

Effect of Integrated Nutrient Management on Yield and Nutrients Uptake of wheat and Soil Health

Reena, S.B. Pandey, D.D. Tiwari, R.C. Nigam, Ajay Kumar Singh¹ & Sateesh Kumar

Department of Soil Science and Agricultural Chemistry

C.S.A. University of Agriculture and Technology Kanpur-208002, India

Corresponding Author: reenakumari8617@gmail.com

ABSTRACT

The present research was conducted for two years 2013-14 and 2014-15 at Crop Research farm Nawabganj, C.S. Azad University of Agriculture & Tech Kanpur to study the effect of each FYM, Sulphur and Boron single with 100% Recommended NPK ($N_{150}P_{60}K_{60}$) and their combine effect with 75% NPK of recommended NPK. There are six treatments combination i.e. T_1 -Control, T_2 - $N_{150}P_{60}K_{60}$, T_3 - $N_{150}P_{60}K_{60}$ +FYM 10t ha^{-1} , T_4 - $N_{150}P_{60}K_{60}$ +40kg Sha^{-1} , T_5 - $N_{150}P_{60}K_{60}$ +1.5 kg B ha^{-1} and T_6 - 75% NPK+40kg S ha^{-1} + 1.5 kg B ha^{-1} + 10t FYM. It is evident from the result that single application of FYM, sulphur and boron with $N_{150}P_{60}K_{60}$ significantly increased grain yield and straw yield of wheat over sole use of $N_{150}P_{60}K_{60}$. Grain & straw yield further increased when FYM, sulphur and boron conjointly used with 75% NPK over other treatments, but increase was non-significant. Highest grain yield 44.82 q ha^{-1} and straw 55.00 q ha^{-1} were recorded at T_6 (75% NPK +S+B+10tFYM ha^{-1}) NPK S and B uptake significantly increased with the use of FYM+S+B with 75% NPK over sole use of $N_{150}P_{60}K_{60}$. Maximum NPKS and B uptake noted with T_6 (75%NPK+S+B+FYM).

Keywords: INM, NPK, Nutrient uptake

Received 02/07/2017

Revised 12/07/2017

Accepted 31/08/2017

Citation of this article

Reena, S.B. Pandey, D.D. Tiwari, R.C. Nigam, A K Singh & S Kumar. Effect of Integrated Nutrient Management on Yield and Nutrients Uptake of wheat and Soil Health. Int. Arch. App. Sci. Technol; Vol 8 [3] September 2017. 25-28.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is most staple and second most important crop after rice of the country which contributes nearly one third of total food grain production. More recently, a real challenge for the workers in agricultural research field to stop using the high rates of agrochemicals which negatively affect human health and environment. Large quantities of chemical fertilizers are used to replenish soil N, resulting in high costs and severe environmental contamination [1]. The wheat (*Triticum aestivum* L.) is grown all over India from the sea level up to an elevation of 3500 m in the Himalaya. The common bread wheat occupies more than 90% of the total wheat area along with 10% area under *Triticum durum* and its cultivation is common under rain fed condition only a large area has come in Punjab under irrigated condition due to high yielding varieties developed to obtain the foreign exchange. Nutrient elements of major significance for yield and quality of wheat are nitrogen, phosphorus, potash, sulphur and zinc for getting higher yield and better quality of wheat. It is essential to carry out research on soil fertilizers complex for ascertaining the nutritional requirement of this crop. The soil organism can have both positive and negative effects on soil quality. They play major role in soil functioning because of interaction with soil organic matter and the recycling of nutrients. The soil organism also interacts chemically and physically with soil mineral particles and soil water. In general, soil organism takes up and release nutrients, decompose organic substrates, produce soil gasses and promote soil aggregation [2]. therefore in a search for an alternative strategies to put apart the possible consequence of using increasing dose of inorganic fertilizers and to

ensure competitive yields of wheat and sustain soil health and fertility in this region, the present investigation was under taken to determine the effect of combined application of FYM, sulphur and boron either single with 100% NPK and conjoint use of all at 25% reduced level of NPK of recommend NPK on wheat yield, nutrients uptake and soil health.

