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POSSIBILITY OF WEED SUPPRESSION BY SEEDING RATE AND CULTIVARS OF WHEAT

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Abstract

An experiment was conducted to study the effect of seeding rate and wheat cultivars on weeds and grain yield of wheat. The experiment was carried out at Agricultural Research Farm, NWFP Agricultural University Peshawar, Pakistan during November, 2006 in Randomized Complete Block Design with split plot arrangement having three replications. Wheat seeding rates (100, 120, 140 kg ha^{-1}) were assigned to main plots while wheat cultivars i.e. Pirsabak–2005, Pirsabak-2004, Khyber–87, Suleman–96 and Saleem–2000 were assigned to sub plots. Statistical analysis of the data showed that higher seeding rate rather than cultivars was effective in decreasing the weed density. While in case of grain yield and yield related characters, higher seeding rate (140 kg ha^{-1}) as well as two cultivars (Pirsabak-2005 and Suleman-96) proved effective by decreasing the weed density and increasing the grain yield. Thus using higher seeding rate and competitive cultivars are recommended for getting higher yield of wheat.

Key words: Wheat**,** cultivars, weeds, seed rate, yield.

INTRODUCTION

Wheat being a staple food of the people in Pakistan plays a vital role in the economy of our country. Recently the food prices have increased and the wheat production in our country is below the requirement of the population. Therefore, increasing the total area under wheat or increasing the yield per unit area is necessary to feed the highly populated country. Weed infestation is a major constraint in wheat production lowering the yield and quality of the produce. Several researchers have reported the importance of seeding rate for increasing grain yield and weed suppression. Major reasons for low yield of the crop are improper seed rate and limited use of herbicides in our country.

Sodhi and Dhaliwal (1998) claimed that taller cultivars had competitive advantage over weeds. Increasing the seeding rate of wheat decreased the dry weight of weed (Khan and Marwat 2006). In

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crop-weed competition studies, Yenish and Young (2004) observed that taller wheat reduced mature jointed goat grass biomass by 46% as compared with short wheat 16%. Olsen *et al*. (2005) observed that increased crop density reduced weed biomass. In a similar study it was observed that weed emergence was not affected by seeding rate or planting arrangement while weed biomass decreased with increased seeding rate (Nathan *et al.* 2009). Due to disadvantages of chemical and physical weed control cultural weed control seems economical, feasible and sustainable for the farming community of Pakistan. However, using cultural method in an integrated weed management approach can greatly affect the weed control program. In Pakistan, chemical weed control is becoming a popular concept of weed control while cultural weed control approaches are neglected.

Thus there is a dire need to improve the cultural method of weed control and popularize this concept among the farmers. As weeds related professional competency in the agricultural extension officers of our country is low (Khan *et al.* 2007), therefore, well trained agricultural extension agents and trained farmers can avoid the losses due to weeds in wheat and all other crops. Keeping in view the importance of weeds in wheat, this experiment was conducted to evaluate the performance of different wheat cultivars against weeds, to examine the weed suppression by different wheat cultivars, to study the impact of different wheat seed rates on weed pressure and to decipher the impact of wheat seeding rates and cultivars on grain yield.

MATERIALS AND METHODS

An experiment was conducted to study the effect of wheat cultivars and seed rate on weeds and yield of wheat. Field trial was carried out at Agricultural Research Farm, NWFP Agricultural University Peshawar Pakistan. Wheat varieties were planted during November 2006 in a Randomized Complete Block (RCB) Design with split plot arrangement, having three replications. The net plot size was kept 5x1.5 m^2. Wheat seeding rates (100, 120 and 140 kg ha^{-1}) were assigned to main plots while wheat cultivars i.e. Pirsabak-2005, Pirsabak-2004, Khyber-87, Suleman-96 and Saleem-2000 were assigned to sub plots. Recommended doses of nitrogen (Urea) and phosphorus (DAP) were applied in the ratio of 135:50. Wheat seeds were planted using hand hoe, with 5 rows per treatment each 30 cm apart. The crop was irrigated as per requirement and standard agronomic practices were followed throughout the crop season. During the course of the studies weed density (m^{-2}) 30 and 60 days after sowing (DAS), fresh weed biomass (m^{-2}) 100 days after sowing (DAS), leaf area plant^{-1} (cm^{2}) ,1000-grain weight (g) and grain yield of wheat (kg ha^{-1}) were recorded.

