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INTERACTION OF WILD OATS (*AVENA FATUA* L.) WITH SPRING WHEAT (*TRITICUM AESTIVUM* L.) SEEDED AT DIFFERENT RATES

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Abstract

Wild oat is noxious weed of wheat crop. In order to study the effect of spring wheat seeding rates on wild oats competition, experiments were conducted at Malkandher Research Farm, NWFP Agricultural University Peshawar during Rabi 2004-05. The experiment was laid out in Randomized Complete Block (RCB) design with split plot arrangement. Four seed rates: 100, 130,160 and 190 kg ha^{-1} were assigned to main plots, while wild oats densities 0, 5, 10, 15, 20, 25 and 30 seed m^{-2} were in sub-plots. Data were recorded on number of spikes m^{-2}, grains $spike^{-1}$, 1000 grain weight (g), and grain yield (kg ha^{-1}). Statistical analysis of the data showed that most of the parameters were statistically significantly affected by wild oats densities and crop seed rates. The highest number of spikes m^{-2} (281.9), grains $spike^{-1}$ (50.0) and 1000-grain weight (30.26) were recorded in wheat monocultures (0 wild oat density plot). A crop seed rate of 160 kg ha^{-1} had significantly more spikes m^{-2} (283.4), greater spike length (8.58 cm), greater 1000-grain weight (30.87 g) and greater grain yield. Thus, a seed rate of 160 kg ha^{-1} is recommended for suppression of wild oats population in wheat. The regression analysis also predicted lowest competition of wild oats in wheat seeded at 160 kg ha^{-1}.

Introduction

Weeds are one of the major problems in crop production. They compete with crop plants for light, moisture, nutrients and space. *Avena fatua* has increased tremendously in the rain fed and irrigated areas of the country as well as elsewhere in the world. It is an annual grass and is difficult to eradicate because the seeds shatter before crop maturation and many of the seeds are plowed into the soil, where they lie dormant for one to many years, and germinate when they are turned up near the surface. Walia *et al.,* (1998) concluded that wheat yield decreased exponentially when wild oats populations varied from 0 to 100 plants m^{-2} and the loss approached 50-60% at 100 plants of wild oats m^{-2}. High seeding rates of wheat also reduced the impacts of weed on crops in a number of previous studies (Carlson & Hill 1985, Barton *et al,*. 1992, Justice *et al.*,1994, Lajos *et al.,* 2000; Hassan, 2006, Khan *et al*., 2007). This experiment was designed with the objectives 1) to quantify the losses caused by A. *fatua* in wheat and 2) to predict the effect of *A. fatua* on wheat and *vice versa* at various densities.

Materials and methods

A field experiment was conducted at Malkandher Research Farm, NWFP Agricultural University, Peshawar, Pakistan during the Rabi season 2004-2005, using variety Ghaznavi-98, to quantify the wheat-wild oat interactions. The experiment was laid out in Randomized Complete Block (RCB) design with split plot arrangement, having four replications. In each replication, there were four main plots. Each main plot

consisted of seven sub-plots. The wheat seed rates: 100, 130, 160 and 190 kg ha^{-1} were kept in main plots while the wild oat densities 0, 5, 10, 15, 20, 25 and 30 plants m^{-2} were assigned to the subplots. The size of subplot was 5 x 1.5 m². Row to row distance was kept at 25 cm. Wheat seeds were sown with the help of a hand hoe. Seeds of wild oat were planted manually, the same day as the wheat. All other weeds were removed manually throughout the wheat season. Data were recorded on number of spikes m^{-2}, spike length (cm), grains $spike^{-1}$, 1000 grain weight (g), and grain yield (kg ha^{-1}). The data recorded for each trait were individually subjected to ANOVA using MSTATC Computer Software and means were separated by using Fisher's Protected LSD test. Regression analysis was also run on grain yield data (Steel & Torrie, 1980).

Results and Discussion

Number of spikes m^{-2}: Analysis of the data revealed that wild oat densities and seed rates had significant effects on the number of spikes m^{-2}, while their interaction showed non-significant variation. The maximum number of spikes m^{-2} was recorded in control plots, while the minimum number were recorded in 30 wild oats m^{-2}. Among the seed rates, the highest number of spikes m^{-2} were with 160 kg ha^{-1}, while the lowest were recorded in 190 kg ha^{-1} (Table 1). Weed competition in wheat reduces yield due to decrease in spike numbers (Bell & Nalewaja, 1969; Cudney *et al.,* 1989) and spike length (Burrows & Olson, 1955).

Grains $spike^{-1}$: Statistical analysis of the data showed that wild oat densities had a significant effect on grains $spike^{-1}$ while crop seed rates and their interaction were not significant. Maximum grains $spike^{-1}$ was recorded in control plots (0 wild oat density m^{-2}). The minimum number of grains was recorded with 30 wild oats m^{-2}. Among the seed rates, the highest number of grains $spike^{-1}$ was recorded with 160 kg ha^{-1}, which was closely followed by other seed rates (Table 1). Weed competition in wheat reduces through decreases in spike numbers (Bell & Nalewaja, 1969; Cudney *et al.,* 1989) and number of grains per spike (Wilson & Peters 1982).

1000-grain weight (g): Wild oat densities and wheat seed rates had a significant impact on the 1000-grain weight of wheat. The interaction of seed rates with wild oat densities was not significant. The maximum 1000 grain weights were recorded in control plot. The minimum 1000 grain weight was measured with 30 wild oat seed m^{-2}. Among the seed rates, the maximum 1000 grain weight was recorded with 160 kg ha^{-1} while the minimum 1000 grain weight was recorded with 190 kg ha^{-1} (Table 2). These findings are in agreement with the work of Justice *et al.,* (1994), Tessema *et al.,* (1996 a,b) and Barton *et al.,* (1992), who concluded the strong impact of crop seeding rates in wild oats management.

