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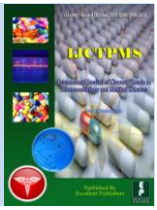

Original Research Article

Screening of Wheat Varieties under Recommended Dose of NPK Fertilizer

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Abstract

An experiment was conducted at Agronomy Research Farm (ARF), The University of Agriculture Peshawar during 2014-15 to screen wheat varieties under recommended dose of NPK. Eight wheat varieties namely, PR-103, Saleem-2000, Tatara-96, Pirsabaq-2004, Ghaznavi-98, Siren-2008, Lasani-08, AAS-11 were tested to screen by using randomized completely block (RCB) design with three replications. NP and K were applied @ 120, 90 and 60 kg ha^{-1}, respectively. Statistical analysis showed significant differences ($P \leq 0.05$) among treatments for wheat grain yield, plant height, emergence m^{-2}, tillers m^{-2}, days to anthesis, spikes m^{-2}, grains $spike^{-1}$and biological yield. Maximum emergence m^{-2}, plant height, spikes m^{-2}, number of grains per spike and grain yield were observed in PR-103 while days to anthesis were higher in variety of Tatara-96. Similarly tillers m^{-2}, was maximum in Ghaznavi-98 while biological yield was higher in PS-2004. It is concluded from the results obtained that constantly better performance were recorded in PR-103 which was better than the other tested varieties in terms of yield and its components for growing area.

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Keywords

NPK fertilizers
Wheat varieties
Yield components

Introduction

Wheat (*Triticum aestivum* L.) is one of the most important cereal crops. It ranks first in the world. It is the most valuable staple food for world population. Wheat occupied more than 36.3 of the total cropped area of Pakistan (Agricultural Statistics of Pakistan, 2004). Enormous gap have been observed between the yields harvested from the farmer's field in Khyber Pakhtunkhwa i.e. in the average is 1832 kg ha^{-1}, compared to 2500 kg ha^{-1}, in Punjab whereas the potential yield of Pakistani wheat cultivars above 6000 kg ha^{-1}. Being a major food crop of Pakistan, it is cultivated on large scale. The global challenge for food security is to increase grain yield while maintaining its quality. There are many reasons attributed to the gap between the actual and potential yield including proper time of sowing, weed infestation, water shortage, low quality seeds, and imbalance uses of fertilizers. The most important factor according to Fageria et al. (1997) is the supply of adequate amount of nutrients to the wheat for increase crop production. For bumper crop production, the balanced and proper amount of fertilizer application is considered a key factor (Tariq et al., 2007). Wheat yield responses to balance application of N: P has been recorded by the David et al. (2003).

Ahmad (1998) reported significant yield increases with the application of P in all the five majors crops grown in Pakistan i.e. wheat, rice, maize cotton and sugarcane.

Nitrogen is an integral component of many compounds and associated with photosynthetic activity. It is an essential component of amino acids and related proteins. Nitrogen is essential for carbohydrates use within plants and stimulates root development as well as the uptake of other nutrients Khan et al. 2014. Similarly more than 1200 to 1800 kg ha^{-1} extra grains over nitrogen alone have been observed with the addition of 60 kg ha^{-1} P_2O_5 (Tandon, 1992). Inadequate and unbalance use of phosphatic fertilizers is considered the most important among several constraints to increase yield per unit area in Pakistan.

Potassium improved photosynthetic activity and transport to the ripening grains, and has active role in bio-chemical functions of plant e.g. activation of various enzymes, protein, formation, carbohydrates and fat concentration, tolerance to drought and resistance to frost, lodging, pests and disease attack.

While application of adequate quantities of plant nutrients is a key to increased crop productivity, recommendations of fertilizer application rates for any particular crop are very general. Factors affecting soil fertility and hence crop yield and quality are site specific (Bhatti et al., 1993) and generalization of fertilizers recommendation rate may lead to unbalanced and inefficient use of these costly fertilizers. This practice would in poor economic return to the farmers and in some cases even degradation of soil and other natural resources. For example when N fertilizer is used in excess, it may lead to the removal of P and K that are not replenished by the addition of fertilizer nutrients and may lead to loss of fertility or soil degradation. In Pakistan majority of farmers are small land holders and usually adopt different cropping systems for their respective fields and thus the variability of soil plant nutrients may vary from field to field. In this scenario, site specific crop nutrient recommendation seems necessary (Khattak, 1992), and may not only lead to farmers' profitability but also reduces the environmental impact of fertilizers application. However, to follow this approach each field may be treated as a single management unit.

