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Research Article

The Effect of Different Levels of Nitrogen and Potash Fertilizers on Some Important Agronomic Traits in Rainfed Wheat Variety (Azar-2)

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ABSTRACT

This experiment was conducted in the crop year 2007-2008 at the research farm of Islamic Azad University, Yasouj Branch, in order to evaluate the effects of different levels of nitrogen and potash fertilizers and interactions of these two fertilizers on some important agronomic traits in rainfed wheat variety (Azar-2). The experiment was done with 2 factors of nitrogen fertilizer at four levels including, N_0 (sham), N_{90} (application of 90 kg of pure nitrogen per hectare), N_{120} (application of 120 kg of pure nitrogen per hectare), N_{150} (application of 150 kg of pure nitrogen per hectare) and of potash fertilizer at four levels including, 0, 90, 120 and 150 kg of potash fertilizer per hectare in a randomized complete blocks design (RCBD) with factorial treatment structure and in three replications. The obtained results showed that the application of nitrogen fertilizer was significantly effective on all traits at 1% probability level. But the application of potash fertilizer and interaction of nitrogen and potash fertilizers was not significant on the number of seeds per spike. Comparison of the mean between different levels of nitrogen fertilizer showed an increase in the mean of the studied traits with increase of nitrogen from N_0 (the sham) level to N_{120} (120 kg per hectare) level. Mean comparison of potash fertilizer effects on the traits revealed that increased potash level had increasing process on the most of the studied traits. This process was significantly lower compared to the enhancement obtained from application of nitrogen fertilizer. Increased level of potash fertilizer had also no significant effect on the mean number of seed per spikelet. The results obtained from interaction of nitrogen and potash fertilizers showed that $N_{120}K_{90}$ (120 kg of nitrogen fertilizer per hectare and 90 kg of potash fertilizer per hectare) had the maximum values in the most of the studied traits.

Keywords: Wheat, Nitrogen, Potash, Important Agronomic Traits

INTRODUCTION

Wheat (*Triticum spp.*) is the oldest plant cultivated by human. This plant is the most important cereal grain in the world, which provides approximately 20 percent of calories and dietary protein for human. It is considered as the staple food in 40 countries with 35 percent of the world's population (Mans et al. 2000). Increased yield of the plant is necessary due to the increasing population growth and limited arable lands. One of the affecting factors on the yield and the quality of crops is the presence of balance between nutrients required by plant and optimized application of fertilizers. However, the use of chemical fertilizers is unbalanced in Iran and do not have any adaptation to real needs of the plant (Malakouti, 2000). Nitrogen and potassium are two important elements among macro nutrients and presence or absence of each of these two elements can seriously affect growth of plants. Two fertilizer levels of 30 and 60 kg of nitrogen per hectare in wheat plant were studied by Edalat in 2005. The results of this study showed that the mean number of seeds per spike and the number of spike per square meter increased significantly with increased levels of nitrogen; so that the maximum number of seeds in each spike and the

number of spike per square meter was obtained at level of 60 kg nitrogen per hectare. Scarf and Alley (1993) and Cassman and Bryant (1999) investigated on the effect of nitrogen including, 1000-seed weight, the number of seed per spike and the number of spike per square meter in wheat. They concluded that the above traits increase by increased application of nitrogen fertilizer.

The effect of nitrogen on the number of spike per square meter, the number of seeds per spike and 1000-seed weight in wheat was significant in the study of Farji et al (2006). It was also observed in this experiment that the number of spike per square meter and the number of seeds per spike increased by increased application of nitrogen fertilizer at tillering stage and before flowering.

Bahrani and Tahmasebi Sarvestani (2006) revealed in their study that increased application of nitrogen led to increase in the number of spike per square meter, the number of seeds per spike and 1000-seed weight. However, no significant difference was observed between the values of 80 and 160 kg of nitrogen fertilizer per hectare. Whingwiri and Kemp (1980) were also received to similar results about these traits. Potassium is an essential element and the most important cation in terms of physiological and chemical activities. The most important role of this element in plants is activation of herbal enzymes and help to improve absorption of nitrogen (Bazargan, 2003; Mengel and Kirkby, 2001). Ziaeian (2006) also examined the yield of Forage Maize at three fertilizer levels of 0, 50 and 100 kg per hectare and the results showed that potassium had significantly influenced at level of 5% on this trait. The highest yield was at level of 50 kg per hectare, while there was no significant difference with application of 100 kg per hectare. However, the mean had a significant increase in the both levels compared to the sham.