MATERIALS AND METHODS

The field experiment was conducted in the Rabi season 2013-14 and 2014-15 at Crop Research farm Nawabganj Kanpur to test the effectiveness of integrated nutrient management on yield, nutrient uptake by wheat crop of variety PBW 550 and soil health. Six treatments were tested in randomized block design with three replications. The detail treatments tested in the present experiment are given in the abstract. The soil (0-15cm) of the experimental field was alluvial, sandy loam in texture, having electrical conductivity (EC) 0.76 dsm⁻¹, pH 7.8, organic carbon 0.43%, available sulphur 16.50 Kg ha⁻¹, Hot water soluble boron 0.45 mg kg⁻¹ and available NPK were 210, 13.50 and 132 kg ha⁻¹ respectively. Recommended dose of N₁₅₀P₆₀K₆₀ were applied as per treatment. Half dose of N, full dose of P, K, S & B were applied as per treatment as basal dressing. 1/2 N was applied in equal two split. FYM was applied @ 10t ha⁻¹ in the respective plots, 25 days before sowing. Sulphur 40 kg & boron 1.5 kgha⁻¹ were applied as per treatments for estimation of physico-chemical properties soil samples were collected at a depth of 0-15cm brought to the laboratory, dried in shade, ground to pass through 2 massive and immediately assayed for physico-chemical parameters. The soil pH was determined using soil: water ratio 1:2 by potentiometric method (Jackson 1973) organic carbon (OC). by (Walkley and Black 1934) available Nitrogen by alkaline permanganate method [3] Available P by Olsen *et.al* [4], available K by neutral normal ammonium acetate, extraction method [5], wheat grain & straw was first air dried and then oven dried at 60 OC. NPKS and boron content in grain & straw were analyzed by standard procedure.

RESULT AND DISCUSSION

Perusal of the data from Table 3, revealed that grain and straw yield increased significantly due to various treatments over control. Grain yield further increased significantly when N₁₅₀P₆₀K₆₀ combined single either with FYM, sulphur or boron over sole use of N₁₅₀P₆₀K₆₀. Reduced the dose of NPK of recommended dose (N₁₅₀P₆₀K₆₀) by 25% and combine with sulphur+ boron +FYM significantly increased grain yield over sole use of N₁₅₀P₆₀K₆₀ and also significant increased of straw yield over sole use of N₁₅₀P₆₀K₆₀ Highest grain 45.26 Qha⁻¹ & straw yield 56.94 Qha⁻¹ were noted with T₆ (75% NPK+S+B+10t FYM) The yield increased may be due to addition of individual FYM, sulphur or boron with 100% NPK (N₁₅₀P₆₀K₆₀), significantly influenced plant growth compared to sole NPK source as evidenced from Table-2. Increase grain & straw yield due to integrated use of FYM, sulphur and boron with 75% NPK may be due to synergistic effect of all inputs when combined together with 75% NPK. Similar results also reported by Reddy *et al* [10] Singh & Kumar [11] Deshpande *et al* [8].

Table :1 Effect of treatments on Grain & straw yield of wheat crop (Mean of two years)

Treatments	Yields q ha ⁻¹		
	Grain	Straw	Biological yield
T ₁ Control	27.29	34.11	61.40
T ₂ N ₁₅₀ P ₆₀ K ₆₀	40.80	52.25	93.05
T ₃ N ₁₅₀ P ₆₀ K ₆₀ +FYM	44.19	55.54	99.73
T ₄ N ₁₅₀ P ₆₀ K ₆₀ +Sulphur	43.64	54.78	99.42
T ₅ N ₁₅₀ P ₆₀ K ₆₀ +Boron	43.04	54.53	98.57
T ₆ 75%.NPK+Sulphur+Boron+10tFYM	45.26	56.94	102.20
CD (P=0.05)	2.96	3.66	