The data collected was statistically analyzed using MSTATC software program. The purpose of ANOVA was to determine the significant effect of treatments on weeds and wheat. The LSD test at a 5% probability level was applied when ANOVA showed a significant difference between treatments (Steel and Torrie 1980).

RESULTS AND DISCUSSION

Weed Density (m^{-2}) at 30 DAS

Statistical analysis of the data indicated that seed rate significantly affected the weed density of 30 days after sowing (DAS) while different cultivars and their interaction were non significant (Table-1). Data indicated that maximum weed density (6.47 m^{-2}) was recorded in seed rate of 100 kg ha^{-1} which was statistically at par with seed rate of 120 kg ha^{-1}. Minimum weed density (3.27 m^{-2}) was recorded in seed rate of 140 kg ha^{-1}. The result showed that with increasing seed rate of wheat, the weed seed density at 30 DAS was decreased. Thus using higher seed rate greatly suppressed the weeds. Means of the cultivars indicated that there was no significant effect of wheat cultivars on weed density at 30 days after sowing. Maximum weed density (5.67 m^{-2}) was recorded in Pirsabak-2005 and minimum (4.67 m^{-2}) was recorded in Suleman 96 and Khyber-2005. Interaction of seed rate and cultivars indicated that weed density (m^{-2}) 30 DAS were non-significantly affected, However higher weed density was recorded in Pirsabak-85 at seeding rate 100 kg ha^{-1} and lower weed density (2.33 m^{-2}) was recorded in Saleem-2000 at seeding rate of 100 and 140 kg ha^{-1}. Similar results were reported by Gharineh *et al*. (2003) they reported that maximum number of weeds (105.6 m^{-2}) was be observed in the treatment with low seed density (200 seeds m^{-2}) was planted. The instant results suggested that the cultivars as well as seeding rate of crops both can greatly suppress the weeds and thus could be used as a cultural weed control method in an integrated weed management strategy.

Table-1. Weed density m^{-2} at 30 days after sowing as affected by seed rate and different cultivars of wheat.

Varieties	Seed Rate (Kg ha^{-1})			Means
	100	120	140	
Pirsabak-2005	7.00	6.66	6.66	5.67
Pirsabak-2004	5.33	6.66	6.00	5.22
Khyber- 87	5.33	5.00	4.66	4.67
Suleman- 96	6.00	4.00	3.66	4.67
Saleem -2000	2.33	4.00	2.33	5.00
Means	6.47 a	5.40 a	3.27 b	

$LSD_{0.50}$ for seed rate = 1.454

Weed Density (m^{-2}) at 60 DAS

Statistical analysis of the data depicted that seeding rate of wheat significantly affected the weed density at 60 days after sowing while different cultivars and their interaction were non significant (Table-2). Data indicated that maximum weed density (27.80 m^{-2}) was recorded in seed rate of 100 kg ha^{-1} that was statistically at par with seed rate of 120 kg ha^{-1} and minimum weed density (23.33 m^{-2}) was recorded in seed rate of 140 kg^{-1}. The instant results suggested that higher seeding rate could be used by the farming community to suppress the weeds. Using higher seeding rate not only prevents the sunlight to reach the underneath weeds but also help the crop compete with the weeds. There was a non-significant effect of wheat cultivars on weed density. Maximum density (27.88 m^{-2}) was recorded in Pirsabak-2005 and minimum was recorded in Saleem-2000 (24.55 m^{-2}). Interaction of seed rate and cultivars indicated that weed density (m^{-2}) at 60 DAS was none significantly affected. Maximum weed density (31.66 m^{-2}) was recorded in Pirsabak-2005 at seeding rate of 100 kg ha^{-1}, while lower weeds density (21.66 m^{-2}) was recorded in Saleem-2000 at seeding rate of 120 kg ha^{-1}. The present studies show that higher seeding rate can suppress the weeds at the initial stages of the crop plants. In similar studies, Khan *et al.* (2002) reported that the crop should be weed free during the initial crop growth stage in order to avoid the yield losses.

Table-2. Weed density m^{-2} at 60 days after sowing as affected by seed rates and different cultivars of wheat.

