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Effect of FYM and phosphorus application on yield and nutrient uptake by wheat crop

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Abstract

The field experiment was conducted at the Agricultural Research Farm RBS College, Bichpuri, Agra during rabi season of 2019-20. To study the effect of FYM and phosphorus application on growth, yield and nutrient uptake by wheat crop. The experiment was laid out in randomized block design with three replications and four level of FYM (0.0, 2.5, 5.0 and 10.0 t ha^{-1}) and four level of phosphorus (0.0, 40, 80 and 120 kg P_2O_5 ha^{-1}). The increase in grain and straw yield of wheat with F_1 (2.5 t ha^{-1}), F_2 (5.0 t ha^{-1}) and F_3 (10.0 t ha^{-1}) were 15.09, 20.00 and 23.39 percent in grain and 14.84, 19.60 and 21.00 percent in straw over control, respectively. The increase in grain and straw yield of wheat with P_1 (40 kg ha^{-1}), P_2 (80 kg ha^{-1}) and P_3 (120 Kg ha^{-1}) were 14.50, 27.86 and 22.90 percent in grain and14.36, 26.76 and 22.25 percent in straw over control, respectively. Application of FYM improved the content and uptake of nitrogen, phosphorus, potassium and zinc by wheat crop. Similar, the content and uptake of these nutrients increased with higher level of phosphorus application. The soil application of FYM @ 10 t ha^{-1} and 80 kg ha^{-1} phosphorus is recommended to the farmers for getting better production of wheat crop.

Keywords: FYM, phosphorus, yield, nutrients uptake, wheat

Introduction

In India wheat is the second most important food grain crop having area, production and productivity of the county were 28.46 million hectares, 80.0 million tones and 2830 q ha^{-1} respectively during 2009-10. Uttar Pradesh is the major wheat growing state having 33.02 percent area (9.4 million hectare) and 33.66 per cent production (25.29 million tons) of the country during 2009-10. In productivity of Uttar Pradesh (2691 kg ha^{-1}) has third rank after first Punjab (4331 kg ha^{-1}) and second Haryana (4066 kg ha^{-1}). In Uttar Pradesh wheat has its own importance in the total food grain production being second in importance as a winter cereal crop. The application of FYM in the soil helps in increasing the fertility of the soils as physical condition including its water holding capacity. Organic manures, which were perhaps the major sources of plant nutrients in tradition agriculture, receive less emphasis with the advent of high analysis chemical fertilizers. 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 indicate that a judicious combination of organic manures and fertilizer better 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. According to Sharma et al. (2020),

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the study clearly indicated that the long-term use of tillage, application of residues and N levels had a significant effect on all the P fractions in soils, except that water-soluble phosphorus (WSP) was not significantly influenced by the tillage practices. Phosphorus is essential element required for plant growth and root development. It is found in every living cell of the plant. It is known to be associated with several vital functions in the plant body such as utilization of sugar and starch, photosynthesis, nucleus formation, cell division, fat and albumin formation, cell organization and transfer of the heredity. The availability of phosphorus from soil to plants depends upon the equilibrium adjustment around the root zone.

Materials and Methods

The field experiment was conducted at the research farm 2019-20 of RBS College, Bichpuri, Agra during Rabi season of 2019-20. The farm is located south-east of Delhi in the semi-arid or gray steppe soil region of south-western Uttar Pradesh. Intersect of 27.20 N attitudes and 77.9º E Longitude is about 21 km south of Agra city. The climate of Agra is hot and dry. The average annual rainfall of Agra district is about 675 mm; 90% rain is received during August and September through south monsoon rains, which start by the end of June and continue up to September. The soil was sandy loam in texture having pH 8.1, EC 1.4 dSm^{-1}, organic carbon 3.4 g kg^{-1}, available N 167 kg ha^{-1}, P 10 kg ha^{-1}, K 190.5 kg ha^{-1} and Zn 0.50 mg kg^{-1}. The experiment was laid out in randomized block design with four levels of FYM (Control (F0), 2.5 (F1), 5.0 (F2) and 10.0 (F3) t ha^{-1}) and four levels of phosphorus (Control (P0), 40 (P1), 80 (P2) and 120 (P3) kg P_2O_5 ha^{-1}). A uniform dose of 120 kg N and 60 kg K_2O ha^{-1} was applied through urea and muriate of potash, respectively at the time of sowing. Phosphorus was applied through single super phosphate respectively at the time of sowing. For sowing, about 5 cm deep furrows were opened at a spacing of 22.5 cm and each furrow was sown uniformly with reweighed seed @ 100 kg ha^{-1} and covered by 2020 soil immediately. Showing was done on 15 Nov. 2020. The first irrigation was given as per sowing irrigation was given as per physiological growth stages taking rainfall into consideration.