Grain yield (kg ha^{-1}): Wild oat densities and crop seed rates significantly influenced grain yield. Their interaction was not significant. The maximum grain yield was recorded with 0 wild oats seed m^{-2} while the minimum grain yield was recorded with 30 wild oats m^{-2} (Table 2). Wheat yield loss due to wild oats competition, involving weed densities as a variable, has been extensively reported in the world literature (Dew, 1972; Tessema *et al.* 1996 a,b) and various models have been reviewed by Cousens (1985). The regression of yield on wild oats densities across the different seeding rates showed that grain yields

and weed density had a strong negative association (Fig. 1). The slopes of regression lines across different seed rates depict the least slope in 160 kg ha^{-1} seed rate.

Table 1. Effect of wheat and wild oats density on number of spike m^{-2} and grain $spike^{-1}$ of wheat.

Oats density (m^{-2})	Seed rates (kg ha^{-1})				Density means
	100	130	160	190	
	No. of spikes m^{-2}				
0	275.25	276.75	288.50	272.50	281.6ab
5	325.75	275.25	286.25	273.00	278.3abc
10	273.50	274.50	284.50	270.75	290.1a
15	271.25	270.25	282.00	268.00	275.8bc
20	270.00	265.75	278.50	266.50	272.9bc
25	265.50	266.50	272.50	263.00	270.2bc
30	278.50	277.25	294.75	275.75	266.9c
Seed rates means	280.0ab[1]	272.4b	283.4a	269.9b	
	Grain $Spike^{-1}$				
0	50.63	50.58	50.60	48.20	50.00a
5	46.93	47.08	47.00	46.65	46.95b
10	46.80	46.66	46.53	46.53	46.74bc
15	46.63	46.70	46.35	45.30	46.54bc
20	46.18	46.28	45.90	45.88	46.17bc
25	45.78	45.88	45.45	45.53	45.77cd
30	45.28	45.35	45.45	43.98	45.01d
Seed rates means	46.89	46.93	46.99	46.15	

Mean followed by the same letter within each category do not differ significantly by LSD test at $p \leq 0.05$.

Table 2. Effect of wheat and wild oats density on 1000-grain weight (g) and grain yield (kg ha^{-1}) of wheat

Oats density (m^{-2})	Seed rates (kg ha^{-1})				Density means
	100	130	160	190	
	1000 grain weight (g)				
0	29.98	30.080	31.30	29.70	30.26b
5	29.85	29.98	31.20	29.60	30.26b
10	29.75	29.85	30.93	29.53	30.16b
15	29.58	29.65	30.58	29.33	30.01b
20	29.48	29.60	30.05	29.18	29.78b
25	29.30	29.43	30.00	28.90	29.57b
30	32.15	32.20	32.05	31.23	29.41b
Seed rates means	30.01b[1]	30.11b	30.87a	29.63b	
	Grain yield (kg ha^{-1})				
0	2888.25	2913.25	3121.0	2827.50	2938a
5	2209.25	2371.25	2767.75	2245.0	2398b
10	2202.0	2326.75	2765.0	2232.75	2382b
15	2196.75	2312.0	2757.50	2200.25	2367bc
20	2192.0	2264.50	2741.50	2103.0	2325bc
25	2189.75	2253.50	2737.25	2063.50	2311bc
30	2182.50	2228.25	2696.25	2022.50	2283c
Seed rates means	2294c	2381b	2798a	2242c	

Mean followed by the same letter within each category do not differ significantly by LSD test at $p \leq 0.05$.

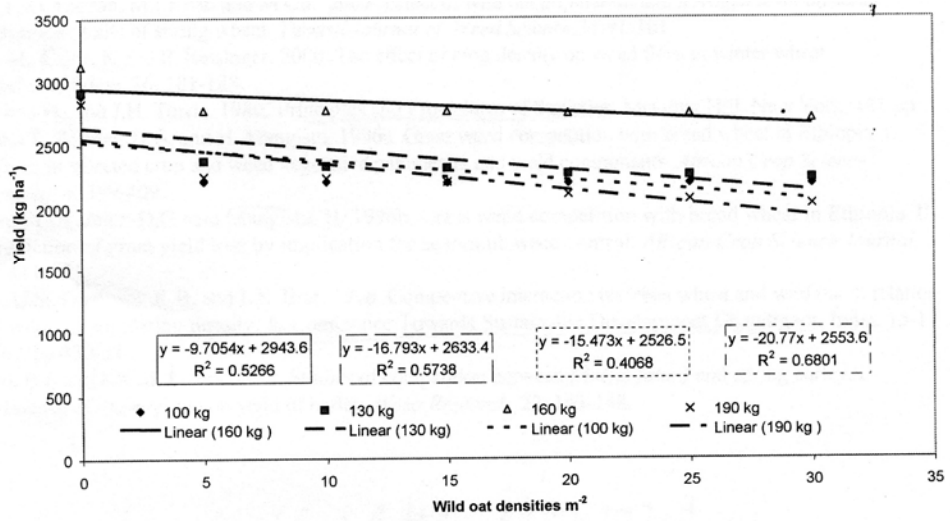

Fig. 1. Wheat grain yield vs. wild oat densities at different seeding rates (kg ha^{-1}).

From the data it is concluded that wild oats densities strongly influence wheat yield. About 49 plants inflict 30% yield loss under 100 kg as compared to 91 wild oats plants m^{-2} under 160 kg ha^{-1}. Thus, it is recommended that wheat may be seeded at 160 kg ha^{-1} for an effective competition with wild oats.

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