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Yield and quality of wheat (*Triticum aestivum* L.) influenced by NPK levels, Sulphur levels and FYM

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Abstract

An experiment on wheat was conducted at student research farm at Nawabganj, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur during *Rabi* season 2014-15. To investigate the effect of NPKS and FYM on yield and quality of wheat which is combination of nine treatments and four replication under RBD by using variety *PBW-343*. The result showed that the grain yield varied from 32.0 to 49.0 q ha⁻¹ and straw from 44.0 to 66.5 q ha⁻¹. The nitrogen content in grains varied from 1.80 to 2.10% and phosphorus 0.33 to 0.46%. It was observed that nitrogen uptake in wheat grain varied from 57.6 to 102.9 kg ha⁻¹ and in straw 19.36 to 38.57 kg ha⁻¹. The phosphorus uptake varied from 10.56 to 22.54 and 4.40 to 11.97 kg ha⁻¹ in grain and straw respectively. The protein content varied from 10.26 to 11.97 % in grain. The treatment T₉ (150 Kg N+ 75Kg P₂O₅+ 75 Kg K₂O +40kg S +FYM (5 t ha⁻¹) gave best results in terms of yield, nutrient and protein, content and uptake value.

Keywords: FYM, NPK, Nutrient uptake, sulphur, wheat

Introduction

Wheat is Asia's second most important staple food and its consumption has been increasing much faster than that of rice. Wheat yield for the last four years (2000-2003) has stagnated (Rajaram *et al.*, 2007) [13] and there has been a wide gap between the target and actual production (Pathak *et al.*, 2003) [8]. Due to food crises all over the world and increasing population pressure there is an urgent need to increase the quantity and improve the quality of grains. Wheat yield and quality are varied with amount and sources of fertilization used during cultivation. The application of FYM is necessary to improve the soil quality and to sustain the wheat productivity in rainfed areas (Abrol *et al.*, 2010) [1]. The residual effect of FYM with fertilizers was significant on succeeding wheat crop and on NPK uptake by crop (Rathore *et al.*, 1995) [12]. The application of N increased grain yield of wheat significantly over control and the extent of increase was 9.18 gm. plot⁻¹ with 200 mg. N Kg⁻¹ Over control (Duhan *et al.*, 2006) [5]. A higher values for raw protein were found in the case of maximum dose of nitrogen fertilizers. The increase of phosphorus and potassium fertilizer doses influenced in significantly on the nitrogen content of grains (Crista *et al.*, 2012) [4]. The application of K increased significantly the N, P, K, S and Zn content in grain and straw whereas the increasing levels of Zn increased N, K, S and Zn content in grain and straw indicating the enhancement in nutritional quality of wheat produce (Majumdar *et al.*, 2012) [10].

Materials and Methods

The experiment was conducted at student's research farm at Nawabganj Chandra Shekhar Azad University of Agriculture and Technology, Kanpur during *Rabi* season 2014-15. The experimental field located between the latitude of 25°28' to 26°58' north and 79°31' to 80°34' east with an elevation of 125.9 m from the sea level while the average rainfall during crop season is 7.25 mm, the experiment comes under sub-tropical and semi-arid zone. The experiment was aimed to know the effect of balance use of NPK, FYM and Sulphur on yield quality and uptake of wheat. The soil of experimental field was sandy loam in texture with basic in reaction (pH- 8.10), high in organic matter (0.44 %), low in Nitrogen (251 kg ha⁻¹) and Sulphur (9.80 kg ha⁻¹), medium in P (14 kg ha⁻¹) and K (138 kg ha⁻¹). The experiment was laid out in Randomized block design by using *PBW-343* which consist of nine treatment and four replication having a plot size 5x4 m = 20sq.m. The treatments were T₁ (control), T₂ (120 kg N + 60 kg P₂O₅ + 40 kg K₂O), T₃ (120 kg N + 60 kg P₂O₅ + 40 kg K₂O + 40 Kg S), T₄ (120 kg N + 60 kg P₂O₅ + 40 kg K₂O +FYM 5 t ha⁻¹),

