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Effect of different levels of nitrogen on the economic yield of Wheat (*Triticum aestivum* L.) variety Aas-11

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Abstract

The present study was planned to determine the effect of different levels of Nitrogen on the economic yield of wheat (*Triticum aestivum* L.) variety Aas-11. Thus, an experiment was carried out in the research area of Regional Agriculture Research Institute Bahawalpur (RARI) during 2013-14 to test the effect of various Nitrogen levels on the yield and yield component of wheat. The experiment was laid out in Randomized Complete Block Design (RCBD) with four replications. Nitrogen levels i.e, 0, 30, 60, 90, 120 and 150 kg/ha were tested in this study. The results revealed that 120 and 150 kg/ha levels of nitrogen fertilizer significantly increased the fertile tillers, plant height, spike length, number of spikelet per spike, number of grains per spike, 1000 grain weight, grain yield per plot and grain yield kg/ha. The application of nitrogen fertilizer was found to be most effective for enhancing the quantitative and qualitative growth of wheat.

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Introduction

Wheat (*Triticum aestivum* L.) is one of the most important grain crop used in the world. Among world cereal crops it ranks first accounting 30 % of all cereal food in the world and is staple food for more than 10 billion people about in 43 countries. Twenty percent of total food calories come from wheat (Reddy, 2004).Being a major food crop of wheat is cultivated on an area of 9042 thousand hectare in Pakistan. The average yield and annual production of wheat in the country is 2.639 kg ha^{-1} and 23864 thousand tons respectively (GOP, 2010).

Balanced fertilizers are essential for the enhancement of the yield. Nitrogen fertilizer is basically used for better seed development, seed maturity and grain production. Nitrogen is most often the limiting nutrient for plant growth and development (Andrews *et al.,* 2004).Grain yield and quality of wheat is improved by the foliar application of nitrogen fertilizer Rozsypal (1989). Nitrogen fertilizer significantly affect the plant height, fertile tillers m^{-2}, spike length, number of spikelet per spike, number of grains per spike, 1000 grain weight and grain yield.

Nitrogen plays an important role in plant metabolism. All plant processes are related to nitrogen. Thus keeping in mind the importance of Nitrogen in increasing yield of crops, the present study was conducted to determine an optimum level of Nitrogen, with which economic yield of wheat can be increased.

Materials and methods

Research site

The trial was conducted in the research area of Regional Agriculture Institute Bahawalpur (RARI) in the mid of November 2013.

Experimental design

The experiment was laid out in Randomized Complete Block Design (RCBD) under four replications having a plot size of 2.4×9m with 10 rows each at a distance of 30cm.

Treatments

Six fertilizer levels was T0 (control): 0-67-43 (NPK= kg/ha), T1: 30-67-43 (NPK= kg/ha), T2: 60-67-43 (NPK= kg/ha), T3:90-67-43 (NPK = kg/ha), T4: 120-67-43 (NPK=kg/ha) and T5: 150-67-43 (NPK=kg/ha) was included in the experiment. Nitrogen levels varied from 0 to 150 kg/ha while Phosphorus (P) and Potassium (K) was remained constant.

Observations recorded

Data on Number of fertile tillers /m^2 , Plant height (cm), Spike length (cm), Number of spikelet / spike, Number of grains / spike, 1000 grain weight (g), Grain yield / plot (kg) and Grain yield kg/ha were recorded.

Statistical Analysis

Data were statistically analyzed using Fisher's analysis of variance techniques (Steel *et al.*, 1997).

Results and discussion

Nitrogen is often most limiting nutrient for development and plant growth (Andrews *et al.,* 2004). Data regarding to different growth, yield parameter and quality parameters of wheat as influenced by different nitrogen (N) fertilizer levels were recorded and statistically analyzed. The highest value for number of fertile tiller m^{-2} (307.00) was achieved in case of T5 where the Nitrogen was applied at the rate of 150 kg/ha followed by T4 (300.00) and T3 (290.50) where Nitrogen was applied at the rate of 120 kg/ha and 90 kg/ha respectively. These results are in line with Maqsood *et al.*, (2001) and Ashraf, (1987) who concluded that nitrogen application increased the number of fertile tillers m^{-2} and grain yield.

Plant height is considered a genetic character which is modified by environmental factors like availability of nutrients and moisture at the growth stages. Plant height was significantly affected by applications of various nitrogen levels. The maximum plant height (109.5 cm) was obtained from T5 where the nitrogen was applied at the rate of 150 kg/ha with constant Phosphorus (67 kg/ha) and Potassium (43 kg/ha),

however it was statistically at par to T4 where the Nitrogen was120 kg/ha and plant height was recorded as 108 cm.Similar trend was observed in T3 and T2 where the plant height was 101 cm and 100 cm respectively. Similar results are given by previous researchers Soylu *et al.*, 2005, Kenbaw & Sade 2002 and Anwar 1981.

