliar application of different plant water extracts of sorghum *(S. bicolor)*. Pak. J. Weed Sci. Res, 9(1-2): 89-97.
4. Ahmad, S., 1996. Presidential Address. 5th Pakistan Weed Sci. Conf. NARC., Islamabad, Pakistan.
5. Cheema, Z.A., A. Khaliq and M. Farooq, 2008. Sorghum allelopathy for weed management in wheat. Allelo. Sustain. Agri and Fores, 3: 255-270.
6. Drost, D.C. and J.D. Doll, 1980. The allelopathic effect of yellow nutsedge *(Cyperus esculentus)* on corn and soybeans. Weed Sci, 28: 229-233.
7. Steel, R.G.D and J.H. Torrie, 1980. Principles and Procedures of Statistics. McGraw Hill Book Co., Inc. New York, pp: 481.
8. Naseem, M., M. Aslam, M. Ansar and M. Azhar, 2009. Allelopathic effects of sunflower water extract on weed control and wheat productivity. Pak. J. Weed Sci. Res, 15(1): 107-116.
9. Razzaq, A, Z.A. Cheema, K. Jabran, M. Farooq, A. Khaliq, G. Haider and S.M.A. Basra, 2010. Weed management in wheat through combination of Allelopathic water extract with reduced doses of herbicides. Pak. J. Weed Sci. Res, 16(3): 247-256.
10. Khaliq, A., Z. Aslam and Z.A. Cheema, 2002. Efficacy of different weeds management strattigies in mungbean (*Vigna radiate* L.). Int. J. Agric. Biol., 4: 237-239.