Research Article

Assessment of nutritional requirement of wheat variety KT-2000 under rainfed condition

Muhammad Ilyas¹, Zahid Iqbal¹, Sabir Gul Khattak¹, Fahim Ullah Khan^{1, 2*}, Zahid Saleem¹, Muhammad Khan¹, Javed Iqbal¹ and Niaz Muhammad¹

1. Barani Agricultural Research Station Kohat, KPK, Pakistan

2. Department of Plant Breeding & Genetics, The University of Agriculture, Peshawar

*Corresponding author's email: fahimbiotech@gmail.com

Citation

Muhammad Ilyas, Zahid Iqbal, Sabir Gul Khattak, Fahim Ullah Khan, Zahid Saleem, Muhammad Khan, Javed Iqbal and Niaz Muhammad. Assessment of nutritional requirement of wheat variety KT-2000 under rainfed condition.

Pure and Applied Biology. Vol. 4, Issue 4, 2015, pp 497-502. <http://dx.doi.org/10.19045/bspab.2015.44007>

Received: 07/06/2015

Revised: 05/11/2015

Accepted: 14/11/2015

Abstract

As increasing fertilizer use efficiency would be beneficial to low value crop producer and friendly environment, a field experiment was thus conducted to assess the nutritional requirements of wheat variety KT-2000 at Barani Agricultural Research Station (BARS), Kohat during 2011-12 crop season. Wheat variety KT-2000 was planted in field condition under varied combination of NPK using randomized complete block (RCB) design with three replications. Data were recorded on days to heading, maturity, plant height, productive tillers m⁻² and grain yield. Analysis of variance showed significant effect of NPK treatments on all the traits studied except plant height. Maximum values for economically important traits viz. productive tillers m⁻² and grain yield were observed at maximum level of NPK (90-60-60). Regression analysis for all the traits confirmed the linear relationship of NPK fertilization with yield and yield associated traits. The highest grain yield of 3800 kg ha⁻¹ was recorded by applying NPK @ 90-60-60 kg ha⁻¹ followed by 3767 and 3600 kg ha⁻¹ obtained by applying NPK @ 60-60-30 and 60-30-0 kg ha⁻¹ respectively. Therefore, NPK @ 90-60-60 could be recommended for wheat variety KT-2000 to obtain high grain yield.

Keywords: Fertilizer application; NPK; Wheat; Grain yield.

Introduction

Nitrogen comprises 7% of total dry matter of plants and is a constituent of many fundamental cell components such as nucleic acids, amino acids, enzymes, and photosynthetic pigments [1].

Nutrients are lost from the soil plant system in a number of ways including, leaching, volatilization, de-nitrification, precipitation

and fixation by clay minerals. Considerable amount of nutrients are taken up from the soil in harvested crop material. For sustainable agriculture, fertility of the soil must be maintained by adding fertilizers to the soil both in natural and organic form. So it is therefore, imperative to add fertilizers to the soil either in organic or in mineral form to get maximum yield of the crops. The

types and amounts of fertilizer to be applied depend on the crop to be grown and nutrient supplying power of soil. It has been reported that judicious and balanced fertilizer can increase crop yield up to 40-50% [2].

A nutrient imbalance exists when one or more nutrients are not in applied in proper ratio. This can cause deficiency, toxic level of one or more nutrients or just excess of a nutrient that is not toxic but hinders another nutrient from performing its normal function. A constant and balanced supply of elements is essential to good plant growth, otherwise nutrient deficiencies, toxicities or other effect, will cause plant nutrients stress. So soil analysis is a better diagnostic tool than other methods of fertility evaluation because it gives rapid results before sowing of crop. By knowing the actual status of the soil and application of balanced fertilizers,

the maximum and economical crop production can be obtained as well as fertility of the soil could be restored [3]. The present experiment was designed to determine the optimum levels of NPK for achieving the profitable yield of improved variety (KT-2000) under the agro-climatic conditions of Kohat.

Materials and Methods

Soil analysis:

The physio-chemical analysis of composite soil sample indicated that the experimental site had pH value of 7.61 with electrical conductivity of 0.18 d S/m. Soil was alkaline, strongly calcareous (20% CaCO_3), deficient in organic matter, nitrogen and phosphorus and adequate in potassium. It has no problem of salinity and is clay loam in texture (Table 1).

Table 1. Physico-chemical characteristics of experimental site at BARS, Kohat.

