International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(6): 1143-1145

Received: 09-09-2018
Accepted: 13-10-2018

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Yield and nutrient uptake by wheat (*Triticum aestivam*) as influenced by integrated nutrient management in verti sol of gird zone of Madhya Pradesh

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Abstract
The present experiments was conducted for two years 2014-15 and 2015-16 at Research Farm of Krishi Vigyan Kendra Aron, Guna in Madhya Pradesh. The experiment was consisted with Twelve treatments of different combinations and doses of fertilizers, bio fertilizers and organic manure along with absolute control on wheat GW-322 in randomized block design. The results revealed that the application of 100% NPK produced significantly higher grain and straw yield and higher uptake of NPK as compared to control, 100% N and 100% NP treatments. The results further revealed that the intregration of FYM (10t/ha) and bio fertilizers (Azotobacter + PSB) with 100% NPK produced maximum grain and straw yield and uptake of N, P and K by grain and straw which was significantly higher over 100% NPK or 20 t FYM/ ha alone was comparable with 150% NPK alone treatment.

Keywords: FYM, INM, NPK uptake and Wheat yield

Introduction
Wheat is one of the most important staple food crops of India grown in diverse agro-climatic conditions from 11°N - 35°N latitude and 72°E- 92°E longitudes. Wheat is the most important winter season crop of India and improvement in its productivity has played a key role in making the country self-sufficient in food grain. Although, India is well placed in meeting its needs for food grains the major objective of food and nutritional security for its entire population has not been achieved. The demand for food grains is expected to rise not only as a function of population growth but also as more and more people cross the poverty line with economic and social development. The demand for wheat in India by 2020 has been projected to be between 105 to 109 mt as against 95.85 mt production of present day. Most of this increase in production will have to come from increased productivity, as the land area under wheat is not expected to expand. Efficient inputs management along with varietal improvement is the two basic aspects that can help us in achieving the target (Singh *et al*., 2011) [6].

Enhanced use of chemical fertilizers for increasing production has been widely recognized but their indiscriminate use may have adverse effect on soil health, ecology and other natural resources, the high cost of fertilizer also restricts their large scale use. Therefore, to reduce dependence on chemical fertilizers and maintenance of high production levels are vital issues in modern agriculture which is only possible through integrated nutrient management (INM). Use of organic manures in INM helps in mitigating the multiple nutrient deficiencies. Addition of organic manures provides favorable environment for plant growth in addition to causing improvement in physical, chemical and biological properties of soil. Trial conducted at farmer's field in Sehore and Bhopal districts for three years further confirmed that integrated nutrient management the best option as far as productivity and profitability of the soybean-wheat system is concerned (Singh *et al.* 2009) [7]. But this information in respect of Vertisol of Gird zone was scanty. Hence, the present investigation was conducted to identify the best combination of inorganic fertilizer with organic manure as well as bio-fertilizer which is appropriate to encourage the nutrient uptake by wheat in Vertisol of Gird zone of Madhya Pradesh.

Materials and Methods

A field experiment was carried out at the Research Farm of Krishi Vigyan Kendra Aron, Guna in Madhya Pradesh during the *rabi* season of 2014-15 and 2015-16. The soil of the experimental field was well drained, clayey, slightly alkaline in reaction (pH 7.86 and 7.84), having E.C.- 0.38 and 0.36 dSm^{-1}, organic carbon- 3.84 and 3.88 g kg^{-1}, available N – (188.6 and 192.2 kg ha^{-1}), available P- (12.18 and 13.14 kg ha^{-1}), available K (286.8 and 295.4 kg ha^{-1}), available S (24.66 and 25.44 kg ha^{-1}) and DTPA- Zn (0.52 and 0.54 mg kg^{-1} soil) during the respective years. Twelve INM treatments T_1 : Control, T_2 : 100% N, T_3 : 100% NP, T_4 : 100% NPK, T_5 : 100% NPK + 20 kg S + 5 kg Zn /ha, T_6 : 100% NPK + Azo. (5kg) + PSB (5kg), T_7 : 100% NPK + 10 t FYM /ha, T_8 : 100% NPK +10tFYM/ha+ Azo.(5kg) + PSB (5kg), T_9 : 75% NPK +10tFYM/ha+ Azo.(5kg) + PSB (5kg), T_{10} : 50% NPK +10tFYM/ha+ Azo.(5kg) + PSB(5kg), T_{11} : 20 t FYM /ha and T_{12} : 150% NPK were laid out in randomized block design with three replications. The experimental crop was sown (Cv. GW-322) with a seed rate of 100 kg per ha and row spacing of 22.5 cm were maintained. Recommended doses of fertilizers were 120 kg N, 60 kg P_2O_5 and 30 kg K_2O per ha and four irrigations were provided.

