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Quantitative and Qualitative Response of Three Wheat Varieties to Nitrogen Application

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Abstract: The performance of three wheat varieties namely MH-97, Kharchia and Inqlab-91 treated with four nitrogen levels (0, 75, 125 and 175 kg ha^{-1}) was studied under irrigated conditions at Faisalabad. The results revealed that MH-97 gave the maximum (2073.3 kg ha^{-1}) grain yield, which was the result of larger leaf area plant^{-1}, higher number of spike bearing tillers and more 1000-grain weight. 125 kg N ha^{-1} (F_2) topped by producing taller plants, higher number of total tillers and 1000-grain weight except grain protein content which was the highest in case of F3 (175 kg N ha^{-1}). The total number of tillers and number of spike bearing tillers were statistically similar in !Web-91 and MH-97 at 125 kg N ha^{-1} or 175 kg N ha^{-1}, but were significantly different from Kharchia. Wheat variety MH-97 in comparison with the other two varieties was higher yielding and 125 kg N ha^{-1} was the most suitable nitrogen level.

Key words: Nitrogen, wheat, fertilizer-varietal interaction

Introduction

Wheat (*Triticum aestivum* L.) plays an important role in Pakistan's economy but its grain yield per hectare in Pakistan is much less than that of other countries of the world. Various factors are responsible for better crop harvest, among which use of chemical fertilizers (Lathwal *et al.,* 1992) and high potential varieties (Behera, 1994) offer a substantial scope. Nitrogen fertilizer increases the grain yield in cereals. Both root and shoot growth are reduced when nitrogen becomes limited (Campbell *et al.,* 1977). Similarly selection of improved and high yielding wheat genotypes having a wide range of adaptations to soil and environmental conditions is essential to increase the yield per hectare (Babar *et al.,* 1992). High yielding wheat varieties demand adequate nutrients to produce maximum yield (Rustam and Yasin, 1990). Increased tillering, more number of grains spike^{-1} and finally higher grain yield were reported by Khan (1997). Need for balanced fertilizer in achieving true potential from varieties evolved for cultivation was emphasized by Raced and Salim (1992). Varieties, however, responded differently to nutrient fertilizer with respect to their genetic make up and physiological life processes (Chandra *et al.,* 1992). Keeping all these points in view, the present research work was taken up to determine astute nitrogen requirements for three wheat varieties namely MH-97, Kharchia and Inglab-91 (standard) grown under agroecological conditions of Faisalabad.

Materials and Methods

Studies were conducted in the Agronomic Research Area, University of Agriculture, Faisalabad during 1998-99 on a sandy loam soil having 17.5 mg kg^{-1} N, 7.3 mg kg^{-1} P_2O_5 and 89.1 mg kg^{-1} K_2O. Experiment was laid out according to randomized complete block design (RCBD) in split plot arrangement where wheat varieties and fertilizer treatments were randomized in the main and subplots, respectively. Varieties used were Inglab-91, MH-97 and Kharchia; while fertilizer treatments were 0, 75, 125 and 175 kg N ha^{-1}. Crop was sown on November 20, 1998 on a well-prepared seedbed in 30 cm apart single rows with the help of a single row hand drill. Seed rate of 100 kg ha^{-1} was used. Urea was used as a source of N and half of the nitrogen was applied at sowing time; remaining half nitrogen was applied with first irrigation in all the treatments except the control. All other agronomic practices such as irrigation, weeding, etc; were kept normal and uniform for all the treatments. Data on relevant growth, yield and quality characteristics of the crop were collected by following standard procedures and analyzed statistically. Significance of treatments was tested by using L.S.D test at 5% level of probability.

Results and Discussion

Data on growth, yield and quality characteristics of different wheat cultivars as affected by varying levels of nitrogen fertilizer are presented in Table 1 (A and B). Varieties differed significantly from one another in all growth and yield parameters except grain protein. Out of the three varieties Kharchia produced the tallest plants but it did not differ significantly from that of Inglab-91. Plants of cv. MH-97 were the lowest in height and it differed significantly from the other two varieties. Number of spikelets spike^{-1} was highest in Inglab-91 but it was statistically at par with MH-97, which produced 39.2 spikelets spike^{-1}. Spikelets formed per spike were the lowest in Kharchia. Variation in plant height and that of number of spikelets spike^{-1} of three wheat varieties may be attributed to their differences in genetic make up. These results are in conformity with those obtained by Ashour and Haleem (1996). Number of grains per spike in Inglab-91 was 42.7, which was statistically higher than that of MH-97 and Kharchia producing 38.3 and 35.2 grains per spike, respectively. The latter two varieties were at par with each other. Maximum 1000 grain weight was recorded in MH-97 and it differed significantly from that recorded for Inglab-91 and Kharchia which were statistically the same with each other. Grain yield recorded in different varieties showed the same trend as that of 1000-grain weight. The highest yield of 2073.3 kg ha^{-1} was recorded in MH-97 and the minimum i.e., 1639.8 kg ha^{-1} was obtained from Kharchia which did not differ significantly from Inglab-91. Differences in grain yields of three wheat varieties may be attributed to their differences in 1000-grain weight. Variations in grain yield of different wheat varieties were also found by Chaudhry *et al.* (1995) and Ghosh *et al.* (1996). Among the wheat varieties, non-significant differences were observed for grain protein content (%). Different growth and yield parameters of wheat such as plant height, 1000-grain weight (g) and grain protein content were affected significantly in response to application of fertilizer. Number of spikelets.

