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Effect of FYM and phosphorus application on yield and yield attributes of wheat (Triticum aestivum L.) crop

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Abstract

The field experiment was conducted at the research farm 2019-20 of RBS College, Bichpuri, Agra during rabi season of 2019-20. To study the effect of FYM and phosphorus yield attribute of wheat crop. The experiment was laid out in randomized block design with three replications. Data revealed that the yield attributes and yield increased significantly with the application of 10 ton ha^{-1} FYM and 120 kg P_2O_5 ha^{-1} over control. Application of 10 ton ha^{-1} FYM ha^{-1} and 120 kg P_2O_5 ha^{-1} gave 3.10, 3.11, 4.27 and 4.16 ton ha^{-1} higher grain and straw yield over control. Application of 10 ton ha^{-1} FYM and 120 kg P_2O_5 ha^{-1} increased significantly plant height, no. of tillers, no. of spikes, length of spike, and grain of spike, test weight, grain and straw yield of wheat crop.

Keywords: FYM, phosphorus, yield, yield attributes 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, 80 million tones and 2830 quintal 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 Uttar Pradesh (2691kg ha^{-1}) has third rank after first Punjab (4331 kg ha^{-1}) and second Haryana (4066 kg ha^{-1}) in the country during 2009-10. Wheat has got special value keeping in view its industrial importance and its existence under problematic to grow successfully.

In India nearly 8.4 million hectares land pose a serious threat to our increase food production to meet the expending needs of its teeming population. The population of our country escalating at an alarming rate of 2.2% per annum is expected to stabilize at 1.40 million in the year 2040 AD. The land for agriculture is shrinking and expect for salt affected soils these appear little scope constitute 182.2 million hectares about 75% to meet this pressing demand, there are two sources open to us, one to increase the area under the plough and the other to increase the production per unit by using adequate amount of plant nutrients. So far as the extension of area is concerned, there as marginal scope for increasing the area under cultivation, yet in many cases it can be done only at greater cost and may even be uneconomical.

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.

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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 27.2^0 N attitudes and 77.9° 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 (F_1), 5.0 (F_2) and 10.0 (F_3) t ha^{-1}) and four levels of phosphorus (Control (P_0), 40 (P_1), 80 (P_2) 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

It is quite clear that the plant height improved significantly with increasing levels of FYM as compared to control or preceding lower levels. The maximum plant height was recorded with F3 (10 t ha^{-1}) level of FYM. The FYM levels F1, (2.5 t ha^{-1}), F2 (5.0 t ha^{-1}) and F3 (10.0 t ha^{-1}) resulted in 6.30, 11.17 and 16.38 Percent enhancement in plant height over control, respectively (Table 1). From the above findings may be narrated that highest dose of FYM proved more beneficial in increasing the plant height of wheat crop, it may be due to gradual mineralization and availability of nutrients along with moisture holding capacity of soil by FYM. Similar results were also reported by Kumar et al., (2010). The maximum plant height was recorded with highest level P3 (120 kg ha^{-1}) level of phosphorus but it was not significantly better over P2 (80 Kg ha^{-1}) level of phosphorus. The phosphorus levels P, (40 Kg ha^{-1}), P2 (80 kg ha^{-1}) and P: (120 kg ha^{-1}) resulted 6.24, 13.05 and 15.92 percent plant height over control, respectively. This increase might be due to well - developed root system, which might have helped in availability of nutrients to the plants (table 1).

The data presented in table1 shows that the number of tillers increased consistent and significantly with the increasing levels of FYM as compared to control or preceding lower level of FYM. The F3 (10 t ha^{-1}) level of FYM proved significantly better over other levels of FYM with respect to no. of tillers (m^{-2}) of wheat crop. From these results it may be inferred that the beneficial effect of FYM is due to its contribution in improving additional plant nutrients, improvement of soil physical conditions and biological process in soil. Metabolites root activities increase resulting absorption of moisture and other nutrients enhanced resulting in to higher plant growth. Results of table 1 also show that the no. of tillers enhanced significantly with increasing level of FYM in comparison to control. The maximum no. of tillers (m^{-2}) were recorded with P3 (120 kg ha^{-1}) level of phosphorus, whereas the phosphorus levels P_2 (80 kg ha^{-1}) and P3 (120 Kg ha^{-1}) do not differ significantly in case of no. of tillers of wheat crop. It may be due to better proliferation of roots resulting in more absorption of water and minerals.

