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INTER SPECIFIC COMPETITION OF TALL AND DWARF WHEAT CULTIVARS WITH WILD OATS *(Avena fatua* L.)

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ABSTRACT

To study the interference of wild oats with various cultivars of wheat, an experiment was conducted at Agricultural Research Farm Malkandher, NWFP Agricultural University, Peshawar Pakistan during 2004-05 using Randomized Complete Block Design, having four replications The experiment comprised of 6 wheat cultivars viz. Khattakwal, Ghaznavi-98, Fakhar-e-sarhad, Dera-91, Saleem-2000 and Pirsabak-85. In all of the cultivars, the wild oat was sown at a constant density of 9 plants m^{-2} The data were recorded on tillers m^{-2}, plant height (cm), spike m^{-2}, spike length (cm), spikelets $spike^{-1}$, grains spike, 1000 grain weight (g), tillers of wild oat, seed/wild oat tiller, biological yield (kg ha^{-1}), and grain yield (kg ha^{-1}). Most of the parameters were significantly affected by wild oats infestation Maximum number of tillers m^{-2}(273.5), spikes m^{-2} (272.3), spikelets $spike^{-1}$(18.00), spike length (9.32) and grain yield 2638 kg ha^{-1} were produced by Saleem-2000. Plant height (119 3) and biological yield (7137 kg ha $^{-1}$) were the maximum in Khattakwal cultivar. Saleem-2000 and Ghaznavi 98 suppressed the growth of wild oats the most exhibiting that the plant height was not the only indicator of aggressivity among the wheat cultivars

Key Word: Wheat cultivars, wild oats, grain yield, competitive ability.

INTRODUCTION

Wheat belongs to the family Poaceae, tribe Hordae and genus *Triticum*. Normally wheat plant produces 2-3 tillers under typical eroded field conditions but individual plant on fertile soil with ample space and space and nutrient may produce as many as 100 tillers (Martin et al. 1976). Wheat is the most important crop produced in Pakistan It is a staple and indispensable food article of the people of Pakistan and occupies more land than any other crop. In Pakistan, wheat productivity per unit area is still very low than its potential yield, although Pakistan is among the top ten producers of wheat in the world. The average yield of wheat in Pakistan does not go beyond 30-35% of its optimum potential (Sarwar and Nawaz, 1985)

Among other factors responsible for low yield, weeds reduce growth, yield and quality of the produce. The importance of weed infestation has been recognized since long time and control of weed is a major component of management in the crop production system (Young *et al.*, 1994). Weeds cause one of the biggest problems in agriculture. They use the soil fertility, available moisture, nutrients and compete for space and sunlight with the crop plans which results in yield reduction. Weeds also deteriorate the quality of farm produce and hence reduce the market value. Pervaiz and Quazi

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(1999) reported that 17.25% losses are caused to wheat by weeds. The losses on annual basis in monetary terms in wheat amount to more than 28 billion at national level and 2 billion in NWFP (Hassan and Marwat, 2001).

The plant height in height has been evaluated to have a negative correlation with weeds; hence the taller cultivars of wheat were considered as more competitive with Italian ryegrass and wild oats as compared to the dwarfed cultivars (Appleby, *et al.* 1976; Pawar *et al.*, 1998).

Sodhi and Dhaliwal (1998) reported a field experiment conducted during Rabi (winter) 1996-97 to study the effect of crop density and cultivars on competitive interaction between wheat and wild oats. Combination of two wheat cultivars, three sowing rates(100,150 and 200 kg ha^{-1}) and two row spacing (15.0 cm and 22.5 cm) formed the main plots and with and without wild oats formed the sub-plots. Cultivar which was taller had a competitive advantage over cv. HD2392; it had higher dry matter accumulation, higher LAI and more light interception than dwarfer cultivar. The taller cultivar exerted more canopy pressure over wild oats and reduced its dry mater production by 14%. Earlier Balyan *et al.* (1991) quantified 17 to 62% losses in winter wheat yield due to wild oats competition depending on cultivars. Wheat height and early dry matter accumulation determined the competitive ability of the cultivars with wild oats. Studies of Mennan and Isik (2004) exhibit the variable competitive ability of wheat cultivars to *Avena* densities.