NPKS & Zn were applied in the form of urea, DAP, MOP, Bentonite –S and zinc sulphate. The whole quantity of P, K, S and Zn and half quantity of nitrogen was applied at the time of sowing and rest half of nitrogen was applied in two splits, first at CRI and second at tailoring stage. FYM, *Azotobector* and PSB were applied at the time of sowing as basal as per treatments, respectively. After the harvest of wheat crop in mid-April, yield data were recorded and representative ground grain and straw samples were digested with nitric-per chloric (9:4) di-acid mixture for the analysis of all other elements except N. Nitrogen was determined by KEL PLUS nitrogen estimation system and phosphorus by vanadomolybdate yellow colour method (Jackson, 1973) [2]. Potassium was estimated by flame photo-meter. The uptake of nutrients was calculated as per formula.

$$\text{Nutrient uptake (kg ha}^{-1}) = \frac{\text{Nutrient Content (\%) x Yield (kg ha}^{-1})}{100}$$

Result and Discussion

1. Effect of integrated nutrient management on yields of wheat

Perusal of the data from Table 1 revealed that grain and straw yield increased significantly due to various INM treatments over control. It is clear from result that application of inadequate amount of nutrients (control, 100% N & 100% NP) produced lesser grain and straw yield whereas remaining all other treatments produced higher yield in second year as compared to first year.

Table 1: Effect of integrated nutrient management on grain and straw yield of wheat

Tr. No.	Treatments	Grain yield (kg ha^{-1})			Straw yield (kg ha^{-1})		
		2014-15	2015-16	Pooled	2014-15	2015-16	Pooled
T_1	Control	2251.2	2008.1	2129.7	3692.0	3473.0	3582.5
T_2	100% N	3191.8	2929.9	3060.8	5021.9	4806.3	4914.1
T_3	100% NP	3644.6	3473.1	3558.8	5573.4	5308.4	5440.9
T_4	100% NPK	4106.8	4337.2	4222.0	5555.2	5971.7	5763.5
T_5	100% NPK + 20 kg S + 5 kg Zn /ha	4518.3	4625.3	4571.8	5785.7	6287.7	6036.7
T_6	100% NPK + Azo.(5kg) + PSB(5kg)	4172.6	4345.1	4258.9	6106.7	6207.1	6156.9
T_7	100% NPK + 10 t FYM /ha	4526.5	4682.9	4604.7	5645.8	6100.1	5872.9
T_8	100% NPK+10tFYM+ Azo.(5kg) + PSB(5kg)	4633.5	4781.6	4707.6	5415.3	6175.8	5795.6
T_9	75% NPK+10tFYM+ Azo.(5kg) + PSB(5kg)	4238.5	4355.0	4296.7	5818.6	5993.1	5905.9
T_{10}	50% NPK+10tFYM+ Azo.(5kg) + PSB(5kg)	3785.8	3910.4	3848.1	5678.7	5448.3	5563.5
T_{11}	20 t FYM /ha	3678.8	3875.8	3777.3	4921.6	5634.3	5277.9
T_{12}	150% NPK	4501.8	4732.3	4617.1	5703.4	6134.7	5919.0
	S.E m.±	88.1	71.2	56.6	136.9	113.8	89.0
	C.D. at 5%	259.1	209.2	163.0	402.5	334.4	256.2