Results and Discussion

Grain and straw yield

Among the four FYM levels, application of FYM @ 10.0 t ha^{-1} recorded significantly higher grain and straw yield of wheat (3.10 and 4.27 t ha^{-1}) followed by FYM applied @ 5.0 t ha^{-1} (3.01 and 4.12 t ha^{-1}) and @ 2.5 t ha^{-1} (2.90 and 4.0 t ha^{-1}) compared to control (2.50 and 3.41 t ha^{-1}) (Table-1). The increase in wheat grain and straw yield with FYM applied @ 2.5 t ha^{-1}, 5.0 t ha^{-1} and 10.0 t ha^{-1} level of FYM over control was tone of extent of 16, 20, 24 and 17, 21 25 percent respectively. According to Singh et al. (2016), application of 5t FYM ha^{-1} gave 20.1 and 20.3 per cent higher green foliage and dry matter yield of fodder oat over control, respectively. Among the four phosphorus levels, application of P @ 80 kg ha^{-1} recorded significantly higher grain and straw yield of wheat (3.25 and 4.39 t ha^{-1}) followed by P applied @ 120 kg ha^{-1} (3.11 and 4.16 t ha^{-1}) and @ 40 kg ha^{-1} (2.90 and 3.98 t ha^{-1}) compared to control (2.25 and 3.39 t ha^{-1}) (Table 1). The increase in wheat grain and straw yield with P applied @ 40 kg ha^{-1}, 80 kg ha^{-1} and 120 kg ha^{-1} level of phosphorus over control was tone of extent of 29, 44, 38 and 17, 29, 23 percent respectively. According to Munna et al. (2020), that the faba bean responded significantly up to 90 kg P_2O_5 ha^{-1} and increased the grain and straw yield by 13.4 and 15.7 percent, respectively, over control. Nagar et al. (2022), the levels of phosphorus influence the grain and straw yield of cowpea, nutrients content and their uptake by cowpea crop and increased significantly with P1 @ 20 kg ha^{-1}, P2 @ 40 kg ha^{-1} and P3 @ 60 kg ha^{-1} levels of phosphorus as compared to control.

Nutrients uptake

Among the four FYM levels, application of FYM @ 10.0 t ha^{-1} recorded significantly higher nitrogen uptake in grain and straw by wheat crop

Table 1: Effects of FYM and phosphorus on grain and straw yield of wheat crop

Treatments	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
FYM levels		
F_0	2.50	3.41
F_1	2.90	4.00
F_2	3.01	4.12
F_3	3.10	4.27
C.D. At 5%	0.06	0.12
Phosphorus levels		
P_0	2.25	3.39
P_1	2.90	3.98
P_2	3.25	4.39
P_3	3.11	4.16
C.D. At 5%	0.06	0.12

Table 2: Effect of FYM and phosphorus on nitrogen phosphorus potassium and zinc uptake by wheat crop

Treatments	Nitrogen (kg ha^{-1})		Phosphorus (kg ha^{-1})		Potassium (kg ha^{-1})		Zinc (mg ha^{-1})	
	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
FYM Levels								
F0	78.43	13.70	18.07	1.40	13.64	51.15	40.23	34.78
F1	98.00	16.88	22.0	1.88	18.80	74.0	55.6	47.6
F2	107.12	18.54	23.9	2.10	21.42	88.99	65.1	54.38
F3	117.42	19.68	26.47	2.35	24.77	104.18	76.86	68.75
CD @ 5%	5.40	1.55	1.63	0.340	1.08	8.77	7.48	5.50
P Levels								
P0	77.97	14.27	14.15	1.562	11.27	53.25	34.06	40.12
P1	96.32	17.53	17.40	1.908	15.00	77.14	45.90	50.75
P2	116.33	20.97	22.11	2.565	20.44	113.14	69.68	69.75
P3	104.05	19.78	19.96	2.213	18.68	95.48	59.57	59.89
CD @ 5%	5.40	1.55	1.63	0.340	1.08	8.77	7.48	6.25

