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EFECT OF FYM AND POTASSIUM ON YIELD, NUTRIENT UPTAKE AND ECONOMICS OF WHEAT IN ALLUVIAL SOIL

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ABSTRACT

An experiment was conducted at Bichpuri (Agra) during rabi seasons of 2008-09 and 2009-10 to study the impact of FYM and potassium on yield, nutrient uptake and economics of wheat in alluvial soil of Agra.The experiment was laid out in factorial randomized block design with four levels of FYM (0,2.5,5.0 and 10 t ha^{-1}) and four levels of potassium (0,30,60 and 90 kg K_2O ha^{-1}).The grain and straw yield increased significantly up to 10 t FYM ha^{-1} and 90 kg K_2O ha^{-1} over absolute control. The increased in grain yield with 2.5, 5.0 and 10 t FYM ha^{-1} were recorded to the tune of 8.6, 14.0 and 15.7% and 4.1, 8.5 and 13.6%, over control in first and second year, respectively. The corresponding increases in yield due to 30, 60 and 90 kg K_2O ha^{-1} over control were 5.3, 14.9 and 25.2%, 11.0 and 19.9 and 31.4%. The levels of FYM and K applied together in different combinations increased the yield significantly more than those with their individual application. Significantly higher nitrogen, phosphorus and potassium uptake n wheat crop was recorded with FYM and potassium application. Magnesium uptake increased with the lower levels of potassium followed by decrease with each higher levels of K. The maximum net returns (₹. 47997.7 ha^{-1}) and B:C ratio (2.42) were obtained with 90 kg K_2O ha^{-1}.

Key words: Potassium, FYM, yield, nutrient uptake, economics, wheat.

INTRODUCTION

Wheat occupies a prominent place as an important cereal crop contributing 40% in the total food grain production. Wheat had high nutritive value (65-70% carbohydrates and 13-15% protein) and also serves as a good source of roughage to cattle. Wheat production in India is low as comparison to global level. The vaeious factors are responsible of low productivity such as poor fertilization and improper soil management of which poor fertilization is main facyor for poor productinity of wheat. The organic matter is a most valuable nourishment organic compound, as it improves physical, chemical and biological properties of soil and sustains fertility and productivity of cultivated land.It is well known that addition of organic manures has shown considerable increase in crop yield and helps in enhancing nutrient availability both from applied and native sources. Potassium is the most important essential nutrient after nitrogen and phosphorus and plays a vital role in plant cell sap, support enzymatic activity, photosynthesis, and transportation of sugar, synthesis of protein and starch but doesn't bounds with carbon or oxygen (Hoeft et al. 2000). It also develops tolerance to draght condition and enhances plant ability to resist attacks of pest and diseases. Supply of plant nutrients in balanced and sufficient quantity is essential to sustain the productivity of crops. Plants require potassium in large quantity. In general, 40-60 kg K_2O ha-^{1} is recommended which is far less than the amount of K removed by cereals like wheat. As a result most of the crops are running with negative K balance. Yet increased intensity of cropping and introduction of high yielding varieties resulted in considerable mining of potassium from the soil. Integration of K with FYM will not only sustain the crop production but also will be effective in improving soil fertility. As information is lacking on the effect of K and FYM on crop productivity in Agra region of Uttar Pradesh, the present study was therefore, planned to assess of the integrated use of FYM and potassium on productivity of wheat.

MATERIALS AND METHODS

Field experiment was conducted at Agriculture Research Farm, R.B.S. College,Bichpuei, Agra during 2008-09 and 2009-10 on sandy loamy soil.The experimental field had EC 0.49 dS m^{-1},pH 8.0, organic carbon 3.4 g kg^{-1},$CaCO_3$ 5.0 g kg^{-1},S available N 177, P 9, K 143 kg ha^{-1}, available S 8.5 mg kg^{-1}, exchangeable Mg 1.75 cmol (p^+) kg^{-1} and DTPA extractable zinc 0.55 mg kg^{-1}. The experiment was laid out in randomised block design with four level of potassium (control, 30, 60 and 90 kg K_2O ha^{-1}) and four levels of FYM (control, 2.5, 5.0 and 10t / ha) with three replications. The recommended doses of N and P @ 150 and 60 kg P_2O_5 ha^{-1}, respectively were applied through diammonium phosphate and urea. Potassium and FYM were supplied through muriate of potash (KCI) and well dicomposed FYM as per treatments. The wheat variety PBW-343 was shown on November 25, 2008 and November 27 2009 and irrigated at the proper time as judged by the appearance of soil and crop. The weeds were cradicated time to time from the crop. The crop was harvested on maturity. The grain and straw samples were processed for nutrient analysis and N content