Nutrient uptake: It is clear from the table that the total(G+S) uptake of nutrients in question (NPKS&B) increased significantly due to various treatments over sole application of N₁₅₀P₆₀K₆₀ (T₂) during both years Maximum total uptake of NPK S&B were observed with T₆ (75% NPK +S+B+10t FYM) and the NPK and S uptake were 101.21,31.60,79.15 & 21.56

kg ha⁻¹ respectively during 1st year and corresponding uptake during 2nd year were 103.98,33.58,86.16,22.28 kgha⁻¹.The boron uptake were 771.85 & 803.36 gmha⁻¹ during 1st& 2nd year respectively at T₆.The increase in uptake may be due to release more native nutrients from the soil and transport to the plant body by combine use of S+B+FYM with 75%NPK. Similarly single use of sulphur, boron or FYM with 100% NPK (N₁₅₀P₆₀K₆₀) increased total nutrient uptake during both years. The results are correlated with the findings of Rathar & Sharma [6], [7]. This may be due to yield attributes and yield of wheat increased due to use S,B and FYM single with N₁₅₀P₆₀K₆₀& combine with 75% NPK and concentration of nutrient in grain & straw both increased with the use of S,B & FYM with inorganic fertilizer alone or conjoint use of all with 75% NPK. Nutrient uptake is a product of yield & concentration of nutrients. This finding is corroborate with the findings by Natan & Anurag [7] Roy *et al* [8] Deshpande *et al* [9].

Table :2 Effect of treatments on nutrient uptake by wheat crop for consecutive two years

Treat ment	Total uptake of Nutrients (Grain + Straw) (Kg ha ⁻¹)								Total uptake (g ha ⁻¹)	
	N 2013-14 2014-15		P		K		S		B	
	IY	IYY	IY	IYY	IY	IYY	IY	IYY	IY	IYY
T ₁	51.52	54.45	12.68	13.23	36.92	39.17	7.87	9.55	299.68	332.57
T ₂	83.68	87.40	25.03	25.66	59.14	60.91	13.07	13.87	279.25	562.56
T ₃	91.18	96.60	25.66	26.48	64.75	68.45	15.95	17.74	675.89	696.23
T ₄	95.20	93.78	27.44	27.51	68.41	66.94	19.63	20.04	615.68	656.50
T ₅	94.63	94.09	26.83	27.59	66.54	55.40	18.50	18.40	742.57	742.88
T ₆	101.21	103.98	31.60	33.58	79.15	86.16	21.56	22.85	771.85	803.36
CD(P=0.05)	5.036	6.148	1.875	2.231	3.533	3.733	1.888	2.319	96.137	114.183

Soil Health

Application of FYM sulphur and boron with N₁₅₀P₆₀K₆₀ tended to reduced soil PH and EC and increased percent organic carbon, available NPK, S and B in the soil of experimental field after harvest of the wheat crop, compared to sole use of N₁₅₀P₆₀K₆₀. Thus enhancement in nutrient status of soil may be due to increase plant biomass due single use of S,B & FYM with NPK. Available nutrients further increased due to combine use of sulphur, boron & FYM with 75% NPK. The positive response of FYM with S and B on available NPK, S and B may be attributed to mineralization of these nutrients from FYM. The most suitable soil conditions under organic sources might have helped the mineralization's of nutrients & leading to buildup higher NPK & B. Similar finding reported by Agarwal *et.al* [12].

Table :3 Effect of treatments on Soil properties after harvest of 2nd year wheat crop.

Treatments	PH	EC	OC (%)	Available nutrients(kg ha ⁻¹)		
				N	P ₂ O ₅	K ₂ O
T ₁ Control	7.8	0.25	0.43	209.00	13.05	135.00
T ₂ N ₁₅₀ P ₆₀ K ₆₀	7.7	0.24	0.44	213.00	15.18	146.00
T ₃ N ₁₅₀ P ₆₀ K ₆₀ +FYM	7.7	0.24	0.44	214.00	15.19	146.00
T ₄ N ₁₅₀ P ₆₀ K ₆₀ +Sulphur	7.6	0.23	0.44	218.00	14.20	147.00
T ₅ N ₁₅₀ P ₆₀ K ₆₀ +Boron	7.6	0.22	0.45	219.00	16.21	145.00
T ₆ N ₁₅₀ P ₆₀ K ₆₀ +S+B+FYM	7.4	0.23	0.46	223.00	18.90	149.00

CONCLUSION

On the basis of above experimental result it is concluded that FYM, Sulphur & boron in combination with fertilizers at 25% reduction in recommended NPK level would improve yield, nutrient uptake of wheat and sustain soil fertility in sandy loam soil of gangetic alluvial region of Uttar Pradesh.

