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INTERACTION OF WILD OAT *(AVENA FATUA* L.) WITH DIVERGENT WHEAT CULTIVARS

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Abstract

To elucidate the competitive ability of various cultivars of wheat with wild oats, field trials were established at NWFP Agricultural University, Peshawar, Pakistan for two crop seasons i.e. 2004-05 and 2005-06 using Randomized Complete Block (RCB) design having four replications. Each experiment comprised of 6 wheat cultivars viz., Khattakwal, Ghaznavi-98, Fakhar-e-Sarhad, Dera-91, Saleem-2000 and Pirsabak-85. In all the treatments, the wild oats was sown at a constant density of 10 plants m^{-2}. Data were recorded on tillers m^{-2}, plant height (cm), number of spikes m^{-2}, leaf area $tiller^{-1}$ (cm^2), $spikelets\ spike^{-1}$, spike length (cm), $grains\ spike^{-1}$, 1000 grain weight (g), biological yield (kg ha^{-1}) and grain yield (kg ha^{-1}). Most of the parameters were significantly affected by wild oats infestation. During both the years maximum number of tillers m^{-2}, leaf area (cm^2), yield and yield components were produced by Saleem-2000, plant height (cm) and biological yield were however the highest in Khattakwal cultivar. During both years Saleem-2000 and Ghaznavi-98 suppressed the growth of wild oats to the most, exhibiting that plant height was not the only criterion for aggressivity among the wheat cultivars. Whereas, tillers m^{-2} emerged as the most important parameter indicative of competitive ability with wild oats, consequently increasing grain yield of wheat.

Introduction

Wheat being the staple food, occupies more than 41% of the cropped area of Pakistan. Yield loss due to weed competition in wheat field has been reported to be about 21% (Montazeri *et al*., 2005).Over the last three decades wheat production in many parts of the world have relied heavily on herbicide as the primary method of weed management (Montazeri *et al*., 2005).But environmental safety concerns, increasing occurrence of herbicide resistance in weed species, and the need to reduce input costs have caused a growing awareness that intensive use of chemical weed control does not fit well in sustainable agriculture systems. If a crop cultivar can tolerate weeds, it may reduce the need for synthetic herbicide (Gealy *et al*., 2003).Weed competition with wheat could be either of broadleaf or grasses. Wild oats (*Avena fatua*), littleseed cannary grass (*Phalaris minor*) and annual ryegrass (*Lolium* spp.) are the grassy weeds, which have now become a threat to the nutritional requirement of mankind.

Wild oats has increased tremendously in the rainfed and irrigated areas of Pakistan like elsewhere in the world. It is an annual grass and is difficult to eradicate because the seeds shatter before crop maturation that get deposited in the soil and lie dormant for one to many years. They germinate when they are turned up near the surface. It is of cosmopolitan distribution in cereals where annual precipitation is between 375 to 750 mm.

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Due to competition between wild oats and wheat for nutrients, water, space and light, the wheat plant is weakened resulting in reduced yields. Yield losses from weed competition can be reduced if crop competitiveness is improved by methods such as fertilizer placement, a varied crop rotation and by using varieties with strong competitiveness. Thus, identification of those trait which enhance crop competitive ability against weeds, play an important role in successful weed management of weed in crops (Olesen *et el*.2004). One of the significant goals of integrated weed management systems is using crop varieties with high competitiveness against weeds to cope with these problems (Baghestani *et al*., 2005).

Keeping in view the aggressiveness of wild oats in wheat crop throughout the country, experiments were designed with the following objectives:

1. To predict the effect of wild oats on wheat cultivars.
2. To evaluate the interaction of wild oats with divergent wheat cultivars.
3. To predict the response of wild oats to the competitive ability of wheat cultivars.

Materials and Methods

Field trails were conducted at Malkandher Research Farm, NWFP Agricultural University, Peshawar, Pakistan during 2004-2005 and 2005-2006 to evaluate 6 wheat cultivars responses to wild oat suppression. The experiment was laid out in Randomized Complete Block (RCB) design with four replications. The size of each plot was 5x1.5 m². The cultivars tested were Khattakwal, Ghaznavi-98, Fakhr-e-Sarhad, Dera-91, Saleem-2000 and Pirsabak-85.