Parameter	Unit	Value
pH	-	7.61
EC x 10^3	ds/m	0.18
CaCO_3	%	20
Organic Matter	%	0.8625
Nitrogen	%	0.0431
Phosphorus	mg/kg	9.78
Potash	mg/kg	104.5
Clay	%	42
Silt	%	38
Sand	%	20
Textural Class	-	Clay loam

Yield and Yield Component:

Days to heading (days)

Analysis of variance regarding days to heading as affected by different combination of NPK depicted highly significant differences among treatments (Table 2). Days to heading were ranged from 120 to 124 days with the average value of 122 days. Mean values indicated that days to heading was delayed in plots received maximum dose of NPK (T5= 90-60-60 kg

ha^{-1}), which was statistically similar with that of T4 and T3. On the other hand earliest heading was observed in plots received NPK @ 30-30-0. These results suggested that increase in NPK application delayed heading period in wheat (Table 3). Regression analysis showed linear relationship of five treatments with days to heading. R^2 value (0.75) approaches to 1 indicating the significance and the fitness of the linear model (Fig 1). The present results

are in accordance with the earlier finding of [2, 3, 4]

Days to maturity (days)

Days to maturity varied significantly by different combination of NPK treatments (Table 2). Mean days to maturity ranged from 158 to 168 days with the average value of 163 days over all the treatments. Earliest maturity was observed in plots where NPK was not applied (T1= 0-0-0). On the other

hand maturity was delayed in plots received maximum dose of NPK @ 90-60-60. NPK application keeps the plant canopy green and delayed plant senescence (Table 3). Linear trend of five treatments with days to maturity was observed with R^2 value (0.99) indicated the significance and the fitness of the linear model (Fig 2). Earlier studies of [4, 5] reported similar results regarding days to maturity in wheat.

Table 2. Mean square for various morpho-physiological and yield traits of wheat variety KT-2000 as affected by different NPK combination.

Traits	Replication (df=2)	Treatments (df=4)	Error (df=8)
Days to heading	6.0667	10.2667**	0.8167
Days to maturity	1.8667	47.1000**	1.4500
Plant height	1.26667	3.06667 ^{NS}	1.51667
Tillers m ⁻²	34.40	1015.23**	13.73
Grain yield	2908	820993*	1865

CV= Coefficient of variation and df= degree of freedom

**, * = significant at 1% and 5 % level of probability, respectively

Table 3. Mean values for various morpho-yield traits of wheat variety KT-2000 as effected by different NPK combinations.

Treatments (N:P:K kg ha ⁻¹)	Days to heading	Days to maturity	Plant height	Tillers m ⁻²	Grain yield (kg ha ⁻¹)
T1= 0-0-0	121 b	158 d	100.3	174 e	1550 d
T2=30-30-0	120 b	161 c	99.3	192 d	3300 c
T3=60-30-0	123 a	163 b	100.7	203 c	3646 b
T4=60-60-30	124 a	165 b	101.3	211 b	3756 a
T5=90-60-60	124 a	168 a	102.0	222 a	3820 a
Mean	122	163	100.7	200	3414
LSD_{0.05}	1.70	2.27	NS	7.00	81.31

Plant height (cm)

Mean square regarding plant height showed non-significant differences among treatments (Table 2). Non-significant differences among treatments indicates that effect of NPK doses had no influence on height of the plant. Plant height ranged from 99.3 to 102.0 cm with the mean value of 100.7. Although different combination of NPK did not affect plant height of wheat variety KT-2000, however maximum and minimum plant height were recorded at T3 (100.7 cm) and T2 (99.2 cm) (Table 3). As non-significant difference among treatments were recorded for plant height, data for regression analysis was not plotted. These findings are contrary to the earlier research work [4, 6, 7], they found significant effect of NPK fertilization on plant height.

Productive tillers m^{-2}

Analysis of variance for productive tillers m^{-2} depicted highly significant differences among NPK treatments (Table 2). Productive tillers m^{-2} ranged from 174 to 222 tillers with the mean value of 200 tillers m^{-2} . Maximum productive tillers m^{-2} were recorded in plots receiving NPK @ 90-60-60 (222), whereas, minimum productive tillers m^{-2} were recorded in T1 plots (174) (Table 3). Regression analysis for productive tiller m^{-2} showed linear relationship of tillers with NPK doses. Linear increase in tillers were observed with the increase in NPK levels. High R^2 value (0.97) indicated the significance and fitness of the model (Fig 3). Similar results regarding tillers m^{-2} were also reported by [4, 8, 10, 11].