was determined by Kjeldahl method (Jackson 1973). Grain and straw samples of wheat were digested in di acid (HNO_3, $HCIO_4$) and the digest were subjected to analysis of phosphorus by vanado molyblophosphoric acid yellow colour method, K by flame photometer Ca and Mg by versenate titration using ammonium purpurate and eriochrome black T (EBT) as indicator for Ca and Ca + Mg, respectively (Jackson 1973). The uptake of nutrients was calculated using the yield datd in conjunction with their respective contents. The economics of treatments was calculated on the basis of prevailing market price of inputs and produce.

RESULTST AND DISCUSSION

Yield

The Results indicate that the yield of grain and straw of wheat enhanced significantly with FYM application. The each increasing levels of FYM significantly increased grain and straw yield of wheat and increases in grain yield due to 2.5, 5.0 10t FYM ha^{-1} were 8.6, 14.0 and 18.7% and 4.1, 8.5 and 13.6% respectively over control in first and second year of study. The straw yield also followed similar trend. The beneficial effect of FYM on yield was also reported by Chandel et al. (2013) and Kumar and Singh (2013). This increase might be due to steady decomposition of FYM and release of nutrients throughout the crop growth period coupled with better assimulation of nutrients (Singh et al. 2013). The grain and straw yields of wheat increased significantly with the addition of potassium over control in both years. The increases in grain yield due to 30, 60 and 90 kg K_2O ha^{-1} over control were 5.3, 14.9 and 25.2% and 11.0, 19.9 and 31.4%, respectively during first and second year of experimentation. As potassium is essential for grain development, the favourable effect of high doses of K on growth and yield attributes of wheat was mainly responsible for higher grain and straw yields. The results are in close conformity with those of Singh and Singh (2009).

Table 1: Effect of FYM and potassium levels on grain, straw yield and economics of wheat

Levels	Grain yield (q ha^{-1})		Straw yield (q ha^{-1})		Net return (₹. ha^{-1})	B:C ratio
	2008-09	2009-10	2008-09	2009-10		
Potassium levels (kg ha^{-1})						
0	45.88	38.82	47.83	46.86	34785.2	1.81
30	46.83	43.12	53.35	52.48	38754.7	1.98
60	50.40	46.55	58.29	56.90	43265.0	2.21
90	32.00	51.03	63.12	62.37	47997.7	2.42
CD (P=0.05)	2.77	1.92	1.98	1.49		
FYM Level (t ha^{-1})						
0	41.09	48.50	52.71	52.04	37890.4	2.07
2.5	44.63	49.77	54.58	53.22	40187.4	2.08
5.0	46.85	52.00	56.57	55.45	42342.3	2.13
10.0	48.78	53.88	58.73	57.91	44292.2	2.15
CD (P=0.05)	2.77	1.92	1.98	1.49		

Interaction

The levels of FYM and potassium applied in different combinations increased the yield significantly more than with their individual application (Table 2). The highest grain and straw yields were recorded with combined application of 90 kg K_2O ha^{-1} and 10t FYM ha^{-1} during 2008-09 and 2009-10.

Table 2: Interaction effect of FYM and potassium on yield of wheat

Potassium (kg ha^{-1})	FYM (t ha^{-1})							
	0	2.5	5.0	10	0	2.5	5.0	10
	2008-09				2009-10			
	Grain yield (q ha^{-1})							
0	37.55	40.32	43.66	45.88	36.06	38.00	39.74	41.51
30	39.75	43.14	44.66	46.85	40.25	42.60	43.85	45.80
60	42.00	46.00	48.08	50.40	43.72	45.10	47.22	50.17
90	45.05	49.14	51.00	52.00	48.50	49.77	52.00	53.88
CD (P=0.05)	4.54				3.84			
	Straw yield (q ha^{-1})							
0	45.06	46.80	48.79	50.66	44.34	45.60	47.69	49.81
30	50.51	52.19	54.04	56.68	49.91	51.55	53.06	55.42
60	54.26	57.34	59.87	61.71	53.77	55.02	57.61	61.21
90	61.00	62.00	63.60	65.88	60.14	60.72	63.44	65.19
CD (P=0.05)	3.96				2.98			