In all of the wheat cultivars the wild oats was sown at constant density of 10 plants m^{-2}. All other weeds were removed manually throughout the wheat growing season. Data were recorded on number of tillers m^{-2}, plant height at maturity (cm), number of spikes m^{-2}, leaf area (cm^2) $tiller^1$ of wheat, biological yield (kg ha^{-1}) and grain yield (kg ha^{-1}). The data for the individual parameters were subjected to analysis of variance technique and means were separated by LSD test (Steel & Torrie, 1980).

Results and Discussion

Number of tillers m^{-2}: Statistical analysis of the data revealed that wild oats population had significant effect on number of tillers m^{-2} of various wheat cultivars. Data pertaining to number of tillers m^{-2} are presented in Figs. 1 and 2 for 1st and 2nd year respectively. Comparison of treatment means reflects that maximum number of tillers m^{-2} (273.5) in the first year were recorded in Saleem-2000, while minimum number of tillers m^{-2} (190.8) were counted in Khattakwal. Similarly in second year maximum number of tillers m^{-2} (277.5) was recorded in Saleem-2000, while minimum number of tillers m^{-2} (194.0) was produced by Khattakwal. All other cultivars possessed the comparable number of tillers m^{-2} (Fig. 1). The least number of tillers m^{-2} in Khattakwal could be attributed to its poor competitive ability with wild oats. Maximum number of tillers m^{-2} was produced by Saleem-2000. It might be due to its higher competitive ability with wild oats. Similar observations were communicated previously by Lemerle *et al*., (2001).

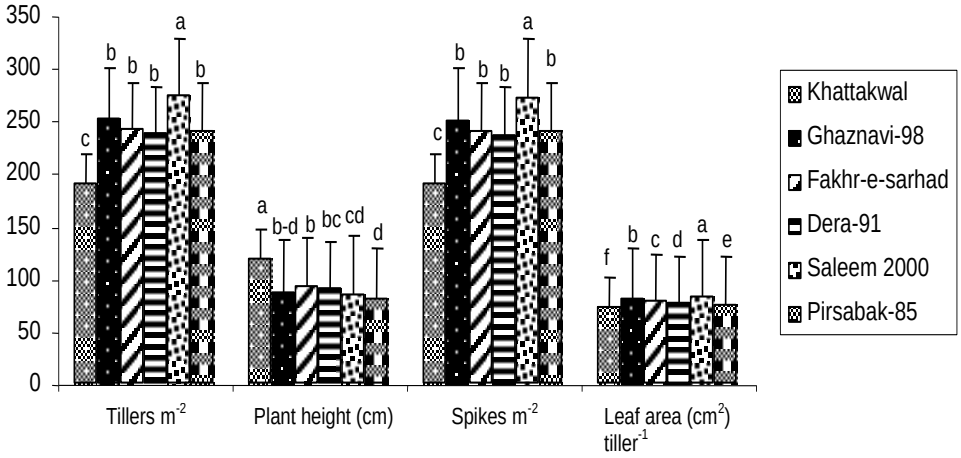

Fig. 1. Competitive ability of wheat cultivars with wild oats for tillers m^{-2}, Plant height (cm), spikes m^{-2} and leaf area cm^2) $tiller^{-1}$ during 2004-05.

