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Original Research Article

Effect of Inorganic Nutrients, Organic Manure and Biofertilizer on Yield Attributes, Yield and Quality of Rice in Normal Soil

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A B S T R A C T

The pot experiment on Rice crop was conducted at pot house of the Department of Soil Science and Agricultural Chemistry, C.S. Azad University of Agriculture and Technology, Kanpur, during the kharif season of 2016. The doses of experiment were half of the soil test recommendation, recommended doses, half of the recommended doses, half of the recommended doses 75%, 150% and 125% recommended doses of N, P_2O_5 and K_2O recommended 75% & 37.5% and 10 tan/ha. Fym + Azotobacter, respectively. The result showed that the grain yield ranged from 31.15 to 59.75 q ha^{-1} and straw yield from 46.06 to 75.60 q/ha^{-1}. The starch content varied from 64.75 to 70.90% amylose from 33.97 to 37.20% and amylopectin from 33.97 to 37.20% and amylopectin from 65.75 to 72.00%. The treatment T_9 (125% STR + FYM + Azotobacter) gave the best result in terms of yield, nutrient concentration uptake values and crop quality.

Keywords

Grain, Straw yield, Nutrient content and Quality

Introduction

Rice is one of the important cereal food crop for more than half of the world's population The global requirement of rice by 2050 AD world by 800 million tones, which is 26% higher than the present level of production. In India it is grown over an area 43.95 million hectare with a production of 106.54 million tones in 2013-14. The area and production of rice in the state is about 13.84 mha and 14.00 mt, respectively with productivity of 2358 $kgha^{-1}$. The ever increasing population of the country is forcing the planners to produce more and more with ever shrinking natural resources. Continuous use of high analysis fertilizers accelerated the mining of micro and secondary nutrients which brought down the productivity. Declining trend in productivity due to continuous use of chemical fertilizers alone has been observed. The combined use of fertilizer, organic and biofertilizers increase the productivity of crops with significant residual effect in soil. The rice production recorded such commendable growth that we achieved self sufficiency and contained imports. It is principal food and cereal crop of south eastern Asia and about 90% of all rice grown in the world is produced and consumed Asian countries. It is one of the cereal crops of world and providing 22% of calories. In Asia, over two billion people obtain 60-70% of their energy intake from rice and its products.

Rice is primarily a high energy or high caloric food, while protein content is less than wheat. The protein content of rice usually 6-7% when milled. The biological value of rice protein is high. The fat content of rice is low about 2.0-2.5% and much of fat is lost during milling. It has low percent of calcium. It contains as much as B group of vitamins as wheat.

Materials and Methods

The pot experiment on Rice crop was conducted at pot house of the Department of Soil Science and Agricultural Chemistry, C.S. Azad University of Agriculture and Technology, Kanpur during Kharif, 2016 to explore the possibility of substituting fertilizer with FYM and Azotobacter. The treatment consisting of chemical fertilizer with different combination of organics T_1-Control, T_2-150: 75: 75 (NPK, $Kgha^{-1}$), T_3-75: 37.5: 37.5 (NPK, $Kgha^{-1}$), T_4-75: 37.5: 37.5 (NPK, $Kgha^{-1}$) +FYM ($10t/ha^{-1}$), T_5-75: 37.5: 37.5(NPK. $Kgha^{-1}$) +FYM ($10t/ha^{-1}$+ Azotobacter, T_6-150: 75: 75 (NPK, $Kgha^{-1}$) + Azotobacter, T_7-125% STR, T_8-125% STR + FYM (10 t/ha), T_9-125% STR +FYM (10t/ha) + Azotobacter were comprised in Randomized Block replicated as thrice. The experimental soil was silty loam in texture having pH (1:25) 7.8, EC 0.26 dSm-1, Organic Carbon 0.31%, Available Nitrogen 158, Phosphorus 10.05, Potassium 160 and Sulphur 12.60 kg ha-1, Available density 0.36 M gm^{-3}, Bulk density 1.48 M gm^{-3}, Porosity 43% and P.D. 2.40 Mg m^{-3}. Whereas half dose of nitrogen entire dose of phosphorus and potash were applied as basal application in the form of urea, diammonium phosphate, muriate of potash and zinc sulphate, respectively, remaining half dose of nitrogen was applied in two equally at tillering and panicle initiation stages. The farm yard manure was applied before fifteen days of transplanting. The seedling were transplanted with spacing of 20 x 10cm all the cultural practices were followed to raise a good crop. The grain and straw yield were recorded at maturity. The soil samples were collected as initial before and after harvest of the crop and analysed for chemical properties by following standard methods (Jackson, 1973). The plant samples were collected N, P and K (Jackson, 1973) and nutrient content by grain and straw was computed. The experimental data were statistically analyzed using MSTATC.

