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COMPETITIVE EFFECTS OF WILD OATS ON WHEAT YIELD AND YIELD COMPONENTS UNDER AGRO-ECOLOGICAL CONDITIONS OF DERA ISMAIL KHAN, PAKISTAN

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ABSTRACT

A field experiment was conducted at Research Farm, Faculty of Agriculture, Gomal University Dera Ismail Khan, Khyber Pakhtunkhwa, Pakistan during winter 2012. The experiment was conducted to determine the effect of wild oats (Aveva fatua L.) densities on yield components of wheat (Triticum eastivum L.). The experiment design used was the randomized complete block design and each of the experimental treatment were replicated three times. A wheat cultivar sahar-2006 was grown at densities of 100, 90, 80, 70, 60, 50, 40, 30, 20 and 10 plants m^{-2} and infested with nine wild oats densities i.e. 10, 20, 30, 40, 50, 60, 70, 80, and 90 plants m^{-2}. A control treatment having the wheat plants monoculture was maintained for comparison. The data were recorded on yield and yield contributing parameters. The results showed the maximum wheat plant height (77.33 cm), number of tillers (256.30 m^{-2}), 1000-grain weight (45 g), biological yield (9.2 ton ha^{-1}), grain yield (4.2 ton ha^{-1}), and harvest index (46.11%) recorded in the control treatment. The minimum wheat plant height (69 cm), number of tillers (100 m^{-2}), 1000-grain weight (35 g), biological yield (3.6 t ha^{-1}), grain yield (1.2 ton ha^{-1}), and harvest index (35.34 %) of wheat were recorded where 90 wild oats plants were present. From the study it could be concluded that wheat yield and yield components were greatly affected by wild oats densities. Judicious control measures for wild oats are recommended to be adopted that can control wild oats in wheat crop to reduce the crop losses due to this noxious weed.

Key words: density, wheat, wild oats, yield component.

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INTRODUCTION

Wheat (*Triticum aestivum* L.) belongs to the family Poaceae and is prominent among the whole world's ration crops for animals and humans. Wheat crop occupies the largest cultivated area than any other cereal. Wheat is grown as annual rabi crop and is self-pollinated long day plant. The wheat is a king of cereal crops and cultivated on about more than 41% area in Pakistan. During the year 2012, total production of wheat was 25.21 m tons from 8.9 m ha area with the mediocrity products of 2833 kg ha^{-1}. Wheat production in Khyber Pakhtunkhwa during the same year was 1.155 m t from 0.724 m ha area with the mediocrity products of 1595 kg ha^{-1} (MINFAL, 2011). In the country wheat products are less than other major wheat producing countries of the world. The reason for the low yield involves certain factors i.e. imbalance nutrients availability, intensive cultivation, lack of high yielding genotypes, low organic matter and infestation etc. Pakistan is dependent on agricultural products therefore fluctuation in production of major crops like wheat adversely affects the overall economy of the country. In Pakistan, wheat crop is the key ration in cereal crops which plays an important role in agriculture and its income importance and wheat is also the vigorous food that is the reason for its being an important crop (Montazeri *et al*., 2005).

Weeds are the main problem pointed out by scientists and researchers throughout the world that accounts for about 30% losses or complete losses in wheat crop. Among the weeds that are compatible with wheat, the most noxious one is wild oat. Their noxious behavior has been proved by the previous research report (Shehzad *et al*., 2012a). In the weeds, wild oat is the most harmful weed throughout the world which germinates earlier than wheat and the roots are deeper and more extensive that utilize higher amount of nitrogen. In this way, wild oat becomes a very serious challenge for wheat productivity. Wild oat densities of 40 and 160 plants m^{-2} reduced the wheat productivity up to 16% and 46%, respectively (Mohammadi *et al*., 2012). There are important practices before sowing of agriculture crops. In these practices i.e. planting on suitable time, seedbed preparation and irrigations but controlling weeds in the wheat field is most important one, because of the weeds having the more competitive behavior with wheat crops as compared to other cereals and weeding should be done within a proper time so that wheat crops may not suffer from resources shortage (Aziz *et al*., 2009).

The aim of the experiment was to conduct an investigation for facilitating the scientists and farmers in decision making process of wild oat management and the present study was carryout to determine the effects of wild oat densities on wheat crop under agro-ecological conditions of D.I. Khan with the objectives to determine the yield losses due to wild oat in wheat and to evaluate the threshold levels of wild oat in wheat fields.