Nutrients uptake

The data (Table 3) clearly indicated that the increasing levels of FYM and potassium application significantly enhanced the nitrogen uptake by grain and straw of wheat. Nitrogen uptake by wheat grain and straw increased from 85.6 to 111.1 and 25.8 to 36.1 kg ha^{-1}, respectively as the levels of FYM increased from 0 to 10t ha^{-1}. The increase in N uptake was mainly due to greater production of grain and straw. Higher uptake of N with FYM levels may be due to mineralization of N from FYM which sufficiently meet the nutritional requirement of the crop. Singh and Tomar (1991) and Singh et al. (2013) also recorded similar results. The additional doses of K significantly enhanced N uptake in grain and straw of wheat from 89.6 kg ha^{-1} at the control to 112.6 kg ha^{-1} with 90 kg K_2O ha^{-1}. The minimum value of N uptake by wheat crop was recorded with control. Shivay (2002) and Kulkarni et al. (2005) also reported similar results. The data (Table-3) showed a significant increase in P uptake with increasing FYM levels as compared to control. The effect of FYM application in increasing P uptake may be associated with physiological stimulation of plant rather than increase ramification of root system (Chandel et al. 2013). The uptake of P by wheat grain and straw signicantly increased with increasing levels of K and maximum values were noted with 90 kg K_2 ha^{-1}. Thus, K had synergistic effect on P nutrition of the crop. These results are in agreement with those of Kulkarni *et al.* (2005) and Singh (2009). The uptake of potassium significantly improved with FYM and K addition. The each enhancing does of FYM increased significantly potassium uptake by wheat grain and straw over control. The higest K uptake was obtained under 10.0 t FYM ha^{-1} and minimum in control. The increasing levels of K had significantly higher K uptake in grain and straw over control. The application of 90 kg K_2O ha^{-1} increased the uptake of K in grain and straw by wheat over 60 kg K_2Oha^{-1}. These finding supported the results obtained by Singh and Tomar (1991) and Singh and Singh (2009). Magnesium uptake by wheat grain and straw significantly increased with addition of FYM and increase was positively marked up to 10t FYM ha^{-1} .The potassium application increased the average Mg uptake in grain and straw of wheat up to 30 kg K_2O ha^{-1}. Each higher levels of applied K had an adverse effect on Mg uptake by wheat crop. The results showed an antagonistic effect of K addition on Mg uptake by plants. Similar results were reported by Singh and Pathak (2002).

Table 3: Effect of FYM and potassium levels on grain, straw yield and economics of wheat

Levels	Nitrogen		Phosphorus		Potassium		Magnesium	
	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
Potassium levels (kg ha^{-1})								
0	89.8	26.7	12.5	6.1	23.7	94.3	10.5	10.1
30	96.3	29.2	13.4	7.0	26.5	107.9	11.1	10.2
60	103.9	31.5	14.6	8.0	29.7	117.1	10.9	10.5
90	111.1	33.8	15.8	8.9	32.3	129.8	10.7	10.0
CD (P=0.05)	6.66	2.57	1.10	1.12	2.17	5.04	0.96	0.81
FYM (t ha^{-1})								
0	86.9	25.5	11.6	5.9	24.5	100.5	8.7	8.55
30	97.1	28.4	13.4	7.0	27.0	108.5	10.1	9.65
60	103.9	32.1	14.9	7.9	29.1	115.9	11.5	10.7
90	113.1	35.2	16.4	9.1	31.7	124.3	12.7	11.9
CD (P=0.05)	6.66	2.57	1.10	1.12	2.17	5.04	0.96	NS

Economics

From the economics point of view, each successive increase in K levels from 0 ti 60 K_2O ha^{-1} and FYM levels from 0 to 10t FYM ha^{-1} increased the values of net returns and B:C ratio (Table-1). The maximum net returns (₹. 47997.7 ha^{-1}) and B:C ratio (2.42) was obtained with 90 kg K_2O ha^{-1}. From FYM application perspective, the maximum net returns (₹. 44292.2 ha^{-1}) and B:C ratio (2.15) were obtain with 10 t FYM ha^{-1}. This means that the higher quantity of potassic fertilizer and FYM required for obtaining higher yield resulted in higher net return and B:C ratio.

From the results, it may be concluded that the wheat crop responded significantly up to the application of FYM and K and magnitude of response was more marked with combined use of FYM and potassium. FYM and potassium had significant effect on the quality, uptake of nutrients and economics of the crop.

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