Results and Discussion

Yield attributes

Application of different manure and fertilizers combinations increased the tiller numbers and plant height of rice. Maximum numbers of tiller per $hill^{-1}$ (8.07) and plant height (103.60 cm) were recorded in T_9 treatment consisting of 125% STR + FYM + Azotobacter and lowest of the numbers of tiller per $hill^{-1}$ and plant height in T_1 treatment (control). Organic manures and inorganic fertilizers combinations have great effect on the yield attribute; here Nitrogen is one of the most important elements for vegetative growth of plant. Indian soils are deficient in nitrogen. Tilling has been found to be promoted by application of nitrogen. Maximum tillers were observed in T9 125% STR + FYM + Azotobacter (Reddy and Prasad (1980). Maximum grain and straw yield was recorded in T_9 followed by T_5 treatment, showing 59.75 and 56.54 qha^{-1}, respectively. Combine use of organic manure and inorganic fertilizers significantly increased the yield of rice crop Bhajpai *et al.,* (2006).

Nutrient content

The data on presented in exhibited that nutrient content of Nitrogen, Phosphorus and

Potassium was significantly affected by the application of optimum combinations of manures and fertilizer in plant at harvest stage of crop. The increase in nutrient content of Nitrogen, Phosphorus and Potassium on its additions is in accordance with dry matter yield. The content of grain and straw was found lowest in T_1 treatment (control-no use fertilizer) i.e. 10.51 and 7.150 kg ha-1 grain respectively. The use of optimum combination of manures and fertilizers increased the content in grain values been 23.300 kg ha-1, respectively Kumar and Prasad (2008).

Quality parameter

Data presented in table 2 revealed that starch, amylase and amylobectin content in rice grain rice were significantly influenced by the application of graded levels of treatments with and without FYM and Azotobacter. On an average, highest starch content was recorded with FYM and Azotobacter combination of graded levels of nutrients i.e. 125% STR +FYM + Azotobacter (T9) was found 70.90 per cent higher than the lowest starch content recorded at 64.75 in control (T1). Similarly, the highest amylose content 37.20 per cent recorded in treatment control (T_1) and 33.97 per cent recorded at T_9. Similarly, the highest amylobectin content 72.00 per cent recorded in T_9 treatment. 125% STR+ FYM + Azotobacter and 65.75 per cent recorded at control. It is very interest mention here again starch content was increased with integration of FYM and Azotobacter Subhiah and Kumaraswamy (2000). Starch content in grains in rice also was significantly influenced by different treatments. The starch content ranged from 64.75 - 70.90, the treatment T9 125% STR+FYM+Azotobacter gave the maximum content of starch 70.90% Jhadhav *et al.*, (2003). In case of amylose content the highest value was recorded in control 37.20% and lowest at T9 treatment 33.97%. The amylopectin content ranged from 65.75-72.00% respectively. The highest value of amylopectin recorded in T9 (125% STR + FYM + Azotobacter) treatment Das *et al.*, (2009).

