

RESEARCH NOTE

WHEAT PRODUCTION AND QUALITY AFFECTED BY DIFFERENT COMBINATIONS OF FERTILIZER NP AND FARM YARD MANURE IN RAINFED AREA

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ABSTRACT: The study was conducted at the National Agricultural Research Centre, Islamabad to assess the effects of different combinations of fertilizer nitrogen (N) and phosphorous (P) with or without farm yard manure (FYM) on yield, yield components and as well as on the grain quality parameters of wheat. Nutrient treatments included full fertilizer NP (100:100:00), full fertilizer NP + FYM (100:100:20), half- fertilizer NP (50:50:00), half- fertilizer NP + FYM (50:50:20), FYM only (00:00:20) and control (00:00:00). N & P were applied in kg ha⁻¹ and FYM in t ha⁻¹. Wheat variety, Chakwal-86 was planted in randomized complete block design (RCBD) with four replications. Because of different combinations of fertilizer NP and FYM, statistically significant differences in biological yield, grain yield and yield components of wheat were recorded. Maximum wheat grain yield of 4083 kg ha⁻¹ was obtained with the application of full fertilizer and FYM. Minimum grain yield and biological yield were recorded with no fertilizer and only FYM application. Different combinations of fertilizer NP with and without FYM did not have any significant effect on quality parameters i.e., test weight, PSI and percent flour yield.

Key Words: Wheat; Rainfed; Fertilizers; Farm Yard Manure; Production; Quality; Yield Components; Pakistan.

INTRODUCTION

In rainfed area of Pakistan, wheat (*Triticum aestivum* L.) is planted over 1.18 million hectares (mha) with an annual production of 1.32 million tonnes (mt). Average wheat yield in rainfed area is 1124 kg ha⁻¹ (MINFAL, 2007-08) which is far below than the potential yield of semi dwarf wheat cultivars.

Wheat productivity in the rainfed region is low due to scarcity of moisture at planting, low soil fertility and inefficient management practices. Soils of the region are low in soil organic matter contents that affect soil fertility and soil structure. Application of farm manure ameliorates the soil permeability (Bhatti et al., 1977) and improves soil fertility. Application of FYM, or sesbania green manure with urea in comparison with urea alone improved N recovery as well as N uptake (Goyal et al.,

1992). Soil compaction can be decreased with the use of soil organic matter (Angers and Simard, 1986; Avnimelech and Cohen, 1988). Application of organic materials alone or in combination with inorganic fertilizer helped in the proper nutrition and maintenance of soil fertility (Talashiker and Renal, 1986; Salim and Hassan, 1988). Hussain et al. (1988) reported that the efficiency of chemical fertilizers increased with the use of organic manures. Similarly beneficial effects of farmyard manure on crop production through improved fertility and physical properties of soil are an established fact (Singh and Sarivastove, 1971).

Salah (2005) observed that application of nitrogen fertilizer in combination with manure improved protein content as well as protein quality of winter wheat in comparison with only nitrogen fertilizer appli-

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cation. The present study was conducted to assess the effects of different combinations of nitrogen and phosphorus fertilizers with or without FYM on yield, yield components and different quality parameters of wheat grain under the rainfed condition of Pothwar region in Pakistan.

MATERIALS AND METHODS

This study was conducted at the National Agricultural Research Centre (NARC) Islamabad during 1995-96. Soil of the experimental area classified as loam, moderately well drained with pH of 8.0 and having organic matter 0.9%, Nitrate - N, 21.3 mg kg⁻¹; extractable P, 3.2 mg kg⁻¹ and K, 86 mg kg⁻¹. Field was thoroughly prepared with disk plow and cultivator. The trial was laid out in RCBD with six nutrient treatments, four replications and keeping plot size 10m × 3m. Nutrient treatments included N (kg ha⁻¹) from urea and DAP fertilizer: P (kg ha⁻¹) from DAP fertilizer: FYM (t ha⁻¹). Six treatments i.e., full fertilizer NP (100:100:00), full fertilizer NP + FYM (100:100:20), half- fertilizer NP (50:50:00), Half- fertilizer NP + FYM (50:50:20), FYM only (00:00:20) and control (00:00:00). All of fertilizers and farmyard manure were applied at the time of planting and incorporated by plowing with cultivator and sohaga. Wheat variety, Chakwal-86 was planted by Wintersteiger wheat planter on November 16, 1995, with row spacing of 25 cm and seed rate of 100 kg ha⁻¹. Wheat biomass samples were taken from plots and air dried till constant weight at 88 and 115 days after planting. At harvesting, data regarding number of tillers m², plant height (cm),

spike length (cm), biological yield (t ha⁻¹), grain yield (t ha⁻¹) and 1000 kernel weight (g) were recorded. Wheat grain samples were analyzed for quality parameters such as: test weight (kg hl⁻¹), particle size index (PSI), ash (%) and flour yield (%) according to the methods as described by AACC (1983) and Williams et al. (1986). The data was analyzed by using the procedures as described by Steel and Torrie (1980) while means were compared by using the Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Maximum biomass weights at different growth stages were recorded with full fertilizer NP application without FYM, while minimum dry weights at different growth stages were recorded in control plots (Table 1). Due to better plant growth (Table 1), application of chemical fertilizer NP with or without FYM significantly ($P \leq 0.05$) increased the biological yield of wheat crop in comparison with no fertilizer NP and only FYM application (Table 2). The findings were in confirmation with Shah and Ahmad (2006) who reported significant increase in the biological yield of wheat with the application of fertilizer in combination with FYM.