MATERIALS AND METHODS

The experiment was conducted at Agronomic Research Area, Faculry of Agriculture, Gomal University, Dera Ismail Khan during winter 2012. The soil of experimental site was clayey, there were 27.8% slit, 11.4% sand and 60.8 % clay. Before sowing, seedbed was properly prepared by ploughing field twice at appropriate condition of soil moisture followed by leveling and harrowing. All the agricultural activities and practices were kept uniform for all the plots of experiment. The applications of nitrogen and phosphors fertilizers in the form of urea and di-ammonium phosphate (DAP) were applied at the rate of 120-90-60 NPK kg ha^{-1}. Half of nitrogen and full dose of phosphorus and potassium were applied at sowing and the remaining nitrogen was applied at the second irrigation. There were three replications, and the design was randomized complete block (RCB) with the plot size of 3.6 m^{-2} in experiment. There were 10 treatments of various densities of wild oats sown with wheat crop. The wild oats were sown in plot of wheat crop having 6 rows of 2m length being 30cm apart. The treatments used in the experiment were (T_1) wheat density of 100 with wild oats density (0), (T_2) 90 wheat plants sown with 10 wild oats plants, (T_3) 80 wheat plants sown with 20 wild oats plants, (T_4) 70 wheat plants sown with 30 wild oats plants, (T_5) 60 wheat plants sown with 40 wild oats plants, (T_6) 50 wheat plants sown with 50 wild oats plants, (T_7) 40 wheat plants sown with 60 wild oat plants, (T_8) 30 wheat plants sown with 70 wild oats plants, (T_9) 20 wheat plants sown with 80 wild oats plants, and (T_{10}) 10 wheat plants sown with 90 wild oats plants.

Data collection

The parameters were studied as plant height (cm) that was measured from the soil surface to the up growing point. Each treatment contained six rows; the four central rows were harvested. For numbers of tillers m^{-2}, the number of tillers was counted m^{-2} area divided by row to row distance multiplied by number of rows multiplied by row length. For the 1000-grain weight, the grains were randomly counted and selected from each treatment and then weighted by spring balance. For biological yield, the harvested sample weight was divided by the harvested area in m^{-2} and multiplied by 10000 for conversion into yield ha^{-1}, similar was the method for grain yield. For

harvest index in percentage, the grain yield was divided by biological yield, and multiplied by 100.

Statistical analysis

Data recorded individually for each parameter were subjected to the ANOVA (at P = 0.05) statistical technique by using MSTATC computer software. The significant differences were separated by using Least Significant Difference test (Steel and Torrie, 1997).

RESULTS AND DISCUSSION

Plant height (cm)

The crop height is actually the result of the nutrients used by crop and addition of the factors of environment. Plant height of wheat as affected by various densities of wild oatsis existed in Table-1. The data manifested after statistical analysis that wild oat densities have significantly affected wheat crop height (cm). The analyzed data exhibited that the maximum wheat crop height was (77.33 cm) where as wild oat was 0 m^{-2}, which was statistically compared with 10, 20 and 30 wild oats area m^{-2}. While the minimum wheat crop height was 69.0 cm in treatments of 90 wild oat plants m^{-2}, which was statistically at par with the 80, 60, 50 and 40 *Avena fatua* m^{-2} and gradually the wheat plant height was decrease with the increase in wild oat density. The result was in agreement with Aziz *et al*. (2009).

Number of tillers m^{-2}

The number of tillers m^{-2} presented in Table-1 revealed that there was significant difference between different treatments. The maximum amount of wheat tillers (256.30) was recorded in wild oat plants of zero m^{-2}, while the minimum number of wheat tillers was 100 m^{-2} whereas the wild oat plant density was 90 m^{-2} which was at par with 80 and 70 wild oat plants m^{-2}. The results were in conformity with Gonzalez *et al*. (2001).

1000-grain weight (g)

1000-grain weight of wheat as impressed by various combinations of wild oat plants is given in Table-1. It showed that wheat planted alone recorded significantly higher 1000-grain weight (45.00g) at par with 90, 80 and 70 wheat plants m^{-2} as compared to the remaining treatments while the lower 1000-grain weights (35.00g, 37.67g and 37.33g) of wheat were observed in the wild oats densities of 90, 80 and 70, respectively. The results are in conformity with those of Hussain *et al*. (2012).

