RESEARCH ARTICLE

PRODUCTIVITY OF RICE, WHEAT AND N REMOVAL BY RICE AS INFLUENCED BY ORGANIC AND INORGANIC SOURCES OF NITROGEN IN RICE AND THEIR RESIDUAL EFFECT ON SUCCEEDING WHEAT CROP

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Abstract: Soil health is towards deteriorating because of continuous use of chemical fertilizers keeping in view experiment were conducted on Integrated nutrient management with different treatment of Prilled Urea, FYM and Green manuring in rice crop and its effect on succeeding wheat crop. The experimental field having pH 7.9 (1:2.5 soil and water), cation exchange capacity 11.1 Cmol (p^+) kg $^{-1}$ and available N, P and K 165.5, 60 and 90.1 kg ha^{-1} respectively. Experiment were laid out in RBD with ten treatment combinations in four replications on rice Variety Pant-10 and Wheat var. K-8804. It is reveled that the addition of green manuring proved superior to FYM in terms of yield and their parameters of rice crop. On an average highest total uptake (128.90 q ha^{-1}) was recorded in treatment T_5 (N 60 through PU + N 60 through GM) followed by T_4 (120 kg N ha^{-1} through PU) i.e. 123.52 kg ha^{-1}.

Keywords: FYM, Grean manure, Productivity, Wheat crop

INTRODUCTION

The increasing cost of chemical fertilizers, poor purchasing capacity of farmers and ill effect on soil health due to continuous use of chemical fertilizers emphasis has to be given on the integrated nutrient management. Chemical fertilizer has to be reduced by sustaining it with green manuring and other organic sources of manuring like FYM, compost and plant residue.

Keeping in view the ill effect of sole use of chemical fertilizer on soil health as well as environment, low affordable capacity of poor farmers due to high cost and prevailing energy crises there is an urgent need to develop best combination of organic and inorganic source of nitrogen like FYM, dhaincha, renewable resource of plant nutrients. There is strong need to identify organic sources having little alternative uses like fodder, fuel, energy and are cost effective. Incidentally the potential of manurial resource and organic wastes is very high in India.

The present study was under taken with objective effect of organic and inorganic sources of nitrogen in rice and their residual effect on succeeding wheat crop; yield and N-uptake by Rice.

MATERIAL AND METHOD

The experiment was conducted for two consecutive crop years at the crop research farm Pura (Kanpur Dehat) of CSA university of agriculture and Tech. Kanpur (25^0 28' to 26^0 58' North latitude of 125. 30 mt MSL). The soil was sandy loam in texture. Important physico-chemical properties of soil were pH 7.9 (1:2.5 soil and water), cation exchange capacity 11.1 Cmol (p^+) kg $^{-1}$ and available N, P and K 165.5, 60 and 90.1 kg ha^{-1} respectively.

The uptake of nutrient (N) was calculated from data on concentration (%) of the given nutrient multiplied by the corresponding dry matter yield. The soil samples were collected at the end of experimentation to determine soil organic carbon, available N, P and K as per methods given by *walkly and Balck (1934), Subbiah and Asija (1956), Olsen et al., (1954) and Jackson (1973).*

Pooled data were analyzed by procedure laid down by Panse and Sukhatme (1978). Summary table prepared and data were interpreted on per standard procedure. The data were large consistent and comparable in both the years, therefore they were pooled.

The experiments were laid out in RBD with ten treatment combinations in four replications on rice Variety Pant-10 and Wheat var. K-8804. The treatments were, T_1 – control, T_2- N60 kg ha^{-1}, through PU (Prilled Urea), T_3 – 90 kg ha^{-1} through PU, T_4- N120 kg ha^{-1} Through PU, T_5- N120 kg ha^{-1} (N60 through PU+ N60 GM (green manure), T_6- N120 kg ha^{-1} (N90 through PU+ N30 GM (green manure), T_7- N120 kg ha^{-1} through GM, T_8-N120 kg ha^{-1} (N60 through PU + N60 through FYM) , T_9- 120 kg ha^{-1} (N90 through PU + N30 through FYM) and T_{10}- N120 through FYM and few residual response on succeeding wheat crop the wheat experiment was conducted on the same layout field N, P and K were applied @80, 40 and 40 kg ha^{-1} respectively in all plots.

The Dhaincha var. *Sesbania aculeata* incorporated in soil before transplanting of paddy in both the years of experiments, nursery was raised and after 30 days the 2 -3 seedlings per hill were transplanted in the main

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field. Recommended normal package and practices including fertilizer application as per the proposed treatments, weeding irrigation and plant protection measured were adopted.