T₅ (120 kg N + 60 kg P₂O₅ + 40 kg K₂O + 40kg S +FYM 5 tha⁻¹), T₆ (150 Kg N + 75 Kg P₂O₅ + 50 Kg K₂O), T₇ (150 kg N + 75 kg P₂O₅ + 50 kg K₂O + 40 Kg S), T₈ (150 Kg N + 75Kg P₂O₅ + 50 Kg K₂O + FYM 5 tha⁻¹), T₉ (150 Kg N+ 75Kg P₂O₅ + 75 Kg K₂O + 40kg S +FYM(5 t ha⁻¹). The sources of fertilizer were Urea, DAP, MOP and elemental Sulphur while FYM used as organic source. The half dose of the nitrogen and full dose of the phosphorus, potassium, and sulphur were applied before sowing while FYM was applied 15 days before the sowing and remaining amount of nitrogen was applied through top dressing after 25 days of date of sowing. The popular recommended variety of wheat PBW-343 was sown in mid of November 2014 at a seed rate of 100 kg ha⁻¹ by using seed drill. The observation were recorded *viz.*, Grain yield (q ha⁻¹), Straw Yield(q ha⁻¹), Nutrients content in wheat grain (%), Nutrient content in straw (%), nutrient uptake(kg ha⁻¹), Protein (%) and lysine (%) in wheat grain. The analysis of data was performed by the method given by Chandel (1990). for determination of nutrient content Nitrogen was determined by Kjeldal' smethod as described by Jackson (1967) [6], Phosphorus was determined calorimetrically (Chapman and Pratt, 1961) [2] in a di acid extract according to Jackson (1967) [6], Potassium was determined by flame photometric method (Chapman and Pratt, 1961) [2] in sodium acetate and acetic acid buffer as outlined by Jackson (1967)

[6], Sulphur was determined by turbidimetric method as described by Chesnin and Yien (1956). To analyze the quality of wheat protein content calculated by Total nitrogen content was estimated using Kjeldal'smethod (Jackson, 1967) [6] and the value obtained for each sample was multiplied with the factor 5.70 to obtain protein content and Lysine is determine by Calorimetric method as described by Tsai *et al.* (1972). The nutrient uptake was computed by using standard formula.

Table 1: Effect of NPK levels, sulphur levels and FYM on yield quality parameters of wheat

Treatment	Yield(q ha ⁻¹)		Protein (%)	Lysine (%)
	Grain	Straw		
T ₁	32.0	44.0	10.26	3.04
T ₂	42.5	54.2	10.60	2.86
T ₃	43.2	55.6	10.71	2.84
T ₄	44.0	57.0	10.77	2.83
T ₅	44.8	58.5	10.83	2.81
T ₆	46.0	59.6	11.28	2.78
T ₇	47.2	61.2	11.40	2.76
T ₈	48.2	64.8	11.68	2.72
T ₉	49.0	66.5	11.97	2.70
SE (d)	0.555	1.886	0.019	0.019
C.D	1.152	3.916	0.040	0.039

Table 2: Effect of NPK levels, sulphur levels and FYM on nutrients uptake of wheat

Treatment	Nutrient uptake (Kg ha ⁻¹)							
	N		P		K		S	
	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
T ₁	57.6	19.36	10.56	4.40	6.08	80.96	3.20	5.28
T ₂	79.05	24.93	15.30	5.96	8.92	102.98	4.67	7.58
T ₃	81.21	26.12	16.41	6.67	9.50	107.86	5.18	8.89
T ₄	83.16	27.36	17.16	7.98	10.12	112.86	4.40	9.69
T ₅	85.12	29.25	17.92	8.77	10.75	120.51	6.72	10.53
T ₆	91.08	30.99	19.32	9.53	11.50	126.35	7.36	11.32
T ₇	94.4	32.43	20.29	9.79	12.27	132.80	8.49	12.85
T ₈	98.81	36.28	21.20	11.01	12.53	143.85	9.64	14.25
T ₉	102.9	38.57	22.54	11.97	13.72	150.29	10.78	15.29
SE (d)	1.76	0.96	0.69	1.09	0.60	0.62	0.53	0.59
C.D.	3.66	2.00	1.44	2.26	1.26	1.29	1.10	1.24

Results and Discussion

Effect on yield

Among the different combination of fertility, Sulphur and FYM, application of T₉ (150 Kg N+ 75Kg P₂O₅+ 75 Kg K₂O + 40kg S +FYM 5 t ha⁻¹) was recorded significantly the highest grain and straw yield as compare to T₇ (150 kg N + 75 kg P₂O₅ + 50 kg K₂O + 40 Kg S), T₆ (150 Kg N + 75 Kg P₂O₅ + 50 Kg K₂O), T₅ (120 kg N + 60 kg P₂O₅ + 40 kg K₂O + 40kg S +FYM 5 tha⁻¹), T₄(120 kg N + 60 kg P₂O₅ + 40 kg K₂O +FYM 5 t ha⁻¹), T₃ (120 kg N + 60 kg P₂O₅+ 40 kg K₂O + 40 Kg S), T₂ (120 kg N + 60 kg P₂O₅ + 40 kg K₂O), and T₁ (control), respectively and it were at par with T₈ (150 Kg N + 75Kg P₂O₅+ 50 Kg K₂O + FYM 5 t ha⁻¹) (Table-1). The similar result also reported by Zia *et al.* (2007) [15], Khan *et al.* (2011) [9], Zhang *et al.* (2011) [14].