Pooled data of two years revealed that the application of 100% N alone had increased the grain yield by 43.72 per cent over control. Supplementation of P with N (100% NP) enhanced the yields by 16.27 per cent. Application of K with NP further increased the grain yield significantly by 18.63 per cent. Yield improvement in yield due to potassium was also reported by Khare and Dixit (2011) [3]. Grain yield further increased significantly when 100% NPK combined single either with FYM, sulphur and zinc (T_7 & T_5) over sole use of 100% NPK (T_4). Reduced the NPK dose by 25% (75% NPK) and combine with FYM + Azo. + PSB (T_9) significantly increased grain yield over sole use of 100% NP (T_3) or 20 t FYM ha^{-1} (T_{11}) treatments and was statistically at par with 100% NPK treatment. Maximum grain yield (4707.6 kg ha^{-1}) was recorded with 100% NPK+10t FYM+ Azo. + PSB (T_8) was comparable with 150% NPK (T_{12}), 100% NPK + 10 t FYM/ha (T_7) and 100% NPK + 20 kg S + 5 kg Zn / ha (T_5) treatments. This might be observed due to adequate and balanced nutrition of plants which might have a favorable influence on the plant growth and development, which ultimately depicted in higher yield. The beneficial effect of FYM clubbing may be due to adequate nutrient supply from its decomposition, enhanced mobilization of nutrients from the soil, activation of beneficial soil biological activities through which nutrient availability was increased as well as improved physical condition of soil which provided the plant a good food hold to grow and develop. This all consequently led to high crop productivity. Similar results were also observed by Singh and Pathak (2003) [9]. and Tiwari *et al.* (2002) [10]. Increase grain & straw yield due to integrated use of FYM, sulphur and zinc with 100% NPK may be due to synergistic effect of all inputs when combined together with 100% NPK. Similar results also reported by Singh and Kumar (2010) [8].

2. Nutrient uptake

The uptake of N, P and K was the lowest in the plants which received no fertilizer or manure treatment (T_1). The lower uptake of nutrient in control plots is due to lower yields obtained in these plots (Table-2). Application of 100% NPK recorded significantly higher total (Grain + Straw) uptake of nutrients (N, P & K) as compared to control, 100% N and

100% NP treatments. This might be due to more availability of nutrients through balanced levels of applied nutrients. Total uptake of NPK increased with their application to the crop because of increased availability of these nutrients through their respective sources and higher biomass yield. Integration of FYM (10 t ha^{-1}) or sulphur and zinc with 100% NPK (T_7 & T_5) was beneficial in enhancing the uptake of nutrients by the wheat over sole use of 100% NPK (T_4) treatment because the nutrient uptake is a product of yield and concentration of nutrients and the concentration of nutrient increased in grain, straw as well as both with the integration of FYM (10 t ha^{-1}) or sulphur and zinc with 100% NPK. This may be because use of nutrients at different levels with FYM influenced the NPK content which could be due to additional supply of these nutrients through organic matter and improvement in the soil physical condition for better plant growth which ultimately led to higher NPK content. This finding is corroborate with the findings by Natan and Anurag (2011) [4].

Table 2: Effect of integrated nutrient management on N, P and K uptake by grain and straw by wheat (two years pooled data)

Tr. No.	Treatments	Nutrient uptake (kg ha^{-1})								
		N			P			K		
		Grain	Straw	Total	Grain	Straw	Total	Grain	Straw	Total
T_1	Control	34.80	16.97	51.77	7.16	3.69	10.84	13.26	36.72	49.98
T_2	100% N	53.54	25.11	78.64	10.74	5.29	16.03	19.84	53.28	73.12
T_3	100% NP	66.13	29.28	95.41	13.76	6.33	20.09	25.85	61.70	87.54
T_4	100% NPK	80.08	31.88	111.95	16.64	6.93	23.57	31.28	67.18	98.46
T_5	100% NPK + 20 kg S + 5 kg Zn /ha	88.33	33.82	122.15	18.17	7.36	25.53	34.11	71.29	105.40
T_6	100% NPK + Azo.(5kg) + PSB(5kg)	81.53	34.77	116.30	16.98	7.88	24.87	31.90	73.28	105.18
T_7	100% NPK + 10 t FYM /ha	85.99	32.08	118.07	18.49	7.69	26.18	34.74	69.00	103.74
T_8	100% NPK+10tFYM+ Azo.(5kg) + PSB(5kg)	91.38	32.63	124.01	19.10	7.75	26.85	35.90	69.98	106.88
T_9	75% NPK+10tFYM+ Azo.(5kg) + PSB(5kg)	76.14	30.74	106.87	16.25/	7.19	23.45	30.53	66.17	96.71
T_{10}	50% NPK+10tFYM+ Azo.(5kg) + PSB(5kg)	66.78	27.95	94.72	14.07	6.33	20.39	26.43	61.39	87.81
T_{11}	20 t FYM /ha	72.92	29.55	102.47	15.24	6.55	21.79	28.62	62.29	90.91
T_{12}	150% NPK	89.46	33.64	123.10	18.70	7.66	26.37	35.14	71.36	106.50
	S.E m.±	1.35	0.60	1.61	0.32	0.16	0.34	0.63	1.21	1.25
	C.D. at 5%	3.87	1.72	4.62	0.92	0.45	0.97	1.81	3.49	3.59