The data on spike length revealed significant increase with various levels of Nitrogen applications. Maximum spike length of 17.75 (cm) was produced by T5 where Nitrogen was applied at the rate of 150 kg/ha with constant Phosphorus (67 kg/ha) and Potassium (43 kg/ha). Similar results were observed in T3 and T2 where the spike length was 14.250 and 14 respectively where Nitrogen (N) was applied at the rate of 90 kg/ha and 60 kg/ha while minimum spike length (8.00 cm) was recorded in T0 (Control). The results are in agreement with Alston (1979), Ling & Silberbush (2002), Woolflok *et al*., (2002) and Oko *et al.*, (2003).

Tillering, number of spikes plant^{-1}, number of grains spike^{-1} and grain weight are the main yield components of wheat. These characters are genetically controlled but their effects are on the large basis which is determined by the environmental factor and mostly include the nutrients which are available in the soil.The highest spikelet per spike 18.25 were recorded for Nitrogen (N) application at the rate of 150 kg/ha at T5. Nitrogen level at T4 was 120 kg/ha and spikelet per spike 17.75 was recorded, however both are statistically at par.In T3 and T2 the spikelet per spike were recorded as 15.5 and 15.25 respectively and Nitrogen (N) was applied at the rate of 90 kg/ha and 60 kg/ha while minimum spikelets per spike (11.75) were recorded in T0 (Control).These results were in line with Singh & Bhan (1998) who also obtained greater spikelets per spike with higher nitrogen fertilizer levels.

Grains spike^{-1} is an important yield component which may be influenced by soil. Data revealed statistically significant ($p<0.05$) difference regarding to number of grains per spike.Table1 represents the data of treatment means for number of grains per spike. It was noted that control treatment produced the minimum 25.25 number of grains per spike while rest of treatment produced the maximum with statistically significant differences. Overall the number of grains per spike increased linearly with increase in the amount of Nitrogen fertilizer. Maximum (54.25) grains per spike were noted at T5 where Nitrogen applied at the rate of 150 kg/ha while and Phosphorus (67 kg/ha) and Potassium (43 kg/ha) were constant followed by T4 (52.50) where nitrogen was applied at the rate of 120 kg/ha, however both are statistically at par. These results were in accordance with Kadry *et al.*, (1984) and Alam *et al.*, (2007).

Table 1. Comparative performance of different treatments of nitrogen fertilizer of Wheat (*Triticum aestivum* L.).

Treatments	No. of fertile tillers /m2	Plant height (cm)	Spike length (cm)	No of spikelet's /spike	No of grains / spike	1000 grain weight	Wheat grain yield / plot (kg)	Grain yield kg /ha
T0	137.3	68	8	12	25	30	68	787
T1	197.8	90.5	11	14	36	32	90.5	2801
T2	270.5	100.5	14	16	41	34	100.5	4387
T3	290.5	101	14	15	44	39	101	4422
T4	300	107.5	15	16	53	42	107.5	4885
T5	307	109	18	18	54	44	109	4642

Note : LSD determined at alpha 0.05.

Integrated Nitrogen treatments significantly affected the 1000-grain weight of wheat. Greater grain weight in fertilized plots can be attributed to the availability of Nitrogen at grain formation stage. The results showed that all treatments under study seemed to be efficient in utilizing their photosynthesis toward grain development. The highest value of 1000-grain weight 44.25 g was achieved in case of T5, where nitrogen was applied at the rate of 150 kg/ha followed byT4 (42.25g) which was statistically at par to T5, where

the nitrogen was applied at the rate of 120 kg/ha. The 1000-grain weight value (29.75g) for T0 was significantly lowest then other while it was also statistically at par to T1 as 31.75g.These findings were in conformity with Ali *et al.*, (2000) and Halepyatie (2001).

Wheat grain yield is the result of numbers of effective tillers, number of grains per spike and grain weight. Maximum grain yield per plot (kg) 10.400 was recorded at T5 level where Nitrogen (N) was applied at the rate of 150 kg/ha, Phosphorus (67 kg/ha) and Potassium (43 kg/ha) applied at constant rate however, it was statistically at par with T4 where Nitrogen level was 120 kg/ha. Minimum wheat grain yield per plot (kg) 1.700 was recorded in T0 (Control) where nitrogen was not applied. These results are in conformity with Alston (1979), Kolota & Osinska (2002).

Data on grain yield kg/ha (Table) revealed significant increase with various Nitrogen applications. Nitrogen application about grain yield does not draw the clear result about grain yield of wheat. The possible reason of increased grain yield with adequate nitrogen supply may be the result of delayed leaf senescence. Application of Nitrogen also showed the positive response to grain yield Kg/ha. Maximum grain yield 4885.0 (kg/ha) was obtained from T5 where Nitrogen was applied at the rate of 150 kg/ha with constant rate of Phosphorus (67 kg/ha) and Potassium (43 kg/ha), where Nitrogen (N) level was 120 kg/ha at T4 the grain yield kg/ha was recorded as 4641.8, similar results were observed in T3 and T2 where the wheat grain yield kg/ha was 4421.5 and 4387.0 respectively. The results are in agreement with Tea, *et al.*, (2007), McGrath (2003), Woolflok *et al.*, (2002).

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