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Effect of potassium and FYM on growth parameters, yield and mineral composition of wheat (*Triticum aestivum* L.) in alluvial soil

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Abstract
A field experiment was carried out at the research farm of R. B. S. College Bichpuri, Agra during the Rabi season of 2016-2017 to study the effects of Farmyard Manure (FYM) and Potassium application on wheat crop in alluvial soil. The experiment was laid out in the randomized block design (RBD) with four levels of FYM (control, 2.5, 5.0 and 10 t ha^{-1}) and four levels of potassium (control, 40, 80 and 120 kg K_2O ha^{-1}) with three replications. Nitrogen, Phosphorus, and Potash (NPK) were applied in the form of urea, single super phosphate and muriate of potash respectively. Data revealed that the plant height(cm), number of tillers (m^{-2}), number of spikes (m^{-2}), spike length (cm), number of grain $spike^{-1}$, 1000 - grain weight and grain and straw yield of wheat crop improved by FYM and Potassium application. The nutrient contents as N, P and K in grain and straw of wheat enhanced significantly with the application of FYM @10t ha^{-1} and Potassium @ 80 kg K_2O ha^{-1}.This treatment also recorded highest grain yield of 43.40 q ha^{-1} as compared to rest of other treatments. Hence the application of FYM @10 t ha^{-1} and Potassium @ 80 Kg K_2O ha^{-1} is recommended to the farmer for getting better production of the wheat crop.

Keywords: Potassium and FYM yield, growth parameters, minerals composition wheat

Introduction
Wheat (*Triticum aestivum* L.) is one of the major cereal crops produced in the world (Anon 1971) [1]. India is the second position of wheat producer in the world after China. Wheat is the second most important crop after rice in India. Production and productivity of wheat improved by a great level with the coming on of the green revolution. Even the productivity increased at a good pace and was computed to be around 2989 $kgha^{-1}$ in the report by the Indian Department of Agriculture (Agricultural Statistics at a glance 2011-12; https://eands.dacnet.nic.in) and Uttar Pradesh is the largest wheat producing state of India accounting for over 36 per cent of the production and 36 per cent of the wheat area of the country. In 2014-15, this state produced 25.20 million tons of wheat and total cultivated area under wheat in Uttar Pradesh is 9.84 million hectares. Uttar Pradesh is Fourth position in productivity of wheat in India. Fine alluvial soil deposited by the mighty Ganga and its several big and small tributaries and a close network of canals, supplemented by large number of tube wells have helped U.P. to occupy the top position.

More than half of the wheat area lies in the Ganga-Ghagra doable. Next in importance is the Ganga-Yamuna doab. These two doabs account for about 75 per cent wheat of U.P. About 55 districts of Uttar Pradesh produce wheat out of which 43 are the leading producers. Saharanpur, Muzaffarnagar, Meerut, Moradabad, Rampur, Budaun, Etawah, Hardoi, Bahraich, Kheri, Gonda, Basti, Etc. are the main producing districts. However, wheat production to the east of Varanasi decreased due to high rainfall and heavy soils. It is used mostly as human food and animal nourish. Only a small portion of the produce is utilized in the industry for malting, brewing, pearling and baby food. In nutritive value, Wheat is superior because it possesses comparative higher protein, lysine and high digestibility in the absence of gluten. Intensive cultivation has resulted in depletion of soil nutrients to a great extent, thus the nutrient requirement of the crops has increased considerably during the last years. Plant roots absorb Potassium as potassium ions (k^+). It is a unique element in sense that plants can accumulate it in abundant amounts without exhibiting any toxicity symptoms. This behavior has been described as the the luxury consumption. Also potassium plays a regulatory role in plant metabolism and development but is is not structural component of the plant. Potassium fertilizer is required on soils that are not naturally well supplied with potassium, especially when large amounts of nitrogen (N) and phosphorus (P) fertilizer are applied. However, the response to potassium fertilizers is weaker than to N and P. Several researchers have shown

that the efficacy of potassium fertilizer depends on optimal N and P; efficacy is less when potassium fertilizer is applied alone, or with P only, but more when applied with N Burlacu (2007) [4].The application of FYM in the soil helps in increasing the fertility of the soil as physical condition including its water holding capacity. Organic manures, which were perhaps the main sources of plant nutrients in traditional agriculture, receive less emphasis with the advent of high analysis chemical fertilizers. The decision on the optimum use of fertilizer required knowledge of crop response to applied fertilizer, inherent nutrients by soil and its short or long-term fate effects (Dobermann *et al*., 2003) [7]. Without detracting from the fact that chemical fertilizer will continue to be the main instrument for quickening the pace for agricultural production the recent researches indicates that a judicious combination of organic manures and fertilizer superior maintain the long-term soil fertility and sustain high levels of productivity. Therefore, use of both organic manure and chemical fertilizers in appropriate proportion assume special significance as complementary and supplementary to each other in crop production. Keeping in view the above perspectives, the present research work was taken up to find out the "Response of wheat to FYM and potassium application in alluvial soil'.