Table-1. Plant height (cm), number of tillers m^{-2} and 1000-grain weight (g) of wheat plants as affected by various densities of wild oats

Densities of wild oats with wheat	Plant height (cm)	Number of tillers m^{-2}	1000-grain weight (g)
T_1 wheat 100 + wild oat 0	77.33a	256.30a	45.00a
T_2 wheat 90 + wild oat 10	76.33ab	225.00b	42.67b
T_3 wheat 80 + wild oat 20	76.67ab	218.30b	42.33b
T_4 wheat 70 + wild oat 30	76.33ab	183.00c	40.00cd
T_5 wheat 60 + wild oat 40	72.67b-d	170.00d	40.67c
T_6 wheat 50 + wild oat 50	72.00cd	165.00d	39.00de
T_7 wheat 40 + wild oat 60	74.00a-c	161.00d	39.67cd
T_8wheat 30 + wild oat 70	71.33cd	122.00e	37.33f
T_9 wheat 20 + wild oat 80	71.67cd	111.00f	37.67ef
T_{10} wheat + wild oat 90	69.00d	100.00g	35.00g
LSD	4.046	9.713	1.376
Coefficient of Variation	5.84	6.04	3.67

Biological yield (t ha^{-1})

It is indicated from the data presented in Table-2 that wild oats densities significantly affected the biological yield. The maximum biological yield of 9.157 t ha^{-1} of wheat crop was recorded in zero wild oat plants m^{-2} and simultaneously biological yield decreased with increase in wild oat densities from 10 to 40; while minimum biological yield of wheat (3.557 t ha^{-1}) was recorded with the wild oats sown at a number of 90 plants m^{-2} which was statistically at par with the densities of 80 wild oat plants m^{-2}. The results are in agreement with Montazeri *et al*. (2005).

Grain yield (t ha^{-1})

The statistical analysis data revealed that wild oats densities showed grain yield is statistical significant differences. The data is presented in Table-2 showed that the maximum grain yield of wheat crops was 4.2 t ha^{-1} recorded in treatments of zero wild oat plants m^{-2}. Gradually grain yield decreased with increase in wild oat density from 10 to 40 plants m^{-2} while minimum grain yield of 1.17 t ha^{-1} of wheat was recorded in 90 wild oat plant density which was statistically at par with 80 wild oats m^{-2} (1.247 t ha^{-1}). The result is in agreement with Montazeri *et al*. (2012).

Harvest index (%):

The data pertaining to various densities of wild oats for harvest index are given in Table-2. It is indicated that in all the treatments there were significant differences among harvest indices of the treatments. The maximum harvest index (46.11%) was recorded in wheat plots with zero wild oats m^{-2} and the harvest index decreased with increase in wild oat density; with the minimum harvest index of

35.34% recorded in plots of 90 wild oat plants. The results are in conformity with those of Chowdhry *et al*. (1991).

Table-2. Biological yield (tonha^{-1}), grain yield (ton ha^{-1}) and harvest index % of wheat as effectedby various densities of *avenafatua* L.

Densities of wild oats with wheat	Biological yield (t ha^{-1})	Grain yield (t ha^{-1})	Harvest index (%)
T_1 wheat 100 + wild oat 0	9.157a	4.200a	46.11a
T_2 wheat 90 + wild oat 10	8.237b	3.633b	44.08ab
T_3 wheat 80 + wild oat 20	8.183b	3.600b	44.11ab
T_4 wheat 70 + wild oat 30	6.907c	2.967c	43.45ab
T_5 wheat 60 + wild oat 40	6.583c	2.833c	43.08ab
T_6 wheat 50 + wild oat 50	5.730d	2.260d	39.24a-c
T_7 wheat 40 + wild oat 60	5.503d	2.133d	40.35a-c
T_8wheat 30 + wild oat 70	4.433e	1.657e	37.85bc
T_9 wheat 20 + wild oat 80	3.557f	1.247ef	36.90bc
T_{10} wheat + wild oat 90	3.600f	1.170f	35.34c
LSD	0.4864	0.4564	7.547
Coefficient of Variation	8.37	18.89	19.57

CONCLUSION

It is concluded from the analyzed data that almost all parameters of wheat recorded significant differences using various densities of wild oat. Yield and yield components were maximum in wheat monoculture plots while yield and yield components were minimum in treatments of 10 wheat plants with 90 wild oat plants m^{-2}. It is recommended that wild oats be controlled effectively for further experiments to obtain higher production of wheat crop under agro-climatic conditions of Dera Ismail Khan, Pakistan.

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