Table.1 Effect of organic manure and inorganic fertilizers on plant height (cm), Test weight (g), grain and straw yield q/ha^{-1}

Treatment	**Plant height (cm)**	**Test weight (g)**	Grain yield q/ha.	Straw yield q/ha.
T_1- Control	71.30	18.06	31.15	42.06
T_2-150: 75 : 75 (NPK, Kgha^{-1})	85.39	21.61	49.250	62.320
T_3- 75 : 37.5 : 37.5 (NPK, Kgha^{-1})	83.05	21.00	47.900	60.610
T_4- 75 : 37.5 : 37.5 (NPK, Kgha^{-1}) +FYM (10t/ha^{-1})	90.42	22.88	52.150	65.980
T_5-75 : 37.5: 37.5(NPK. Kgha^{-1}) +FYM (10t/ha^{-1}+ Azotobacter	97.88	24.50	56.450	71.430
T_6- 150: 75: 75 (NPK, Kgha^{-1}) + Azotobacter	95.97	23.80	55.350	70.030
T_7- 125% STR	88.77	22.25	51.200	64.780
T_8- 125% STR + FYM (10 t/ha)	93.11	23.25	53.700	67.950
T_9-125% STR +FYM (10t/ha) + Azotobacter	103.60	24.65	59.750	75.600
SE ±	**1.9336**	**0.5441**	**1.9215**	**3.119**
CD 5%	**5.8877**	**1.6316**	**5.7702**	**6.5978**

Table.2 Effect of organic manure and inorganic fertilizers on Nutrient content in grain (%), Amylose, Amylopectin and Starch (%)

Treatment	Nutrient content in Grain			Amylose (%)	Amylopectin (%)	Starch (%)
	N	P	K			
T_1- Control	1.290	0.340	0.227	37.200	65.758	64.750
T_2-150: 75 : 75 (NPK, $Kgha^{-1}$)	1.310	0.350	0.272	35.000	66.910	65.900
T_3- 75 : 37.5 : 37.5 (NPK, $Kgha^{-1}$)	1.300	0.340	0.264	35.490	67.280	66.250
T_4- 75 : 37.5 : 37.5 (NPK, $Kgha^{-1}$) +FYM ($10t/ha^{-1}$)	1.350	0.360	0.288	35.120	67.980	66.950
T_5-75: 37.5: 37.5(NPK. $Kgha^{-1}$) +FYM ($10t/ha^{-1}$+ Azotobacter	1.430	0.380	0.311	34.570	68.690	67.650
T_6- 150: 75: 75 (NPK, $Kgha^{-1}$) + Azotobacter	1.400	0.370	0.305	34.700	67.740	66.710
T_7- 125% STR	1.330	0.350	0.283	34.760	67.160	66.150
T_8- 125% STR + FYM (10 t/ha)	1.370	0.360	0.296	35.760	67.960	66.950
T_9-125% STR +FYM (10t/ha) + Azotobacter	1.4800	0.390	0.330	33.970	72.000	70.900
SE ±	**0.0191**	**0.0055**	**0.115**	**0.8826**	**0.4796**	**0.1862**
CD 5%	**0.0574**	**0.0164**	**0.0367**	**2.6465**	**1.4384**	**0.5591**

It is concluded from this investigation that application of Inorganic nutrients and organic manure significantly increased the grain and straw yields. Maximum grain yield of rice was obtained in treatment T_9 (59.75 qha^{-1}) consisting of 125% STR +FYM + Azotobacter. Similarly, highest nitrogen uptake in rice grain was recorded to the extent of 88.43 Kg ha^{-1} in T_9 and minimum 40.18 Kg ha^{-1} control use of inorganic nutrients and organic manure FYM and biofertilizer (Azotobacter) increased the grain and straw yields of rice, also maintained soil fertility and agro-ecosystem. Farmers are advised to test the soil of cultivated field and deficient nutrients area applied with the integration of organic (FYM) and biofertilizer (Azotobacter) to procure better sustainable yield and to maintain the quality of rice. Organic manures improve the physical condition of soil and supply limited quantities of plant nutrients through microbial activities. On decomposition, organic matter is converted in humus into soil.

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