The data given in table 1shows that the maximum no. of spikes were counted under F_3 (10 t ha^{-1}) level of FYM. Similar to these finding Dixit et al., (2011). The data present in Table 1 further implies that the no. Of tillers (m^{-2}) improved significantly with the application of each dose of FYM over control. The maximum number of spikes (m^{-2}) were recorded under P3 (120 Kg ha^{-1}) level of phosphorus but it was not significantly improved as compared to P2 (80 kg ha^{-1}) level of phosphorus. It might be concluded from the above findings that wheat crop responded markedly of phosphorus application. This favorable effect might be owing to the fact that phosphorus is well known for its role as ćenergy currencyô and plays a key role in development and energy transformation in various vitally important metabolic processes in the plant. Response of wheat crop to phosphorus application was also reported by Dixit et al., (2011).

It is apparent from table 1that the spike length significantly improved with increasing levels of FYM over control except F_1, (2.5 t ha^{-1}) Level of FYM. The difference between F_1, and F_2 (5.0 t ha^{-1}) was not found significant in the case of spike length of wheat crop. The highest level F3 (10 t ha^{-1}) of FYM proved significantly better over other FYM levels regarding spike length. Similar to these findings Bonde et al., (2009) and Kumar et al., (2010). The Table 1 indicates that the spike length increased significantly with increasing each dose of phosphorus in comparison to control. The phosphorus levels P. (40 kg ha^{-1}) and P2 (80 kg ha^{-1}) did not differ significantly with respect to spike length. Although, P_3 level (120 kg ha^{-1}) contained maximum spike length but the increment in spike length was not significant with P_3 level as compared to P_2 (80 kg ha^{-1}) level of phosphorus. From the above findings it may be stated that phosphorus application improved the spike length through accelerating as cell division, cell various metabolic processes such development. Similar to these findings Dixit et al., (2011).

Table 1: Effect of FYM and phosphorus on plant height (cm) and number of tillers (m^{-2}), no. of spikes (M^{-2}) and spike length (cm) of wheat crop

Treatments	Plant height (cm)	No. of tillers	No. of Spikes	Spike Length (cm)
FYM level				
F_0	78.15	231	262.0	7.8
F_1	83.19	265	317.0	8.1
F_2	87.07	285	360.2	8.5
F_3	91.21	301	374.1	9.35
S.Em±	1.19	3.83	3.02	0.226
C.D. at 5%	3.37	10.82	8.55	0.64
P levels				
P_0	78.10	233	260.5	7.6
P_1	83.10	276	308.0	8.6
P_2	88.37	290	366.0	9.21
P_3	90.71	297	370	9.25
S.Em±	1.19	3.83	3.02	0.226
C.D. at 5%	3.37	10.82	8.55	0.64

Grain of spike

It is evident from table 2 that the number of grains $spike^{-1}$ enhanced significantly each increasing dose of FYM except F_1 (2.5 t ha^{-1}) levels as F_1 (2.5 t ha^{-1}), F2 (5.0 t ha^{-1}) and F_3 (10 t ha^{-1}) resulted 8.13, 16.92 and 34.16 percent enhancement in number of grains $spike^{-1}$ of wheat crop as compared to control, respectively. Similar results were observed by Kumar et al., (2010).

A critical evaluation of data presented in table 2 reflect that the number of grains $spike^{-1}$ enhanced up to P2 (80 kg ha^{-1}) level of phosphorus thereafter it reduced with increasing level of phosphorus as P3 (120 kg ha^{-1}) overall, P2 (80 kg ha^{-1}) level of phosphorus proved better over rest of the treatments regarding number of spike/plant of wheat crop. It may be due to well developed root system which might have helped in availability of nutrients, cell division, and metabolic process of the plant. Similar results were also reported by Dixit et al., (2011).