Varieties	Seed Rate (Kg ha^{-1})			Means
	100	120	140	
Pirsabak-2005	31.66	27.33	29.00	27.88
Pirsabak-2004	24.66	26.33	27.66	25.22
Khyber- 87	26.33	24.66	26.33	25.66
Suleman -96	25.66	24.33	22.00	25.44
Saleem- 2000	23.33	25.33	21.66	24.55
Means	27.80 a	26.13 a	23.33 b	

$LSD_{0.50}$ for seed rate = 2.655

Fresh weed biomass (g m^{-2}) at 100 days after sowing

Weed biomass is an important indicator that affects the magnitude of crop yield reduction. Data presented in Table-3 showed that seeding rates and different cultivars of wheat had a non significant effect on fresh weed biomass while their interaction was significant ($P<0.05$). Means of seed rates indicated that higher fresh biomass (675 g m^{-2}) was recorded at seed rate of 100 kg^{-1}

and lower fresh biomass (553.4 g m^{-2}) was recorded in medium seed rate (120 kg ha^{-1}). Among the cultivars, maximum fresh biomass (884.2 g m^{-2}) was recorded in Khyber-87 and minimum (463.9 g m^{-2}) was recorded in Pirsabak-2004. Interaction of seed rates and cultivars maximum fresh weed biomass (674.86 g m^{-2}) in Suleman-96 at a seeding rate of 100 kg ha^{-1} while minimum weed density (377.36 g m^{-2}) in Pirsabak-2005 at seed rate of 140 kg ha^{-1}. Analogous results were reported by Jena and Behera (1998). They reported that weed density and biomass at harvest were higher with wider row spacing, lower wheat sowing rate and higher fertilizer rates.

Table-3. Fresh weed biomass (g m^{-2}) at 100 days after sowing as affected by seed rates and different cultivars of wheat.

Varieties	Seed Rate (kg ha^{-1})			Means
	100	120	140	
Pirsabak-2005	620.33 abc	420.96 f	377.36 f	576.3
Pirsabak-2004	525.6 de	433.96 ef	531.63 cd	463.9
Khyber 87	343.70 f	639.63 ab	577.16 bcd	884.2
Suleman 96	674.86 a	577.00 bcd	627.10 abc	578.1
Saleem 2000	636.00 abc	631.56 ab	404.53 cd	504.4
Means	675	553.4	575.2	

$LSD_{0.50}$ for seed rate x cultivars = 93.38

Leaf area tiller^{-1} (cm^2)

Leaf, the food manufacturing factory of plants plays a vital role in regulating the plant growth and development. Thus any increase/decrease in leaf area can be a major sign in yield prediction of wheat. Statistical analysis of the data indicated that seeding rate non-significantly affected the leaf area tiller^{-1}, while the leaf area in different cultivars was significant (Table-4). Means of seed rates indicated that maximum leaf area tiller^{-1} (32.74 cm^2) was recorded in seed rate of 100 kg ha^{-1}. Means of the cultivars indicated that there was significant effect of wheat cultivars on leaf area tiller^{-1}. Maximum leaf area of (38.67 cm^2) was recorded in Suleman-96 which was statistically at par with Pirsabak-2005 and minimum leaf area tiller^{-1} (27.23 cm^2) was recorded in Saleem-2000. Interaction of seeding rates and cultivars indicated that leaf area tiller^{-1} was non significantly affected ($P>0.05$). Maximum leaf area tiller^{-1} was recorded in Pirsabak-2005 and Pirsabak-2004 at seed rate of 100 kg^{-1} whereas minimum leaf area tiller^{-1} was recorded at seeding rate of 100 kg ha^{-1} in saleem-200. All other values were intermediate. Similar results were reported by Chauvel *et al.* (2005). They reported that the lack of nitrogen and higher plant density increased the leaf and tiller appearance rate. Growth and seed production was strongly influenced by the plant density and the increased nitrogen availability at a given density did not modify the values of growth parameters. These results indicated that seeding rate as well as cultivars can be used as a technique in weed control programs.

Table-4. Leaf area tiller^{-1} (cm^{2}) as affected by seed rates and different cultivars of wheat.