Field specific or site-specific fertilizer management for wheat, for example, may be wise way of helping farmers to apply fertilizer to their fields rationally. Although a review of the literature or a soil survey map may be useful in getting information about physical and chemical values of any particular soil or soil series but for site-specific fertilizer management, average values may not be adequate. Instead actual physical and chemical measurements from a field may be needed.

Keeping in view importance of fertilizers especially NPK the present study was planned to investigate better wheat variety in terms of better utilization and response to various application of fertilizers.

Materials and methods

Field experiment was conducted to screen wheat varieties under recommended dose of NPK fertilizer at New Developmental Farm (NDF), The University of Agriculture Peshawar, Pakistan during 2014-2015. Eight wheat varieties namely, PR-103, Saleem-2000, Tatara-96, Persabak-2004, Ghaznavi-98, Siren-2008, Lasani-08 and AAS-11 were tested in Randomized Complete Block Design(RCBD) with 3 replication. Recommended dose of NP and K @ 120, 90 and 60 kg ha^{-1}, respectively was applied using as urea, SSP and SOP fertilizers. Sowing was done on November 25, 2014 with the help of drill. First irrigation was applied after 20 days of sowing and subsequent irrigation were applied as per need of the crop and soil. All P, K with half N were applied during seedbed preparation. The remaining half N was applied with 2^{nd} and 3^{rd} irrigations. Recommended agronomic operations were strictly followed throughout growing period for optimum crop growth and development.

Results and discussion

An experiment was conducted at Agronomy Research Farm (ARF), The University of Agriculture Peshawar during 2014-2015 to investigate the performance of different varieties of wheat under recommended dose of NPK fertilizers.

Physico-chemical properties of soil before crop sowing

Table 1 shows data about physico-chemical properties of the soil. The soil under study was silty clay loam in texture, highly calcareous containing 17 % lime, alkaline

in reaction with pH 8.2, having extractable K (90 mg K kg^{-1}), low in organic matter (0.86 %) and marginal in AB-DTPA extractable P (5.5 mg P kg^{-1}) (Table 1).

Emergence m^{-2}

Statistical analysis of the data showed that emergence m^{-2}, was significantly different for various wheat varieties under the recommended dose of NPK fertilizer. Data in (Table 2) showed that maximum emergence m^{-2} was noted for PR-103 i.e. 86.3 followed by Ghaznavi (71.66) as compared to the lowest recorded in variety AAS-11 (21.33). These results are like with those of Amin et al. (2013) who observed maximum emergence m^{-2} by applying recommended fertilizer of N, P and K at the rate of 120, 90 and 60 kg ha^{-1} respectively.

Tillers m^{-2}

Data showed in (Table 2) that tillers m^{-2}, was significantly different for different wheat varieties. Maximum tiller m^{-2}, was recorded in Ghaznavi-98 i.e., (342.33) followed by Tatara-96 which is (328.67) as compared to the lowest value recorded in variety Pirsabaq-2004 i.e., (175.67). Similar results were also recorded by Husnain and Shah (2011) by applying recommended dose of N, P and K fertilizer at the rate of 120, 90 and 60 kg ha^{-1}, respectively.

Table 1. Physico-chemical properties of the experimental plot before sowing.

Parameter	Value
pH	8.2
Lime	17 %
Organic matter	0.86 %
AB-DTPA extractable K	90 mg kg^{-1}
AB-DTPA Extractable P	5.5 mg kg^{-1}
Texture	Silty clay loam

Table 2. Mean value of emergence m^{-2}, tillers m^{-2} and plant height of different wheat varieties tested at recommended dose of NPK.

Varieties	Emergence m^{-2}	Tiller m^{-2}	Plant height (cm)
PR-103	86.3a	251.67 d	93.86a
Saleem-2000	41.00e	308.67 c	81.83d
Tatara-96	47.00d	328.67 d	92.36ab
PS-2004	37.00f	172.67 f	88.20c
Gaznavi-98	71.66b	342.33 a	71.50e
Siren-2008	69.6c	241.33 e	90.50bc
Lasani-08	69.33bc	245.67 e	84.16d
AAS-11	21.33g	175.67 f	83.83d
LSD ($p \leq 0.05$)	5.83	5.83	3.15

Mean values of the same category followed by different letters are significant at $p \leq 0.05$

Plant height (cm)

The statistical data related to plant height (Table 2) showed that maximum plant height was recorded in PR-103 i.e. (93.86 cm) followed by Tatara-96 i.e. (92.36 cm) and the lowest value was recorded in Ghaznavi which is (71.50 cm).