Table 1: Growth, yield and quality characteristics of three wheat varieties treated with varying levels of nitrogen

Treatments (A)	Plant height	No. of spikelets spike^{-1}	No. of grains spike^{-1}	1000-grain weight (g)	Grain yield (kg ha^{-1})	Grain protein contents (%)
Varieties V_1 (Inqlab-91)	93.8 a	43.1 a	42.7 a	42.3 b	1795.0 b	10.1^{Ns}
V_2 (M- 97)	88.2 b	39.2 a	38.3 b	47.8 a	2073.3 a	10.4
V_3 (Kharchia)	97.0 a	35.0 b	35.2 b	42.1 b	1639.8 b	10.4
LSD at 5%	5.4	4.2	4.0	1.0	275.3	
Fertilizer Levels (kg ha^{-1})						
F_o (0 kg ha^{-1})	89.4 b	38.8^{Ns}	38.3^{Ns}	41.3 d	1675. 6^{Ns}	9.8 c
F_1 (75 kg ha^{-1})	94.2 a	38.9	37.9	43.4 c	1788.9	10.0 bc
F_2 1125 kg ha^{-1})	95.0 a	39.4	39.4	47.1 a	1907.8	10.4 b
F_3 (175 kg ha^{-1})	93.3 a	39.7	39.5	44.9 b	1972.2	11.2 a
LSD at 5%	3.08	-	-	1.3	-	0.4

(B)

Varieties	Total No. of tillers (m^{-2})				No. of spike bearing tillers (m^{-2})			
	F_0	F_1	F_2	F_3	F_0	F_1	F_2	F_3
V_1 (Inqlab-91)	147.3 d	224.6 he	363.3 a	335.6 a	125.0 e	294.3 be	343.3 ab	317.3 ab
V_2 (MH- 97)	193.3 cd	66.6b	374.0 a	393.6 a	157.6 a	234.7 cd	352.0 ab	372.0 a
V_3 (Kharchia)	193.3 cd	247.6 bc	245.6 bc	241.3 be	177.0 de	229.3 cd	231.0 cd	232.3 cd
LSD at 5%			68,4				68.4	

spike^{-1}, No. of grains per spike and grain yield (kg ha^{-1}), however, were not significantly affected by various nitrogen levels. Maximum plant height and 1000-grain weight (g) were obtained when crop was treated with 125 kg N ha^{-1}. The protein content of wheat grain increased with increasing nitrogen level and its percentage was highest when nitrogen was applied at 175 kg N ha^{-1}. All the crop characteristics showed minimum values in no fertilizer treatment. These results are in conformity with that of Basit (1996) and Loewy (1990). Total number of tillers unit area^{-1} was maximum in MH-97 when fertilized at the rate of 175 kg N ha^{-1} but it did not differ significantly from V_2F_2, V_1F_2 and V_1F_3 combinations which produced 374.0, 363.3 and 335.6 tillers (m^{-2}), respectively. The tillers (m^{-2}) in all the varieties decreased with no or 75 kg N ha^{-1} application and Kharchia produced less tillers even when treated with 125 or 175 kg N ha^{-1}. To sum up Kharchia seemed to be less responsive to nitrogenous fertilizer as compared to either MH-97 or Inglab-91. Similar findings were reported by Mazurek *et al.* (1992) and Ayoub *et al.* (1994). A similar trend of results was seen in the number of spike bearing tillers which were highest (372.0) in treatment V_2F_3 and it was statistically at par with V_2F_2, V_1F_2 and V_1F_3. The treatment V_1F_3, producing 294.3 spike bearing tillers (m^{-2}) differed significantly from V_2F_3 but was statistically at par with V_2F_2, V_1F_2 and V_1F_3, which on an average produced 337.5 spike bearing tillers m^{-2}. Treatment V_1F_1 was also statistically similar with treatments V_2F_1, V_3F_3, V_3F_2 and V_3F_1 where the average number of spike bearing tillers was 231.8 m^{-1}. These treatments were not statistically different from V_3F_1. The lowest number of tiller bearing spikes (125 m^{-2}) was obtained from V_3F_0, which was statistically similar to that of V_3F_0 and V_2F_0. It is concluded that MI-I-97 and Inolab-91 produced significantly more spike bearing tillers per m^2 at higher levels of nitrogenous fertilizer as compared to Kharchia. The number of spike bearing tillers was reduced in all varieties at zero fertilizer. These findings are supported by the results of Basit (1996).

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