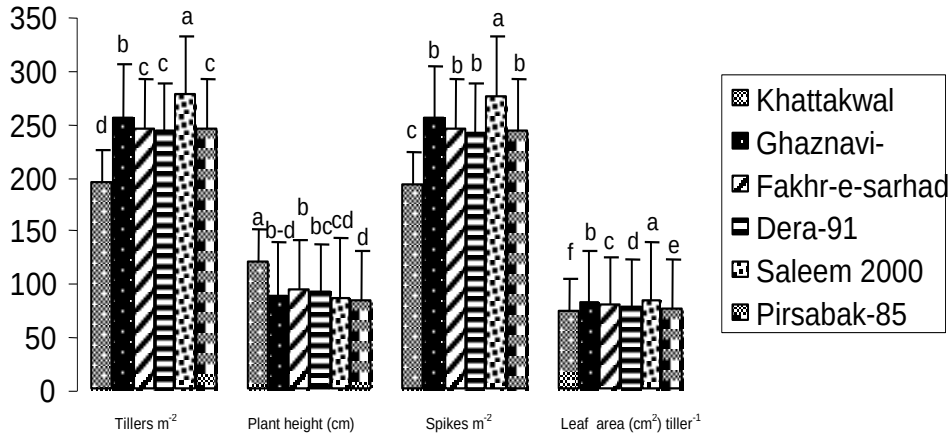

Fig. 2. Competitive ability of wheat cultivars with wild oats for tillers m^{-2}, Plant height (cm), spikes m^{-2} and leaf area (cm^2) $tiller^{-1}$ during 2005-06.

Plant height at maturity (cm): The analysis of the data showed that wild oats densities had significant effect on plant height of different wheat cultivars. In the 1st year (Fig. 1) maximum plant height (119.3 cm) was recorded in Khattakwal variety, while the minimum (82.5 cm) was observed in Pirsabak-85. Likewise in the 2nd yea r maximum plant height (120.5 cm) was recorded in Khattakwal variety, while the minimum (83.75 cm) was noted in Pirsabak-85 (Fig. 2). The possible reason for differential plant height may be due to the genetic characteristic of cultivars. These findings are in line with the work of Cousens *et al*., (2003), who are of the view that height of wheat had no influence over its competitive superiority.

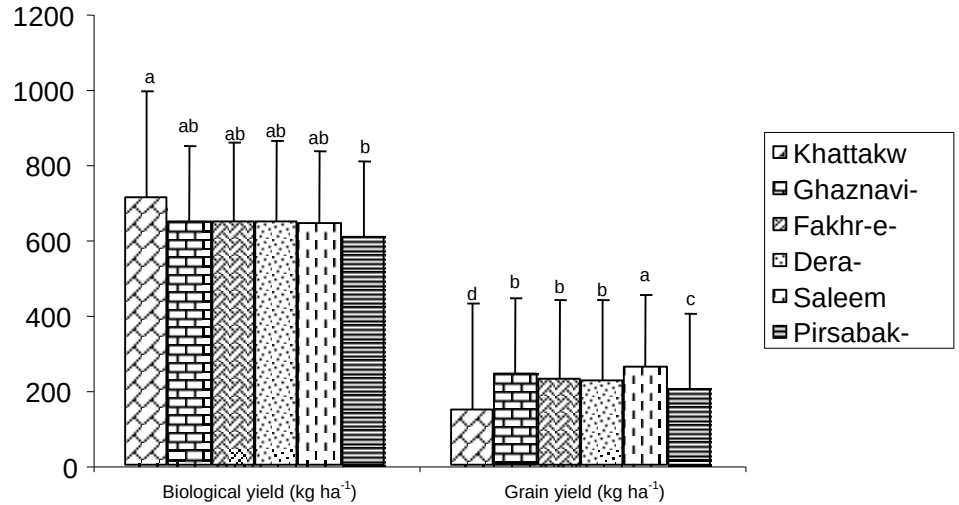

Fig. 3. Competitive ability of wheat cultivars with wild oats for biological yield (kg ha^{-1}) and grain yield (kg ha^{-1}) during 2004-05.