Varieties	Seed Rate (Kg ha^{-1})			Means
	100	**120**	**140**	
Pirsabak-2005	39.33	26.66	33.00	38.44 a
Pirsabak-2004	39.33	25.36	38.33	28.67 b
Khyber- 87	26.66	27.33	38.33	28.11 b
Sulema-96	29.66	37.66	32.66	38.67 a
Saleem-2000	24.00	38.33	26.66	27.23 b
Means	32.74	32.07	31.87	

$LSD_{0.50}$ for variety = 3.810

1000-Grain Weight (g)

Statistical analysis of the data indicated that seed rates had non-significant effect on 1000-grain weight while different cultivars had an effect significant (Table-5). Mean data of seeding rates showed that the values of 1000 grain weight were in the range of 39.08 to 39.61. Means of the cultivars indicated that there was a significant ($P<0.05$) effect of wheat cultivars on 1000 grain weight. Maximum 1000 seeds weight of (41.80 g) was recorded in Suleman 96, which was statistically at par with Pirsabak-2005 (41.4 g). The values for the said parameter were statistically comparable in all the other cultivars. Interaction of seed rate and cultivars indicated that 1000 grain weight was non-significantly affected. The range of the values recorded was 37.48 to 42.36 g. The instant results suggested that different cultivars produced different 1000-grain weight probably due to inherent capability of the varieties. As there is a continuous improvement in wheat breeding therefore working for more competitive wheat cultivars is suggested to effectively suppress the weeds. Tessema and Tanner (1997) reported that in competition studies, four grassy weeds (*Avena abyssinica, Lolium temulentum, Snowdenia polystachya* and *Phalaris paradoxa)* varied significantly in their effect on 1000-grain weight.

Table-5. 1000-Grain weight (g) as affected by seed rate and different cultivars of wheat.

Varieties	Seed Rate (kg ha^{-1})			Means
	100	120	140	
Pirsabak-2005	40.61	39.03	36.47	41.40 a
Pirsabak-2004	41.75	37.66	39.66	38.80 b
Khyber-87	37.85	37.80	42.36	37.50 b
Suleman-96	37.48	40.96	39.64	41.80 a
Saleem-2000	38.23	41.38	37.52	37.51 b
Means	39.08	39.61	39.55	

$LSD_{0.50}$ for variety = 1.785

Grain Yield (kg ha^{-1})

ANOVA showed that seeding rates had non-significant effect on the grain yield of wheat while different cultivars had significant ($P<0.05$) effect on the grain yield (Table-6). Means of the seeding rates indicated that maximum grain yield (3626.20 kg ha^{-1}) was recorded in seed rate of 140 kg ha^{-1} and minimum grain yield (3578.06 kg ha^{-1}) was recorded in seed rate of 100 kg ha^{-1}. Means of the cultivars presented in Table-6 showed that the effect of cultivars on the grain yield was significant. Higher grain yield (3786.11 kg ha^{-1}) was recorded in Prisabak-2005 which was statistically at par with Suleman-96 (3755.66 kg ha^{-1}) and minimum (3476.55 kg ha^{-1}) was recorded in Khyber-87. However, the values recorded in minimum were statistically at par with Pirsabak-2004 and Saleem-2000. Interaction of seed rates and cultivars indicated that grain yield (kg ha^{-1}) was non-significantly affected. Our results are in line with those reported by Arduini *et al.* (2006) who reported that grain yield was highest with 400 seeds m^{-2} primarily due to the higher number of spikes per unit area, and secondly, to the higher mean kernel weight. Mennan and Zandstra (2005) claimed that higher seeding rate produced higher grain yield and the competitive ability of different cultivars was different.

The common seed rate used in the experimental area is 100-120 kg ha^{-1}, therefore, using higher seeding rate is recommended for getting higher grain yield and suppressing the weeds. In light of the present findings it is concluded that using higher seeding rate (140 kg ha^{-1}) and competitive cultivars in combination with other methods of weed control in an integrated fashion might be proved economical for the farming community of the area studied.

Table-6. Grain yield as affected by seed rate, and different cultivars of wheat.

Varieties	Seed Rate (Kg ha^{-1})			Means
	100	120	140	
Pirsabak-2005	3758.6	3547.33	3434.33	3786.11 a
Pirsabak-2004	3780.33	3469.66	3762.66	3503.77 b
Khyber 87	3463.33	3514.33	3729.66	3476.55 b
Suleman 96	3423.66	3837.00	3500.00	3755.66a
Saleem 2000	3481.00	3757.00	3555.33	3482.88 b
Means	3598.06	3578.73	3626.20	

$LSD_{0.50}$ for variety = 0.3138

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