Because of better tillering, spike length and plant growth, significantly higher grain yield with full fertilizer NP application with and without FYM were observed (Table 2). Application of full fertilizer NP with FYM had maximum wheat grain yield in the trial, which could be attributed to improvement of efficiency of

Table 1. Effect of different combinations of fertilizer NP and FYM on air dried wheat biomass (kg ha⁻¹) during wheat growth period

Treatments (N:P:FYM)	Air dried biomass	
	88 DAP (kg ha ⁻¹)	115 DAP (kg ha ⁻¹)
Full fertilizer NP (100:100:00)	175a	507a
Full fertilizer NP + FYM (100:100:20)	165ab	464a
Half fertilizer NP (50:50:00)	165ab	344b
Half fertilizer NP + FYM (50:50:20)	173a	341bc
FYM (00:00:20)	112bc	240bc
Control (00:00:00)	111c	222d

Means followed by same letters do not differ significantly at $P \leq 0.05$

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Table 2. Effect of different combinations of fertilizer NP and FYM on the yield and the yield components of wheat crop

Parameter	Full fertilizer NP (100:100:00)	Full fertilizer NP+FYM (100:100:20)	Half- fertilizer NP (50:50:00)	Half- fertilizer NP + FYM (50:50:20)	FYM (00:00:20)	Control (00:00:00)
Tillers m ⁻²	141ab	159a	138abc	107cd	101d	112bcd
Plant height (cm)	88a	85ab	71c	79b	70c	68c
Spike length (cm)	8.9a	9.1a	8.7a	8.9a	7.9ab	7.3b
1000 kernel weight (g)	38.2a	37.0a	34.5a	35.4a	34.1a	31.5a
Biological yield (kg ha ⁻¹)	13110a	12080a	8575b	8792b	6375c	6216c
Grain yield (kg ha ⁻¹)	3600b	4083a	2883c	2545cd	2250d	2108d

Means followed by same letters do not differ significantly at P ≤ 0.05

Table 3. Effect of different combinations of fertilizer NP and FYM on the yield and the yield components of wheat crop

Parameter	Full fertilizer NP (100:100:00)	Full fertilizer NP+FYM (100:100:20)	Half- fertilizer NP (50:50:00)	Half- fertilizer NP + FYM (50:50:20)	FYM (00:00:20)	Control (00:00:00)
Test weight (kg ha ⁻¹)	71.7a	70.6a	71.1a	70.4a	72.0a	71.3a
PSI	37.0a	38.0a	38.5a	39.0a	38.0a	36.8a
Ash (%)	1.4b	1.5a	1.5a	1.5a	1.5a	1.5a
Flour yield (%)	52.9a	52.2a	52.7a	51.9a	52.5a	52.4a

Means followed by same letters do not differ significantly at P ≤ 0.05

chemical fertilizers (Talashiker and Renal, 1986; Salim and Hassan et al., 1988). On the other hand, application of FYM only and no fertilizer treatment had lower wheat grain yield that could be attributed to deficiency of required plant nutrients to wheat in these plots.

Grain Quality Parameters

The grain quality parameters namely 1000 kernel weight (TKW), test weight (bulk density), PSI (grain hardness) and flour yield (milling quality) were not affected by different combinations of fertilizer NP with and without FYM, however, grain ash was lower with full fertilizer NP fertilizers application in comparison with other treatments (Table 3). PSI (grain hardness) is a genetic varietal character, which increases with increased nitrogen fertility levels, but this increase is unstable in nature (Svensson, 1981). Shuey and Gilles (1972) reported that kernel size, shape and plumpness influences endosperm percentage and hence found significant correlation (0.65) between flour yield and total

kernel weight. In present study TKW (although differing non significantly) is decreasing with the decreasing nitrogen application from 38.2 g to 31.5g showing a fair variation in grain size which is reflected in corresponding ash content and decreasing flour yield trends.

This study indicates that wheat crop yield and yield components were influenced positively by the application of fertilizers. Application of FYM further enhanced the efficiency of the applied chemical fertilizers. Grain quality parameters like grain weight, test weight, grain hardness and flour yield were affected non-significantly by different combinations of fertilizers and FYM.

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