(117.42 and 19.68 kg ha^{-1}) followed by FYM applied @ 5.0 t ha^{-1} (107.12 and 18.54 kg ha^{-1}) and @ 2.5 t ha^{-1} (98.0 and 16.88 kg ha^{-1}) compared to control (78.43 and 13.70 kg ha^{-1}) (Table 2). Among the four phosphorus levels, application of P @ 80 kg ha^{-1} recorded significantly higher nitrogen uptake in grain and straw by wheat crop (116.33 and 2097 kg ha^{-1}) followed by P applied @ 120 kg ha^{-1} (104.05 and 19.78 kg ha^{-1}) and @ 40 kg ha^{-1} (96.32 and 17.53 kg ha^{-1}) compared to control (77.97 and 14.27 kg ha^{-1}) (Table 2). Among the four FYM levels, application of FYM @ 10.0 t ha^{-1} recorded significantly higher phosphorus uptake in grain and straw by wheat crop (26.47 and 2.35 kg ha^{-1}) followed by FYM applied @ 5.0 t ha^{-1} (23.9 and 2.10 kg ha^{-1}) and @ 2.5 t ha^{-1} (22.0 and 1.88 kg ha^{-1}) compared to control (18.07 and 1.40 kg ha^{-1}) (Table 2). Among the four phosphorus levels, application of P @ 80 kg ha^{-1} recorded significantly higher phosphorus uptake in grain and straw by wheat crop (22.11 and 2.56 kg ha^{-1}) followed by P applied @ 120 kg ha^{-1} (19.96 and 2.21 kg ha^{-1}) and @ 40 kg ha^{-1} (17.40 and 1.90 kg ha^{-1}) compared to control (14.15 and 1.56 kg ha^{-1}) (Table-2). Among the four FYM levels, application of FYM @ 10.0 t ha^{-1} recorded significantly higher potassium uptake in grain and straw by wheat crop (24.77 and 104.18 kg ha^{-1}) followed by FYM applied @ 5.0 t ha^{-1} (21.42 and 88.99 kg ha^{-1}) and @ 2.5 t ha^{-1} (18.8 and 74.0 kg ha^{-1}) compared to control (13.64 and 51.15 kg ha^{-1}) (Table 2). Among the four phosphorus levels, application of P @ 80 kg ha^{-1} recorded significantly higher potassium uptake in grain and straw by wheat crop (20.44 and 113.14 kg ha^{-1}) followed by P applied @ 120 kg ha^{-1} (18.68 and 95.48 kg ha^{-1}) and @ 40 kg ha^{-1} (15.0 and 77.17 kg ha^{-1}) compared to control (11.27 and 53.25 kg ha^{-1}) (Table-2). Among the four FYM levels, application of FYM @ 10.0 t ha^{-1} recorded significantly higher zinc uptake in grain and straw by wheat crop (76.86 and 68.75 mg ha^{-1}) followed by FYM applied @ 5.0 t ha^{-1} (65.1 and 54.38 mg ha^{-1}) and @ 2.5 t ha^{-1} (55.6 and 47.6 mg ha^{-1}) compared to control (40.23 and 34.78 mg ha^{-1}) (Table-2). Among the four phosphorus levels, application of P @ 80 kg ha^{-1} recorded significantly higher zinc uptake in grain and straw by wheat crop (169.68 and 69.75 mg ha^{-1}) followed by P applied @ 120 kg ha^{-1} (59.57 and 59.89 mg ha^{-1}) and @ 40 kg ha^{-1} (45.90 and 50.75 mg ha^{-1}) compared to control (34.06 and 40.12 mg ha^{-1}) (Table 2). According to Prabhakar et al. (2013), application of phosphorus @ 60 kg ha^{-1} recorded significantly higher plant height (42.70, 44.30 cm), green foliage (178.50, 181.50 kg ha^{-1}), dry matter yield (19.64, 20.52 q ha^{-1}), content N (1.12, 1.13 %) P (0.18, 0.19 %) K (1.34, 1.35 %) and Mn (1.19, 1.20 ppm) over the control. Earlier researcher Singh et al. (2020), the content and uptake of nutrient were also affected by the application of phosphorus and manganese. Application of phosphorus improved the content of nitrogen, phosphorus and potassium but depressed the manganese content.

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