Data table 2 showed that the FYM levels significantly affected the 1000 - grain weight of wheat crop. The test weight (1000-grain weight) improved significantly with the application of every dose of FYM beyond the F_1 level (2.5 t ha^{-1}) in comparison to control. The level F_1 and F_2 do not differ significantly with respect to 1000-grain weight of wheat crop. The highest level F_3 (10 t ha^{-1}) proved better in case of enhancing the 1000 grain weight of wheat crop. Similar to these findings Dixit et al., (2011). A perusal of the data (Table 2) affecting that phosphorus levels significantly affected the 1000-grain weight of wheat crop. The test weight improved significantly with increasing doses of phosphorus except P_1 (40 kg ha^{-1}) as compared with control. The phosphorus level P_2 (80 kg ha^{-1}) and P_3 (120 kg ha^{-1}) were found at par with regards to 1000 - grain weight of wheat crop. These results are in favor of Arya and Kalra (1988) and Dixit et al., (2011).

Grain yield of wheat increased significantly with increasing levels of FYM (Table 2). It is quite clear that maximum grain yield of wheat was recorded under highest level of FYM (10 t ha^{-1}). The increase in grain 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 over control, respectively. From these results it may be inferred that the beneficial effect of FYM is due to

Table 2: Effect of TYM and phosphorus on No. of grain spike^{-1}, 1000-grain weight (g) grain and straw yield t ha^{-1} of wheat crop

Treatments	Grain spike^{-1}	1000-grain weight(gm)	Grain yield(t ha^{-1})	Straw yield (t ha^{-1})
Fym Level				
F_0	29.3	26.0	2.50	3.41
F_1	31.2	27.1	2.90	4.00
F_2	34.0	28.15	3.01	4.12
F_3	39.1	31.02	3.10	4.27
S.Em$\pm$	0.981	0.461	0.021	0.042
C.D. at 5%	2.77	1.30	0.06	0.12
Phosphorus Levels				
P_0	29.2	25.9	2.25	3.39
P_1	33.4	27.1	2.90	3.98
P_2	39.04	30.6	3.25	4.39
P_3	39.0	30.6	3.11	4.16
S.Em$\pm$	0.981	0.461	0.021	0.042
C.D. at 5%	2.77	1.30	0.06	0.12

its contribution in improving additional plant nutrients, improvement of soil physical conditions and biological process in soil. Metabolites root activities increased resulting absorption of moisture and other nutrient enhanced resulting in to higher production. Similar results were observed by Kumar et. al., (2010) and Chauhan et. al. (2011). It is evident from (Table 2) that grain yield of wheat significantly affected by phosphorus levels. It is also noted that P_2 level of phosphorus (80 kg ha^{-1}) proved better over control in case of enhancement in grain yield of wheat. The increase in grain 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 over control, respectively. These results are in favor of Dixit et al., (2011).

Straw yield of wheat increased significantly with increasing revels of FYM (Table 2) it is quite clear that maximum straw yield of wheat was recorded under highest level of FYM (10 t ha^{-1}) the increase in 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 14.84, 19.60 and 21.00 percent over control, respectively. It may be due to the gradual release and steady supply of nutrients from humus organics throughout the growth and development of wheat crop. It is evident from (Table 2) that straw yield of wheat significantly affected by phosphorus levels. It is also noted that P_2 level of phosphorus (80 kg ha^{-1}) proved better over control in case of straw yield of wheat. Time increase in straw yield with P_1, (2.5 t ha^{-1}), P_2 (5.0 t ha^{-1}) and P_3 (10.0 t ha^{-1}) were 14.36, 26.76 and 22.25 percent over controls, respectively. Earlier researcher, the combined effect of phosphorus and molybdenum early reflects that increased doses of phosphorus and molybdenum were significantly useful in respect of plant height, number of pods plant^{-1}, number of grains pod^{-1} and yield of broad bean. The most beneficial effect was confined to P3 @ 90 kg ha^{-1} level of phosphorus and M3 @ 3 kg ha^{-1} level of molybdenum in respect to plant height of broad bean number of pods plant^{-1}, number of grains pod^{-1} and yield of broad bean (Munna et al. 2019).

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