Effect on quality parameters

Protein

An application of T₉ (150 Kg N + 75Kg P₂O₅+ 75 Kg K₂O + 40 kg S +FYM 5 t ha⁻¹) was recorded significantly the highest protein percent in grain as compare to T₇ (150 kg N + 75 kg P₂O₅ + 50 kg K₂O + 40 Kg S), T₆ (150 Kg N + 75 Kg P₂O₅ + 50 Kg K₂O), T₅ (120 kg N + 60 kg P₂O₅ + 40 kg K₂O + 40kg

S +FYM 5 tha⁻¹), T₄(120 kg N + 60 kg P₂O₅ + 40 kg K₂O +FYM 5 t ha⁻¹), T₃ (120 kg N + 60 kg P₂O₅+ 40 kg K₂O + 40 Kg S), T₂ (120 kg N + 60 kg P₂O₅ + 40 kg K₂O), and T₁ (control), respectively and it were statistically at par with T₈ (150 Kg N + 75Kg P₂O₅+ 50 Kg K₂O + FYM 5 t ha⁻¹) (Table-1). Results are corroborated with the research finding of Majumdar *et al.* (2012) [10], Crista *et al.* (2012) [4], Madan *et al.* (2009) [11].

Lysine

Among the different treatment combinations, application of T₁ (control), was recorded significantly the highest lysine percent in grain as compare to T₂ (120 kg N + 60 kg P₂O₅ + 40 kg K₂O), T₃ (120 kg N + 60 kg P₂O₅+ 40 kg K₂O + 40 Kg S), T₄(120 kg N + 60 kg P₂O₅ + 40 kg K₂O +FYM 5 t ha⁻¹), T₅ (120 kg N + 60 kg P₂O₅ + 40 kg K₂O + 40kg S +FYM 5 tha⁻¹), T₆ (150 Kg N + 75 Kg P₂O₅ + 50 Kg K₂O), T₇ (150 kg N + 75 kg P₂O₅ + 50 kg K₂O + 40 Kg S), T₈ (150 Kg N + 75Kg P₂O₅+ 50 Kg K₂O + FYM 5 t ha⁻¹) and T₉ (150 Kg N+ 75Kg P₂O₅+ 75 Kg K₂O + 40kg S +FYM 5 t ha⁻¹), respectively (Table-1). The similar results are also reported by Majumdar *et al.* (2012) [10], Crista *et al.* (2012) [4], Madan *et al.* (2009) [11].

Effect on NPK and S uptake

Data clearly indicated that nitrogen, phosphorus, potassium and sulphur uptake in grain and straw enhanced significantly with each increment of fertility level, sulphur level and FYM and it recorded highest with the application of T₉ (150 Kg N + 75Kg P₂O₅+ 75 Kg K₂O + 40 kg S +FYM 5 t ha⁻¹) followed by same was T₈ (150 Kg N + 75Kg P₂O₅+ 50 Kg K₂O + FYM 5 t ha⁻¹), T₇ (150 kg N + 75 kg P₂O₅ + 50 kg K₂O + 40 Kg S), T₆ (150 Kg N + 75 Kg P₂O₅ + 50 Kg K₂O), T₅ (120 kg N + 60 kg P₂O₅ + 40 kg K₂O + 40kg S +FYM 5 tha⁻¹), T₄(120 kg N + 60 kg P₂O₅ + 40 kg K₂O +FYM 5 t ha⁻¹), T₃ (120 kg N + 60 kg P₂O₅+ 40 kg K₂O + 40 Kg S), T₂ (120 kg N + 60 kg P₂O₅ + 40 kg K₂O), and T₁ (control), respectively (Table-1). Similar kind of results has been reported by Parihar and Tiwari, (2001) [7], Rathore *et al.* (1995) [12].

Conclusion

It may concluded that, application of T₉ (150 Kg N + 75Kg P₂O₅+ 75 Kg K₂O + 40 kg S + FYM 5 t ha⁻¹) recorded maximum grain and straw yield, and its obtained maximum nutrient uptake values and protein contents.

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