Gonzalez-Ponce and Santin (2001) in a field experiment grew wheat (*Triticum aestivum* L.) the infesting weed wild oat (*Avena sterilis* ssp. *sterilis* L.) in semi-arid conditions. In comparison with the semi-dwarf cultivar (Anza), the tall wheat cultivar (Pané 247) is competitively superior to *A. sterilis*. This competitive superiority was related more to the height of the wheat plant and supposed competition for light than to tiller production. The competition affected the production of *A. sterilis* panicles and spikelets. In addition, the height and competitive ability of the tall wheat cultivar increased more than that of the semi-dwarf cultivar with increasing nitrogen doses.

Planting more competitive wheat cultivars has been suggested as culture practice to suppress weed growth (Ogg and Seefeldt, 1999). Researchers have shown that differences in wheat competitiveness of crop cultivars are the rule rather than exception (Callaway, 1992).

In view of the importance of the problem for nutrition of human being and national economy, this experiment is designed with these objectives 1) to quantify the losses caused by *Avena fatua* in wheat and 2) to evaluate the interaction of wheat cultivars and *Avena fatua*.

METHODS AND MATERIALS

Field study was conducted at Malkandher Research Farm, NWFP Agricultural University Peshawar during Rabi 2004-05. The experiment was laid out in Randomized completed block (RCB) design with four replications. Six cultivars of wheat viz Khattakwal, Ghaznavi-98, Fakhr-e-sarhad, Dera-91, Saleem-2000 and Pirsabak-85 were used with a plot size of 5 x 2.5 m^2 and the row to row distance was maintained at 25 cm. In all of the treatments the wild oats was sown at a constant density i.e. 9 plants m^{-2}. Standard agronomic practices were followed during the course of experiment. The data were recorded on the number of tillers $plant^{-1}$, plant height at maturity (cm), number of

spikes m^{-2} number of spikelets $spike^{-1}$ number of grains $spike^{-1}$, 1000-grain weight (g) ,wheat Spike length (cm) ,wild oat tillers $plant^{-1}$ number of wild oat seed $plant^{-1}$ wheat biological yield (kg ha^{-1}) and grain yield (kg ha^{-1}). The data recorded for each parameter were individually subjected to the ANOVA technique by using MSTATC computer software and the significant means were separated by using Fisher's Protected LSD test (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Number of tillers m^{-2}

Statistical analysis of the data revealed that wild oat population had significant effect on number of tiller m^{-2} of various cultivars. Data pertaining to number of tillers m^{-2} are presented in Figure-1. Comparison of treatment means reflects that maximum numbers of tillers m^{-2} (273.5) were recorded in Saleem 2000, while minimum number of tillers m^{-2} (190.8) were counted in Khattakwal. All other cultivars possessed the comparable number of tillers m^{-2} (Figure-1). The least number of tillers m^{-2} in Khattakwal could be attributed to the competition with wild oats or its genetic characteristic of the cultivar under reference.

Plant height at maturity (cm)

The analysis of the data showed that wild oat population had significant effect on plant height of different wheat cultivars. Data regarding the plant height are given in Figure-1. The maximum plant height (119.3) was recorded in Khattakwal variety, while the minimum (82.5) was observed in Pirsabak-85. The possible reason for differential plant height may be due to the genetic characteristic of cultivars or due to differential competitive ability with wild oats. These findings are in agreement with the work of Baghestani *et al.* (2006) who determined that plant height is not the only parameter influencing the competitive ability of wheat cultivars. However, the findings of Appleby *et al.* (1976) determined the plant height as determinant for competitive ability in wheat.

Number of spikes m^{-2}

Number of spikes m^{-2} of various cultivars was significantly affected by wild oat infestation. The data in Figure-1 showed that maximum number of spikes m^{-2} (272.3) were recorded in Saleem 2000, while the minimum number of spikes m^{-2} (190.0) were observed in Khattakwal. All the other cultivars produced almost the same number of spikes m^{-2}. Goldberg (1990) stated that a competitive crop can be defined as either a crop that maintain its yield well in the presence of weeds (tolerance to weed pressure) or as one that is able to reduce weed growth significantly (weed suppressive ability). As a result Saleem 2000 may be considered as both a weed tolerant and weed suppressive crop.