REFERENCES

1. Dai J, Becquer T, Rouiller JH, Reversat G, Bernhard-Reversat F and Lavelle P (2004), Influence of heavy metals on C and N mineralization and microbial biomass in Zn, Pb, Cu, and Cd contaminated soils, *Applied Soil Ecology*, 25: 99-109
2. Powlson, D.S., Hirsch, P.R., Brookes, P.C., (2001). The role of soil microorganisms in soil organic matter conservation in the tropics. *Nutrient Cycl. Agroecosyst.* 61, 41e51.
3. Subbiah and Asija, G.S. (1956) a rapid procedure for the estimation of available nitrogen in soil. *Current Sci.* 25: 259-260.
4. Olsen, S.R; Cole, C.V; Watanabe, F.S. and Dean, L.A. (1954). Estimation of available phosphorus in soil by extraction with sodium bicarbonate. *Circ.US Dept. of Agric. Washington D.C.* 939.
5. Jackson, M.L. (1973). Soil chemical analysis. *Constable and Co. Ltd. London.* Khan, A.A. Jilani, G., Akhtar, M.S., Naqvi, S.M.S. and Rasheed, M. (2009) Phosphorus solubilizing bacteria: occurrence, mechanisms and their role in crop production. *Journal of Agricultural Biology Science*, 1, 48-58.
6. Rather, S.A. and Sharma, N.L. (2010). Effect of integrated nutrient management (INM) on productivity and nutrient in wheat and soil fertility. *Asian Journal of Soil Science*, 4 (2): 208-210.
7. Netam, U.P. and Anurag, C.R. (2011) Residual effect of organic and inorganic fertilizer nutrients on sulphur content and uptake in wheat crop under rice-wheat cropping system. *Journal of Soils and Crops*. 21 (10):82-85. *10 ref.*
8. Deshpande. A.N, Dalavi S.S. Pandey S.H., Bhalarao. V.P. and Gosavi AB (2015). Effect of Rock phosphate along with organic manures on soil properties, yield and nutrient uptake by wheat and chickpea. *Journal of the Indian society of soil science* 63(1) 93-99.
9. Roy M.De., Sarkar G.K., Das I, Karmakar, R and Saha T. (2017) Integrated use of Inorganic biological and organic manures on rice productivity, nitrogen uptake and soil health in Genetic alluvial soils of west Bengal. *Journal of the Indian society of soil science* 65(1) 72-79.
10. Reddy, A.R ; Singh, Balwan and Narwal, R.P. (2009) Effect of long term FYM and nitrogen application in bajra-wheat cropping system on yield and uptake of sulphur, iron and manganese by wheat crop. *Annals of Biology* 25 (2):113-120. *12 ref.*
11. Singh, R. V.; Rajeev Kumar (2010). Effect of organic and inorganic fertilizers on growth yield and quality and nutrients uptake of wheat under late sown condition. *Progressive Agriculture*; 2010. 10(2):341-344.
12. Agarwal, M.; Ram, N. and Ram, S. (2010). Long-term effect of inorganic fertilizers and manure on physical and chemical properties of soil after 35 years of continuous cropping of rice-wheat. *Pantnagar Journal of Research*, 8(1) 76-80.
13. Shukla, R.P.; Singh R.P. and Yadav, D.S. (2006). Effect of zero and conventional tillage on nitrogen requirement of wheat (*Triticum aestivum*). *Annals of Plant Physiology*, 20 (1): 131-132.