Days to anthesis

The Statistical analysis related to days to anthesis (Table 3) showed that the maximum value of days to anthesis was recorded in Tatara-96 i.e. (121.67) followed by Saleem-2000 which is (121.33) as compared to the lowest value recorded in variety PR-103 which is (112.67). Similar results were found by Ahmad (1998).

Spike m^{-2}

From (Table 3) statistical analysis of the data showed that spike m^{-2}, was significant different for various wheat varieties. Data showed that maximum spike m^{-2}, was recorded in PR-103 i.e. (222.00) followed by Tatara-96 which is (180.00) while the lowest value was recorded in ASS-11 variety i.e. (127.00). These results are like with those of Ali et al. (2013).

1000 grain weight (kg ha^{-1})

Statistical analysis (Table 4) revealed that thousand grains weight was significant in different varieties of wheat. Maximum value was recorded in PR-103 i.e.(75.33g) followed by Pirsabaq-2004 which is (62.66g) while the lowest data was recorded in ASS-11 variety which is (44.33g). Similar results were found by Amin et al. (2013).

Biological yield (g)

The Statistical analysis showed in (Table 4) that the biological yield (kg ha^{-1}) was significantly different for different wheat varieties. Maximum biological yield was noted in PS-2004 i.e. (17105 kg ha^{-1}) followed by Siren-2008 which was (16203 kg ha^{-1}), while minimum was recorded for Gaznavi-98 which was (9345 kg ha^{-1}).

Table 3. Mean value for days to anthesis and spike m^{-2}, of different wheat varieties tested at recommended dose of NPK.

Varieties	Days to Anthesis	Spike m^{-2}
PR-103	112.67e	222.00 a
Saleem-2000	121.33ab	153.00 c
Tatara-96	121.67a	180.00 b
PS-2004	118.67bc	179.00 b
Gaznavi-98	116.33cd	171.00 b
Siren-2008	115.00d	146.00 c
Lasani-08	116.00cd	154.00 c
AAS-11	116.33cd	127.00 d
LSD(p≤0.05)	3.04	11.824

Table 4. Mean values of 1000 grain weight and biological yield m^{-2}, of different wheat varieties tested at recommended dose of NPK.

Varieties	1000 grain weight (g)	Biological yield (kg ha^{-1})
PR-103	75.33a	10230f
Saleem-2000	52.66cd	15700ab
Tatara-96	61.33b	12302d
PS-2004	62.66b	17105a
Gaznavi-98	61.66b	9345g
Siren-2008	50.00d	16203b
Lasani-08	53.33c	13102e
AAS-11	44.33e	10567c
LSD(p≤0.05)	3.26	0.12

Mean values of the same category followed by different letters are significant at p≤0.05.

The lowest value was recorded in Ghaznavi-98 i.e. (9345 kg ha^{-1}). These results are in conformity with those of Hassan et al. (2013).

Grain yield (kg ha^{-1})

Statistical analysis of the data showed that grain yield was significantly different in various wheat varieties under the recommended dose of NPK fertilizer. Data in (Table 5) showed that maximum grain yield was noted for PR-103 i.e. (2680 kg ha^{-1}) followed by Tatara-96 (2455kg ha^{-1}) as compared to the lowest recorded in variety AAS-11 (2143 kg ha^{-1}). These results are like with those of Amin et al. (2013) who observed maximum grain yield by applying recommended fertilizer of N, P and K at the rate of 120, 90 and 60 kg ha^{-1} respectively.

Table 5. Mean values of Grain Yield kg ha^{-1} of different wheat varieties tested at recommended dose of NPK.

Varieties	Grain yield (kg ha^{-1})
PR-103	2680a
Saleem-2000	2235cd
Tatara-96	2455b
PS-2004	2415b
Gaznavi-98	2395b
Siren-2008	2200d
Lasani-08	2285c
AAS-11	2143e

Conclusions

Following conclusion could be drawn from the results of this experiment. Among varieties of wheat PR-103 showed better results for plant height, emergence m^{-2}, spike m^{-2}, 1000 grain weight and grain yield. Days to anthesis were higher in wheat variety (Tatara-96). Similarly Tillers m^{-2}, was higher in Ghaznavi-98 and biological yield (kg ha^{-1}) was maximum in Pirsabaq-2004 variety of wheat.

Recommendations

On the basis of findings, following are suggested recommendations. Further studies are suggested to investigate (PR-103) variety of wheat on national level as well as on regional level under recommended dose of N, P and K fertilizer at the rate of 120, 90 and 60 kg ha^{-1}, for parameters like emergence m^{-2}, plant height, spike m^{-2}, days to anthesis, 1000 grain weight and grain yield.

Conflict of interest statement

Authors declare that they have no conflict of interest.

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