Spike length (cm)

The effect of wild oat population on spike length of various wheat cultivars are shown in Figure-1. Maximum spike length (9.32) was recorded in Saleem 2000. All other cultivars possessed almost the same spike length (Figure-1). Jordan (1993) stated that a competitive cultivar should maintain its yield when competing with weeds (low weed interference) and at the same time, reduce the growth and seed production of the weeds which it competing.

Number of spikelets $spike^{-1}$

The analysis of the data shoed that wild oat population had significant effect on spikelets $spike^{-1}$ of various wheat cultivars. The data in Figure-1 exhibited that the highest (18.0) spikelets $spike^{-1}$ was obtained from Saleem 2000. It was however, statistically

similar with Ghaznavi-98 (16.75). The lowest (14.0) spikelets spike^{-1} were obtained from Khattakwal. Similar results have been reported by Callaway, 1992.

Number of grains spike^{-1}

Analysis of variance of the data revealed that number of grains spike^{-1} of different cultivars were significantly affected by wild oat infestation. Minimum grains spike^{-1} (28.42) were recorded in Khattakwal, while all other wheat cultivars possessed the same number of grains spike^{-1} (Figure-1). Previous studies reveal that the most competitive wheat cultivar (Turkey) had the smallest percent yield reduction when competing against downy brome (*Bromus tectorum* L.) and reduced the biomass of the downy brome more than other less competitive cultivars (Challaiah *et al.*, 1986)

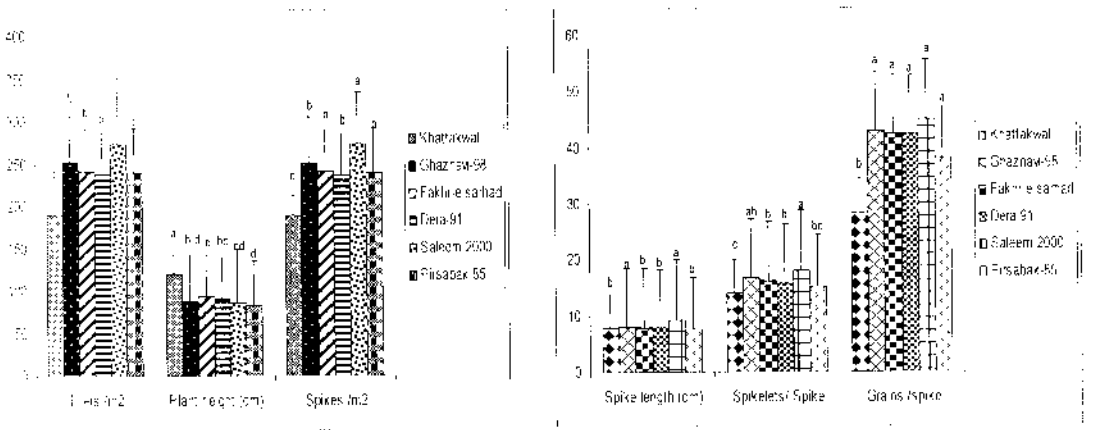

Figure-1. Interference of wild oat with wheat cultivars for Tillers m^{-2}, plant height and spikes m^{-2} (Left) and spike length, spikelets spike^{-1} and grains spik^{e-1}(Right).

1000-grain weight (g)

Statistical analysis of the data showed that wild oat population had significant effect on 1000 grain weight of wheat cultivars. The data regarding 1000 grain weight are given in Figure-2. The highest (31.23g) grain weight was obtained from Saleem 2000. It was statistically at par with Fakhr-e-sarhad (28.50g), Ghaznavi-98 (28.15g) and Dera-91 (27.8g). The perusal of data in Table-2 further revealed that the lowest 1000 grain weight (24.83g) was noted in Khattakwal cultivar, which was statistically equal with Pirsabak-85 (25.30g).