RESULT AND DISCUSSION

Yield of rice and wheat

Significantly higher grain yield were obtained by the nitrogen application through Prilled Urea, green manure and FYM, over control, in case of rice as well as in residual effect on succeeding wheat crops. The maximum grain yield was produced T_5 (60 kg N (PU) + 60 kg N (GM) followed by T_4 (120 kg N (PU) and T_6 (90 kg N (PU) + 30 kg N (GM), showing the value 52.2q, 51.0 q and 50.4 q ha^{-1}, respectively.

Table 1. Effect of organic manure and inorganic fertilizer on grain yield (qha^{-1}) of rice and residual effect of on succeeding wheat crop (Pooled data) for two seasons.

Treatment	Rice	Wheat
T_1	32.00	34.17
T_2	43.40	34.62
T_3	46.95	35.23
T_4	51.00	36.67
T_5	52.20	38.61
T_6	50.40	37.24
T_7	45.10	39.86
T_8	48.20	41.45
T_9	49.50	37.95
T_{10}	44.10	42.30
SE (diff)	1.285	1.832
CD at 5%	2.637	3.760

Chemical fertilizer and organic manure both are important for rice cultivation, organic manure improve the physical condition of soil and supply limited quantities of plant nutrients through enhanced microbial activity rice crop remove large quantity of nutrients from soil. Green manure through root nodules helps in atmosphere nitrogen fixation. In addition of N fixation green manure enriched the soil with organic matter which helps in reduction on many nutrients such as Fe, Mn, P etc in soil, causing their higher availability to crop plant and in turn higher yield.

In paddy soil mostly reducing condition prevail and decomposition of organic matter reduces organic anions which help in maintaining reducing condition of the soil and also help in release of phosphate in which become availability to plant. Rice is NH_4 loving crop and due to hydrolysis of urea NH_4 -N is produced is become availability to plants. *(Patel 1971), Pongathai (1993), Hidayatullah et al. (2012) and Moola Ram et al. (2014).*

The residual response of added inorganic fertilizers and organic manure in rice to succeeding wheat crop, higher wheat grain yield was recorded in treatment T_{10} 120 kg N (FYM) followed treatment consisting of T_8 60 kg N (PU) + 60 kg N (FYM) T_9 120 kg N (GM) during the study. FYM is store house of a number of macro and micro Nutrients like P, S, K, Fe, Mn, Cu, and Zn. When wheat crop sown after rice the C: N ratios is reduced and availability of nutrients to the crop increases, consequently grain yield of succeeding wheat crop increased. These results collaborated with the findings of *Mulen et al, (1981), Nambiar and Abrol (1989), Davari et al. (2012), Hidayatullah et al. (2012) Moola Ram et al, (2014) and Mairan et al, (2014).*

Nitrogen uptake

Table 2. Effect of organic manure and inorganic fertilizer on total nitrogen uptake in rice crop (Pooled data two seasons).

Treatment	Total N uptake (Kg ha^{-1}) rice crop
T_1	73.48
T_2	100.08
T_3	111.08
T_4	123.52
T_5	128.90

T_6	120.61
T_7	105.68
T_8	114.36
T_9	113.36
T_{10}	102.42
SE (diff)	1.695
CD at 5%	3.478

Nitrogen uptake by both the crops increased significantly and consistently with the addition of organic manure with chemical fertilizer over control. Uptake of nutrients depends upon total yield and their concentration. The prolonged and spatial availability of green manure N or FYM seem to supply and supplement smaller amount of nitrogen to rice plant over a period of non availability of nitrogen from urea – nitrogen top dressing in limited quantities at tillering and panicle initiation stages. Maximum uptake was recorded in treatment T_5 (60 N(PU) + 60 kg N (GM) showing 123.52 kg N ha^{-1} followed by 128.90 kg N ha^{-1} in T_4 120 kg N (PU) and 120.6 kg ha^{-1} in T_6 90 kg N (PU) + 30 kg N (GM). These results are supported by the findings of *Jany and Chang (1992), Rokima and Prasad (1989), Singhundhup and Rajput (1990), Bacar (1990), Prasad and Rokima (1992), Moola Ram et al, (2014) and Mairan et al, (2014).*

CONCLUSION

Integrated use of organic manures viz: FYM and green manures along with chemical fertilizers give at par results over sole use of chemical fertilizers. The application of urea in 3 splits recorded better grain yield (51.0 q ha^{-1}) of rice. Highest grain yield (52.20 q ha^{-1}) was obtained in treatment consisting of 60 kg N through green manuring (dhaincha) incorporation in soil and 60 kg N through prilled urea application in splits. The addition of green manuring proved superior to FYM in terms of yield and their parameters of rice crop. On an average highest total uptake (128.90 q ha^{-1}) was recorded in treatment T_5 (N 60 through PU + N 60 through GM) followed by T_4 (120 kg N ha^{-1} through PU) i.e. 123.52 kg ha^{-1}.

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