This study is aimed to provide scientific approaches to safe and reliable application of chemical fertilizers for crop production associated with stable viewpoint.

MATERIALS AND METHODS

This experiment was conducted in the crop year 2007-2008 at the research farm of Islamic Azad University, Yasouj Branch, in a randomized complete blocks design (RCBD) with factorial treatment structure. The experiment was done with 2 factors of nitrogen fertilizer at four levels including, N_0 (sham), N_{90} (application of 90 kg of pure nitrogen per hectare), N_{120} (application of 120 kg of pure nitrogen per hectare), N_{150} (application of 150 kg of pure nitrogen per hectare) and of potash fertilizer at four levels including, 0, 90, 120 and 150 kg of potash fertilizer per hectare in three repetitions on rainfed wheat variety (Azar-2). The distance between rows and the wheat bushes in each row was respectively 25 and 4 cm and the length of each row was 1.5 m.

Nitrogen and potash fertilizers for each treatment were separately and manually delivered in plots.

After removing of the first and the last bushes, five bushes in each row were randomly recorded in order to eliminate their marginal effects. Some traits including the number of spike per square meter, the number of seed per spikelet, the number of seed per spike and 1000-seed weight were measured and examined and the obtained data were analyzed using statistical analysis system (SAS), MSTATC, EXCEL and MINITAB.

RESULTS AND DISCUSSION

The obtained results from analysis of variance showed that the main effects and interactions of nitrogen and potash fertilizers on the maen number of spikes per square meter, the number of seeds per spike and 1000-seed weight in each wheat variety (Azar-2) were significant at 1% probability level (Table 1). But increased nitrogen level was significant in the average number of seeds per spikelet and the effect of potash fertilizer and the interaction of nitrogen and potash fertilizers was not significant on this trait. The results showed that the mean number of spike per square meter was significantly increased from 208.75 to 214.75 by increased application of

nitrogen from N_0 to N_{120} level. However, no significant difference was observed between the mean numbers of spike per square meter for application of nitrogen fertilizer at N_{120} and N_{150} levels. Faraji et al. (2006), Edalat (2005), Scarf and Alley (1993) and Cassman and Bryant (1999) were achieved to similar results in relation to the effect on nitrogen fertilizer on this trait.

The effect of potash on the mean number of spike per square meter was significant, so that the maximum mean number of spike per square meter was at K_{150} (213.25) and the lowest mean was at K_0 (211.25). There was no significant difference between the mean number of spike per square meter in application of potash fertilizer at K_{120} and K_{150} levels (Table 3). No significant difference was also observed in this trait between the means obtained from application of 0 and 90 kg of potash fertilizer per hectare. The comparison between the interaction of nitrogen and potash fertilizers on the number of spike per square meter showed that application of 90 kg of potash with 120 kg of nitrogen ($N_{120}K_{90}$) was the maximum value (215.7). Furthermore, there was no significant difference in terms of the mean number of seeds per spikelet in the examined genotype, Azar-2 wheat, at different levels of nitrogen. However, all of the application levels were different from the sham. In addition, increased application of potash fertilizer up to 150 kg per hectare did not have significant effect on the mean number of seeds per spikelet and the means at all levels were in one group and equal to 2.75 seeds.

It was observed from comparison of the means at different levels of nitrogen fertilizer (Table 2) that by increase of nitrogen from N_0 to N_{120} the mean number of seeds per spike increased significantly from 8.50 to 22.25. Comparison of the means at different levels of potash fertilizer (Table 3) showed that by application of K_{150} (150 kg potash per hectare) the mean number of seeds per spike was the maximum value (18.75) and this trait was minimum (16.25) in the sham group (K_0); and the maximum mean from the numbers of seeds per spike was related to the combined application of 90 kg of potash and 120 kg of nitrogen fertilizers per hectare (Table 4). The maximum value of 1000-seed weight (32.30 g) was at fertilizer level of N_{120} (120 kg of nitrogen fertilizer per hectare) and the lowest value of 1000-seed weight (30.08) was related to N_0 (the sham group). Whingwiri and Kemp (1980), Faraji et al. (2006), Edalat (2005), Scarf and Alley (1993) and Cassman and Bryant (1999) were achieved to similar results in relation to the effect of nitrogen on this trait.