Wild oat tillers plant^{-1}

Analysis of variance of the data exhibited that various wheat cultivars had significant effect on wild oat tillers plant^{-1}. Figure-2 depicts the effect of different cultivars on number of wild oat tillers plant^{-1}. The data indicated that minimum number of tillers/ plant in wild oats were recorded where Saleem 2000 cultivar was sown. All other plots possessed almost same number of tillers/ wild oat plant. These findings are in agreement with the work of Mennan and Isik (2004) who concluded that competitive ability of wheat cultivars with wild oats and black grass was not dependent on the height of the cultivars. Whereas the studies of Balyon *et al.* (1991) conclude otherwise. They concluded the height to be an index of the competitive ability of wheat cultivars. The studies of Gonzalez-Ponce and Santin (2001) also conclude the height as the determinant of

competitive index in wheat. The height played a significant role in light interception. This result is in line with those reported by Jordan (1993).

No. of wild oat Seeds tiller^{-1}

Shattering is very common in wild oats. Hence, statistical analysis of the data showed that different wheat cultivars had non- significant effect on seeds wild oat tiller^{1} All of the wild oat tillers produced similar number of seeds tiller^{-1} (Figure-2)

Biological yield (kg ha^{-1})

Statistical analysis of data a revealed that wild oat population had significant effect on biological yield of different wheat cultivars. Data regarding biological yield of different cultivars are given in Figure-2. The data indicated that maximum biological yield of 7137 kg ha^{-1} was produced by Khattakwal, while the other cultivars produced comparable biological yield with each other. These results have similarity with those reported by Appleby *et al.* 1976).

Grain yield (kg ha^{-1})

Analysis of variance of the data exhibited that grain yield of various cultivars was significantly affected by wild oat infestation. Figure-2 shows the effect of wild oat on grain yield of various cultivars. The data indicated that maximum grain yield 2638 kg ha^{-1} was produced by Saleem 2000. The minimum grain yield 1483 kg ha^{-1} and 2024 kg ha^{-1} was produced by Khattawal and Prisabak-85, respectively. The possible reason for maximum grain yield in Saleem 2000 cultivars is due to large number of tiller produced by Saleem 2000 and its highly competitive ability with wild oat. These findings are in line with the work of Mennan and Isik (2004).

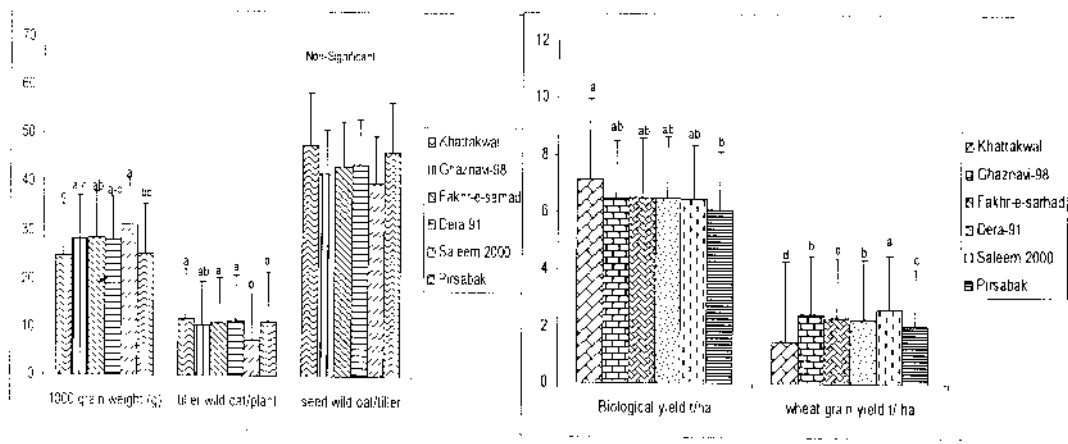

Figure-2. Interference of wild oat with wheat cultivars for 1000-grain weight, wild oats tillers plant^{-1} and wild oats seed tiller^{-1} (Left) and biological and grain yield of wheat (Right).

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