Maximum N (124.01 kg ha^{-1}), P (26.85 kg ha^{-1}) and K uptake (106.88 kg ha^{-1}) was recorded with 100% NPK+10t FYM+ Azo. + PSB (T_8) was comparable with 150% NPK (T_{12}), 100% NPK + 10 t FYM/ha (T_7) and 100% NPK + 20 kg S + 5 kg Zn /ha (T_5) treatments. Application of FYM, *Azotobacter* and PSB with 100% NPK significantly increased the NPK uptake by the crop than the application of fertilizers (100% NPK) or 20 t FYM alone. The increase in uptake of N, P and K following FYM application is probably because of the improvement of soil environment, which encouraged proliferation of roots, which in turn drew more water and nutrients from larger area and also from deeper layer. Further, FYM after decomposition releases major and micronutrients, which become available to the plants and thus increase the uptake. These results are in agreement with the findings of Rather and Sharma (2010) [5] and Bhadauria, *et al.* (2016) [1].

Conclusion

These results suggested that application of 100% NPK fertilizers was although more effective in comparison to 100% N or 100% NP treatments, but the integration of FYM (10 t ha^{-1}) and bio fertilizers (*Azotobacter* + PSB) with 75% or 100% NPK produced statistically at par yield of 100% and 150% NPK treatments, respectively. Hence, integrated nutrient management practices helps in decreasing the 25 to 50% dose of chemical fertilizer besides in increasing crop yield.

References

1. Bhadauria Jaideep Singh, Trivedi SK, Verma SK, Parajapati BL, Singh Akhilesh, Khan Sajiya. Effect of Integrated Nutrient Management on Yield and Nutrient Uptake by Wheat in Alluvial Soils of Madhya Pradesh. International Journal of Agriculture Sciences. 2016; 8(51):2206-2209.
2. Jackson ML. Soil Chemical Analysis, Prentice Hall of Indian Pvt. Ltd. New Delhi, 1973.
3. Khare D, Dixit HC. Effect of potassium and zinc on yield, quality and uptake of nutrients in wheat. Annals of Plant and Soil Research. 2011; 13(2):158-160.
4. Netam UP, Anurag CR. 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. 2011; 21(10):82-85.
5. Rather SA, Sharma NL. Effect of integrated nutrient management (INM) on productivity and nutrient in wheat and soil fertility. Asian Journal of Soil Science. 2010; 4(2):208-210.
6. Singh CM, Sharma PK, Kishor P, Mishra PK, Singh AP, Verma R, *et al*. Impact of integrated nutrient management on growth, yield and nutrient uptake by wheat (*Triticum aestivum* L.). Asian Journal of Agricultural Research. 2011; 5(1):76-82.
7. Singh Muneshwar, Dwivedi BS, Datta SP. Integrated nutrient management for enhancing productivity, nutrient use efficiency and environment quality. Indian Society of Soil Science, Platinum Jubilee Symposium- Proceedings, 2009, 55-67.
8. Singh RV, Kumar Rajeev. 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.
9. Singh RN, Pathak RK. Response of wheat (*Triticum aestivum*) to integrated nutrition of K, Mg, Zn and S and Bio-fertilization. J Indian Society Soil Sci. 2003; 51:56-60.
10. Tiwari Alok, Dwivedi AK, Dikshit PR. Long term influence of organic and inorganic fertilization on soil fertility and productivity of soybean –wheat system in a Vertisol. Journal of the Indian Society of Soil Science. 2002; 50:472-475.