The effects of different levels of potash fertilizer on 1000-seed weight in wheat variety (Azar-2) revealed that the maximum 1000-seed weight was in K_{90} (30.08) and the minimum was related to the sham group (29.17) (Table 3). No significant difference between 1000-seed weight was observed in application of potashat K_{90} and K_{120} levels. The results of mean comparison between the interaction effects (Table 4) showed that the maximum amount of 1000-seed weight was in the application of $N_{120}K_{90}$ (34g) and the minimum amount was related to the applications of N_0K_0, N_0K_{90} and N_0K_{120}.

Ziaeian (2006) also examined the yield of Forage Maize at three fertilizer levels of 0, 50 and 100 kg per hectare and the results showed that potassium influenced significantly on this trait at level of 5%. The maximum yield was related to the level of 50 kg per hectare, while it did not have significant difference with application of 100 kg per hectare.

Table 1- The mean square of the measured traits at 4 levels of nitrogen fertilizer and 4 levels of potash fertilizer

Resources of changes	Degree of freedom	Mean number of spike per square meter	Mean number of seed per spikelet	Mean number of seed per spike	1000-seed weight
Iteration	2	3.27*	ns0.0001	ns0.19	ns0.08
Nitrogen fertilizer	3	99.68**	3**	464.19**	70.92**
Potash fertilizer	3	10.35**	0.001ns	16.69**	1.91**

Nitrogen fertilizer	9	6.002**	ns0.001	6.68**	5. 15**
Potash fertilizer error	30	0.76	0.001	0.19	0.32
Total	47				

- * and ** are significantly significant at 1% and 5% probability levels and ns is non-significant

Table 2- Comparison between the mean of the main effects of traits at different levels of nitrogen fertilizer

Nitrogen fertilizer	Mean number of spike per square meter	Mean number of seed per spikelet	Mean number of seed per spike	1000-seed weight
0	208.75c	b2	d8.50	c26.42
90	b211.08	a3	c16.50	b29.92
120	a214.75	a3	a22.25	a32.30
150	a214.50	a3	b21	b30.08
LSD (5%)	0.98	0	0.49	0.64

- The means in each column that at least have one common letter do not statistically have a significant difference at 5% probability level and using the least significant difference (LSD) test.

Table 3- Comparison between the mean of the main effects of traits at different levels of potash fertilizer

Potash fertilizer	Mean number of spike per square meter	Mean number of seed per spikelet	Mean number of seed per spike	1000-seed weight
0	211.25b	a2.75	c16.25	c29.17
90	211.75b	a2.75	b17	a30.08
120	a212.83	a2.75	c16.25	ab29.88
150	a213.25	a2.75	a18.75	bc29.58
LSD (5%)	0.73	0	0.36	0.47

- The means in each column that at least have one common letter do not have statistically a significant difference at 5% probability level, using the least significant difference (LSD) test.

Table 4- Comparison between the means interactions of nitrogen and potash fertilizers

Nitrogen fertilizer (kg per hectare)	Potash fertilizer (kg per hectare)	Mean number of spike per square meter	Mean number of seed per spike	Mean number of seed per spikelet	1000-seed weight
0	0	f207.3	b2	f8	g26.67
	90	ef208	b2	f8	g26.67
	120	d210.3	b2	f8	g27
	150	de209.3	b2	e10	h25.33
90	0	de209	a3	d15	f28
	90	de209	a3	d15	e29.33
	120	c212	a3	d15	c-e30
	150	ab214.3	a3	c21	b32.33
120	0	ab215	a3	c21	b32.33
	90	a215.7	a3	a24	a34
	120	b214	a3	c21	b32.20
	150	ab214.3	a3	b23	c30.67
150	0	b213.7	a3	b21	De29.67
	90	ab214.3	a3	c21	cd30.33
	120	ab215	a3	c21	cd30.33
	150	ab215	a3	c21	c-e30
LSD (5%)		1.45	0.02	0.73	0.94

- The means in each column that at least have one common letter do not have statistically a significant difference at 5% probability level, using the least significant difference (LSD) test.

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