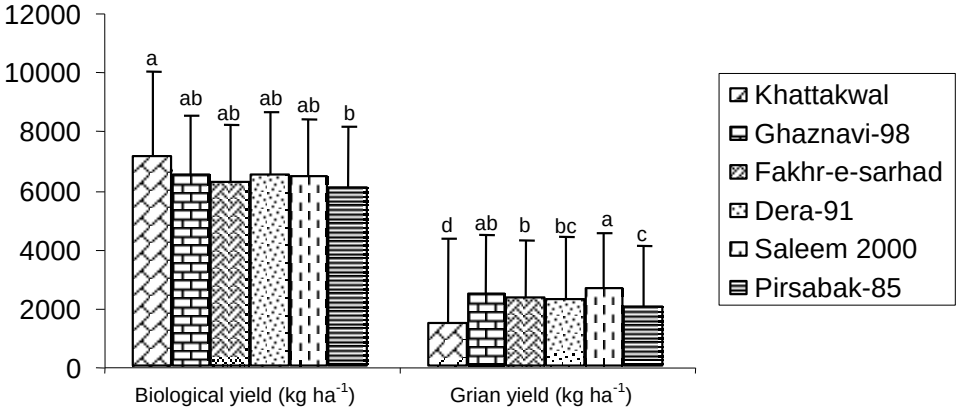

Fig. 4. Competitive ability of wheat cultivars with wild oats for biological yield (kg ha^{-1}) and grain yield (kg ha^{-1}) during 2005-06.

Number of spikes m^{-2}: Number of spikes m^{-2} of various cultivars was significantly affected by wild oats infestation. The Fig. 1 showed that in 1st year maximum number of spikes m^{-2} (272.3) were produced by Saleem-2000, while the minimum number of spikes m^{-2} (190.0) were observed in Khattakwal. Also in the 2nd year (Fig. 2) maximum number of spikes m^{-2} (276.3) were recorded in Saleem-2000. Minimum number of spikes m^{-2} (193.5) was noted in Khattakwal. All other cultivars produced almost the same number of spikes m^{-2}. Goldberg (1990) stated that a competitive crop can be defined either as 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.

Leaf area (cm^2) $tiller^{-1}$: The analysis of the data showed that wild oats population had significant effect on Leaf area $tiller^{-1}$of various wheat cultivars. First year data (Fig. 1) exhibited the highest (83.15 cm^2) leaf area $tiller^{-1}$ that was recorded in Saleem-2000. The lowest (73.15 cm^2) Leaf area $tiller^{-1}$ was noted in Khattakwal. In the second year (Fig. 2), the highest (84.07 cm^2) leaf area $tiller^{-1}$ was observed in Saleem-2000. The lowest (74.07 cm^2) leaf area $tiller^{-1}$ was noted in Khattakwal. Results show that Saleem-2000 had more potential for investing in photosynthetic tissue as compared to Khattakwal. In fact, greater leaf area in Saleem-2000 has increased the crop resource capture at the expense of weeds, in particular by reducing light quantity and quality beneath the crop canopy and thereby reducing weed growth. Thus, as in many other studies, it is concluded that greater leaf area is one of the most important contributing factors increasing crop competitiveness against weeds. Similar result has been reported by Wang *et al*., (2004).

Biological yield (kg ha^{-1}): Statistical analysis of data revealed that wild oats population had significant effect on biological yield of different wheat cultivars. Data regarding biological yield of different cultivars are given in Fig.3 and Fig. 4 for the consecutive years. Data indicated that maximum biological yield of 7137 and 7162 kg ha^{-1} was produced by Khattakwal in 1st and 2nd year respectively, while the other cultivars produced comparable biological yield with each other. These results are supported by the findings of Khan *et al*., (2008a).

Grain yield (kg ha^{-1}): Analysis of variance of the data exhibited that grain yield of various cultivars was significantly affected by wild oats infestation. The data in Fig.3 (1st year) shows the effect of wild oats on grain yield of various cultivars. The data indicated that maximum grain yield of 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 Khattakwal. The data in Fig.4 (2nd year) also indicated that maximum grain yield of 2663 kg ha^{-1} was observed in Saleem-2000 while minimum grain yield of 1508 kg ha^{-1} was produced by Khattakwal. The possible reason for maximum grain yield in Saleem-2000 cultivar is due to its larger number of tillers and consequently its high competitive ability with wild oats. These findings are in line with the work of Khan *et al*., (2008b), who concluded that wild oat infestation reduced the grain yield of wheat.

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