Fig2. Regression analysis of days to maturity as affected by different combination of NPK

Fig3. Regression analysis of tillers m^{-2} as affected by different combination of NPK

Grain yield (kg ha⁻¹)

Grain yield of wheat varieties was significantly affected by varied level of NPK (Table 2). Grain yield under varied level of nitrogen ranged from 1550 to 3820 kg ha⁻¹. Significant increase in grain yield with increase in NPK levels signify the importance of macro nutrients (N, P and K) in crop growth. Maximum grain yield was observed in plots received NPK @ 90-60-60 (3820 kg ha⁻¹), however it was statistically similar with plots receiving NPK @ 60-60-30 (3756 kg ha⁻¹). Minimum grain yield (1550 kg ha⁻¹) were recorded in plots received no NPK dose indicates there is sufficient amount mineral available to the crop to produce yield (Table 3). Regression analysis of grain yield data indicate linear relationship of NPK levels with grain yield. The R^2 value of 0.68 indicates the fitness of the linear model of grain yield with NPK doses (Fig 4). Role of NPK in grain yield have been previously reported by many researcher. The present research work are in accordance with the earlier findings of [9, 10, 11]. They found highest wheat grain and straw yield with NPK @ 120-90-60 kg ha⁻¹ respectively. Increased grain yield with increase in nitrogen level were also reported by [6]. Similarly, [12] also reported linear

relationship of grain yield with the increase in NPK fertilization.

Authors' contributions

Conceived and designed the experiments: SG Khattak. Performed the experiments: M Ilyas & Z Iqbal. Analyzed the data: F Khan & Z Saleem. Contributed reagents/materials/analysis tools: J Iqbal & N Muhammad. Wrote the paper: F Khan & M Khan.

References

1. Bungard RA, Wingler A, Morton JD & Andrews M (1999). Ammonium can stimulate nitrate and nitrite reductase in the absence of nitrate in *Clematis vital*. *Plant Cell Env* 22: 859-866.
2. Memon KS (1996). Soil and fertilizer phosphorus. In *Soil Science- National Book Foundation, Islamabad*. 291-314.
3. Bhatti A, Qureshi AA & Rahman S (1985). Effect of N alone in combination with P x K on the yield of wheat. *Pakistan J. Agric. Res.* 6 (2): 89-92.
4. Khan I, Mohammad F & Khan FU (2015). Estimation of genetic parameters of yield and yield related traits in wheat genotypes under rainfed conditions. *Int'l J Environ* 4(2): 193-205.
5. Ayoub M, Guertin S, Lussier S & Smith DL (1994). Timing and levels of nitrogen

- fertility effects on spring wheat. *Crop Sci* 34: 748-750.
6. Geleto T, Tanner DG, Mamo T & Gebeyehu G (1995). Response of rain fed bread and durum wheat to source level and timing of nitrogen fertilizer on two Ethiopian vertisole S. I. yield and yield components. *Comm in Soil Sci Plant Analysis* 26: 1773-1794.
 7. Jan S, Mohammad F & Khan FU (2015). Genetic potential and heritability estimates of yield traits F3 segregating populations of bread wheat. *Int'l J Environ* 4(2): 106-115.
 8. Singh VPN & Uttam SK (1992). Response of wheat cultivars to different N levels under early sown conditions. *Crop Res* 5: 82-86.
 9. Chaudhry GA, Nawaz S, Hussain R, Asghar A & Kashif SR (2000). Fertilizer requirements of new wheat genotype under rain fed condition. *Pakistan J Soil Sci* 18: 125-109.
 10. Khan FU, Raziuddin & Khalil IA (2013). Correlation and factorwise contribution of various traits related to yield in rapeseed (*Brassica napus* L.). *American-Eurasian J Agric & Environ Sci* 13 (1): 101-104.
 11. Khan FU, Khan M, Khattak SG, Iqbal Z, Saleem Z, Iqbal J & Muhammad N. Evaluation of advance bread wheat lines in preliminary wheat yield trial. *Pure Appl Bio* 4(3): 384-388.
 12. Lathwal OP, Tej S & Singh T (1992). Effect of irrigation and nitrogen levels on yield attributes and yield of wheat. *Haryana J Agron* 8: 69-70.