Material and Method

The field experiment was conducted during rabi season at R. B.S. College research farm Bichpuri, in 2016 -17. The soil of the field was sandy loam in texture with pH 8.7, Jackson, (1973) [9], EC 1.6 (ds/m at 25ºC) and organic carbon 0.42% (Walkley and Black, 1934) [19], available N 167.29 Kg ha^{-1} alkaline permanganate oxidizable N (Subbiah and Asija, 1956) [18], available P 10.07 Kg ha^{-1} 0.5 M $NaHCO_3$ extractable P Olsen *et al*., (1954)[12] and exchangeable K 189.0 Kg ha^{-1} neutral *N* ammonium acetate exchangeable K Hanway and Heidel, (1934) [9]. The experiment was laid out with three replication in Randomized Block Design with four FYM levels as control (F_0), 2.5 (F_1), 5.0 (F_2) and 10 (F_3) t ha^{-1}, four levels of potassium as control (K_0), 40 (K_1), 80 (K_2) and 120 (K_3) Kg K_2O ha^{-1}. Well decomposed FYM was applied before sowing of the crop. Potassium was applied through murate of potash, respectively at the time of sowing. Forty eight plots of 2x2 sqare meter were prepared by one deep ploughing using tractor drawn soil turning plough followed by two cross harrowing and leveling. The recommended dose of nitrogen and phosphorous were supplied to every plot through urea and single super phosphate, respectively. Potassium and phasphorous were applied as basal dose and urea was applied in three equal splits as basal, at CRI stage and at third irrigation. The variety of wheat PBW-502 was grown up to maturity. The crop was irrigated by tube well water as when need of different growth stages. The data of plant height, number of spikes (m^{-2}), number of tillers (m^{-2}), spike length (cm), number of grain $spike^{-1}$, 1000 grain weight and grain and straw yield were taken on physical maturity of crop at the harvesting time. The data of field observations were collected from ten plants in each plot selected randomly and grain and straw yield were resolute by net area basis after border rows disinterested. Grain and straw samples were collected and washed with distilled water to dirt free impurities, separately air-dried and oven dried to remove the moisture until constant weight was attained. The plant samples were digested with diacid mixture of HNO_3 and $HClO_4$ in 9:1 ratio. Phasphorous was determined by vanado molybdate yellow colour method Jackson, (1973), K by flame photometer and Nitrogen in plants was determined by modified micro Kjeldahl method. The nutrient uptake was calculated by multiplying the nutrient concentration values with the dry matter yield. The data were statically analysed using standard procedures of ANOVA at levels of significance. Similar to these findings are of Singh *et al*., (2010) [17].

Results and Discussion

Plant growth

It is evident from Table 1 that the plant height and number of tillers (cm^{-2}) enhanced significantly with increasing levels of FYM as compared to control. The maximum plant height and number of tillers were recorded with the dose of FYM (10 t ha^{-1}) application. It is obvious that FYM proved more useful in case of plant growth of wheat crop, it may be due to slow mineralization and availability of nutrients along with moisture holding capacity of soil by FYM. Similar results were also reported by Bonde *et al*., (2009) [3]. Further evaluations of data reflect that the plant height and number of tillers (cm^{-2}) improved significantly with increasing doses of potassium as compared to control. However, the plant height and the number of tillers (cm^{-2}) increased up to K_3 (120 Kg K_2O ha^{-1}) level of potassium but in plant growth, it was not significantly better over P_2 (80 Kg K_2O ha^{-1}) level of potassium. Because it might be due to the initial high level of soil exchangeable potassium and the mineralization of medium organic matter in the soil brought K, which is available to requirement of wheat plants and increasing K level as fertilizer may be used as luxury consumption and contribute equal effects to grain and biological yield. This result established with the research findings that potassium result on harvest index was not significant indicating something like equal positive effects of potassium on grain and straw yield Zara M *et al*., (2013) [20]

Yield and yield attributes

The data (Table 1) indicates that yield attributes like the number of spikes (m^{-2}), spike length (cm), the number of grain $spike^{-1}$ and test weight increased significantly with each increasing dose of FYM over control. Grain yield of wheat increased significantly with increasing levels of FYM. It is quite clear that maximum grain yield and straw yield was recorded under highest level of FYM (10 t ha^{-1}). The increase in grain and straw yield of wheat with F_1 (2.5 t ha^{-1}), F_2 (5 t ha^{-1}) and F_3 (10 t ha^{-1}) were 7.69, 15 and 19.23 and straw yield 14.02, 19.06 and 20.44 percent, respectively. From these result it may be inferred that the beneficial effect of FYM is due to its contribution in supplying additional plant nutrients, improvement of soil physical, chemical and biological process in soil. Metabolites root activities increased resulting absorption of moisture and other nutrients enhanced resulting into higher production. Kumar *et al.,* (2010) [11] and Chauhan *et al*., (2010) [5] reported similar to these findings. There was a significant increase in the yield and yield attributes characters with the application of potassium. The grain and straw yield of wheat enhanced significantly up to 80 Kg K_2O ha^{-1}. The potassium levels as control, 40, 80 and 120 Kg ha^{-1} result 13.20, 25.30 and 19.4 percent enhancement in grain yield over control, respectively. These results are fevour of Kumawat (2011) [10], Sharma and Rad Das (2002) [16], Singh *et al*., (2010) [15] and similarly the 14.15, 25.55 and 22.22 percent enhancement in straw yield over control, respectively. This positive effect might be due to the fact that phosphorus is well known for its role in development and energy transformation in various vitally important metabolic processes in the plant, the positive results of phosphorus application was also earlier reported by Dixit *et al.,* (2011) [6].

Table 1: Effect of FYM and potassium on plant height (cm), number of tillers (m^{-2}), number of number of spikes (m^{-2}), spike length (cm), grain spike^{-1}, test weight (g), grain and straw yield (q ha^{-1}) of the wheat crop

Treatment	Plant height (cm)	Number of tillers (m^{-2})	Number of spikes (m^{-2})	Spike length (cm)	Grain spike-1	Test weight (g)	Grain yield (q ha^{-1})	Straw yield (q ha^{-1})
FYM level								
F0	82. 40	332	306.55	8.85	20.60	39.87	26.00	36.20
F1	87.60	353	338.48	9.25	23.40	40.81	41.10	41.30
F2	91.50	371	347.12	9.55	25.20	42.18	42.90	43.10
F3	96.78	390	358.30	10.40	26.20	41.54	43.40	43.36
S. Em±	1.60	3.85	3.08	0.29	0.99	0.49	0.020	0.40
C.D. at 5%	3.48	10.84	8.63	0.66	2.79	1.31	0.056	1.13
Potassium level								
K0	80.15	330	304.12	8.68	22.6	37.75	25.60	36.00
K1	85.20	353	334.2	9.50	23.5	38.60	29.00	41.10
K2	90.50	376	343.1	10.12	24.3	39.55	32.10	45.50
K3	92.80	388	354.1	10.15	24.0	39.55	30.50	43.70
S.Em ±	1.20	3.83	3.03	0.226	0.981	0.461	0.020	0.40
C.D. at 5%	3.39	10.82	8.55	0.64	2.77	1.30	0.060	1.13

Nutrient composition

The Table 2 indicate that nutrient contents (N, P and K) in grain and straw of wheat enhanced significantly with increasing levels of FYM as compared to control. The highest level of FYM (10 t ha^{-1}) gave better performance over rest of the treatment in case of the nutrient composition of the wheat crop.

In general, the nutrient composition of wheat enhanced by the application of FYM. It might be due to better availability of nutrients under adequate supply of available nutrients by FYM application. Pathan *et al.,* (2010) [13] and Sisodia *et al.,* (2010) [17] reported similar to these findings. Further, it could be inferred from Table 2 that the N, P and K contents in grain and straw of wheat crop increased with higher levels of Potassium application. The maximum nitrogen content of wheat was noted highest level of potassium (80 kg ha^{-1}). Similar results were reported by Singh *et al.,* (2001) [14] The phosphorous content of wheat increased significant with increasing levels of potassium in comparison to control. Similar results were reported by majority of worker such as Arya and Kalra (1988) [2] The higher dose of FYM (10 t ha^{-1}) application significantly increased the grain and straw yield over the control besides improved the content and uptake of nitrogen, phosphorus and potassium by wheat crop. And the similar result was recorded with 80 Kg K_2O ha^{-1} (K_2) level of potassium application. Hence the application of FYM @10 t ha^{-1} and potassium @ 80 Kg K_2O ha^{-1} is recommended to the farmer for getting better production of the wheat crop.

Table 2: Effect of FYM and potassium on nutrient composition of the wheat crop.

Treatment	Nitrogen (%)		Phosphorous (%)		Potassium (%)	
	Grain	Straw	Grain	Straw	Grain	Straw
FYM level						
F0	2.41	0.40	0.57	0.042	0.45	1.59
F1	2.58	0.43	0.59	0.047	0.49	1.92
F2	2.69	0.46	0.62	0.053	0.53	2.19
F3	2.85	0.48	0.66	0.056	0.60	2.48
S. Em±	0.044	0.0023	0.004	0.001	0.01	0.055
C.D. at 5%	0.124	0.007	0.113	0.003	0.003	0.155
K0	2.41	0.404	0.56	0.043	0.44	1.57
K1	2.55	0.434	0.58	0.044	0.47	1.92
K2	2.85	0.467	0.65	0.055	0.55	2.54
K3	2.67	0.460	0.63	0.051	0.55	2.54
S. Em ±	0.044	0.0024	0.004	0.001	0.01	0.053
C.D. at 5%	0.122	0.007	0.112	0.003	0.003	0.155

Conclusion

The soil application of FYM @10t ha^{-1} and 80 kg ha^{-1} potassium as is recommended to farmers for getting better production .Application of FYM improved the yield and content of nitrogen, phosphorous and potassium by wheat crop. Similarly, the content and yield of these nutrients increased with higher level of potassium application.

References

1. Anonymous. Production year Book, FAO, Rome. 1971; 25:37-41.
2. Arya MPS, Kalra GS. Effect of phosphorous doses on the growth yield and quality of summer moong and soil nitrogen. India, J. Agric Res. 1988; 22(1):22-30.
3. Bonde AS, Deshmukh PA, Band SB, Bhurghate SK, Deshmukh SB. Effect organic and inorganic sources of phosphorus on yield attributes and yield of wheat. Ann. Pl. Soil Res. 2009; 11(2):98-99.
4. Burlacu G. Research results on the rational use of fertilizers. Analele INCDA Fundulea LXXV, Volum jubiliar. 2007, 287-307
5. Chauhan SS, Kumar V, Bhdaura UPS, Dwivedi AK. Effect of conjoint use of organic and inorganic fertilizer on soil fertility and productivity of soyabean wheat crop sequence. Ann. PI. Soil Res. 13(1):47-50d used of chemical on organic sources of nitrogen on growth and yield of barley. Ann. Pl. Soil Res. 2011; 13(1):67-68.
6. Dixit Ashish, Dawson Joy, Verma Rajan, Diwan Paravati, Kishore. Effect of integrated used of chemical on organic sources of nitrogen on growth and yield of barley. Ann. PI. Soil Res. 2011; 13(1):67-68
7. Dobermann A, Witt C, Abdulrachman S, Gines HC, Nagarajan R, Son TT *et al.* Soil fertility and indigenous nutrient supply in irrigated rice domains of Asia. Agron. J. 2003; 95:913-923.
8. Hanway JJ, Heidel H. Soil analysis methods as used inIowa State College Soil Testing Laboratory. Bulletin 57. Ames, IA: Iowa State College of Agriculture 57: 1-31. Indian Farming. 1952; 17:43-45.
9. Jackson ML. Soil Chemical Analysis Prentice Hall of India Private Limited, New Delhi, 1973.
10. Kumawat BL, Yadav RL, Kumawat Anil. Effect of clay mixing organic and sulphur on soil fertility and crop productivity. Annals of plant and Soil Research. 2011; 13(1):28-32
11. Kumar P, Singh A, Singh AK. Effect of bio-fertilizers, farmyard manure and nitrogen levels on growth yield and uptake of nutrients in wheat. Ann. Pl. Soil Res. 2010; 12(2):92-94.

12. Olsen SR, Cole CV, Watanabe FS, Dean LA. Estimation of available phosphorus in soils by extracting with\ sodium bicarbonate USDA. Circular 939. Washington, DC: United States Department of Agriculture, 1954.
13. Pathan ARK. Effect of FYM in phosphorus on the performance of Fenugreek Irrigated with saline water Ann. pl. Soil Res. 2010; 12(2):153-155.
14. Singh, Sandeep, Yada MS. Effect of S and organic matter on nutrient uptake and yield of wheat. Ann. PI. Soil Res. 2001; 3(1):61-64
15. Singh RK, Misra BN. Effect of phosphorus, sulphur, and zinc on growth, yield and uptake of nutrients in late sown wheat in Eastern Uttar Pradesh. Ann. Pl. Soil Res. 2010; 12(2):119-121.
16. Sharma, Rad Das N. Response of draft wheat to NPK and Ca. Indian J Plant Physiol. 2002; 25:364-370.
17. Sisodia RS, Pandey Manoj, Pal Anil. Response of oat to FYM under sodic water irrigation Ann. Pl. Soil Res. 2010; 12(2):86-88.
18. Subhiah BV, Asija GL. A rapid procedure for estimation of available nitrogen in soils. Current Science. 1956; 25:259-60
19. Walkey A, Black I. Armstrong An examination of the Degtjareff method for determining soil organic matter and a proposed modification of the chromic acid titration method. Soil Science. 1934; 37(1):29-38.
20. Zara M, Zadehbahen m, Azarpanah A. Influence of Potassium and Boron on some traits in wheat. International Journal of biotechnology. 2013; 2:141-153