Effect of Integrated Nutrient Management on productivity and quality of Rice

Abstract

The present field experiment was conducted at crop research farm Nawabganj of C.S. Azad University of Agriculture and Technology Kanpur, under the Central Plain zone of Uttar Pradesh,during Kharif season of 2018. The experiment comprised of 9 treatment combinations in randomized block design with three replications consisted of T_1: Control, T_2: 100% RDF(120:60:60), T_3: 75% RDF+25% N as FYM, T_4: 75% RDF+25% N as CWC, T_5: 75% RDF+25% N as PM, T_6: 75% RDF+25% N as FYM+ CWC, T_7: 75% RDF+25% N as CWC+ PM, T_8: 75% RDF+25% N as FYM+PM, T_9: 75% RDF+25% N as FYM+ PM+CWC. On the basis of the results emanated from present investigation, it could be concluded that application of 75% RDF+25% N as FYM+ PM+CWC applied in rice to significantly increases yield attributes, yield and protein content.Results showed that maximum among the different fertility levels, application of T_7 [75% RDF+25% N as CWC+PM] significantly enhanced productivity parameters i.e. grain yield and straw yieldover the control.

Key Words: FYM, Protein, Rice, Tiller, and Yield.

1. Introduction:

Rice (*Oryza sativa* L.) is the most important staple food for three fourth of the Indian population has become an item of commerce since last two decades. 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 by Asian countries. The protein content of rice about 6-7%. 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**(Varma *et al.*, 2017).**

In the global content India stands first in area with 43.5mha, second in production with 115mt in 2018-19(Food Corporation of India, and GOI Budget). Over increasing population of India, it is assumed that we have to produce about 140 million tonnes rice by

2025 AD. For achieving the goal of food grain requirement satisfactory which can be achieved only by increasing the rice production by over 2.0 million tonnes every year in coming decade **(Ghosh *et al.*, 2017)**

Nitrogen is the most important plant nutrient and influences plant growth and production. It is a structural constituent of cell. It provides help is build up of vegetative growth and assist in the utilization of other nutrients likes P and K in cereals and plays an important role in plant metabolism by virtue of being an essential constituent of diverse type of metabolically active compounds likes amino acids, proteins, nucleic acids, co-enzymes and alkaloids. In lack of Nitrogen the crop growth is greatly retarded, foliage turns yellowish, cause shriveling of grains and ultimately lower crop yield, chlorophyll and carbohydrate assimilation are greatly diminished**(Leghari *et al.*, 2016)**

Phosphorous is second i.e. next to N and is one production. It influences very widely crop production plant growth. P is called, "the key of life" because it is directly involved in most life processes. It is present in all living cell and is a constituent of cell nucleus. It is essential for cell division and development of meristmatic tissues at growing of plants. P has been also called as the "bottle neck of world hungers". It is saturated component of cell membranes, chloroplast and mitochondria. It is necessary for photosynthesis and breakdown of carbohydrate and transfer of energy within plant. It is a stimulant for plant root development as well as plant tillers**(Cordell *et al.*, 2009).**

Potassium plays an important role in the maintenance of cellular organization by regulating the permeability of cellular membrane by stabilizing the emulsion of high colloidal properties. K has a great buffering action and solubilizes various enzyme systems. It plays role in photosynthesis and translocation of food from leaves to the seeds. It affects both carbohydrates and protein metabolism and regulates their proportion in plant. It also enhances the plant ability to resist pest attack, stain of moisture and cold conditions. Its role in the plant growth is very specific with nature of soil**(Maurya *et al.*, 2014).**

In India, Farm Yard Manure (FYM) and compost have been used traditionally by farmers for crop production since times immemorial. Conversely, organic manure can alone cope with heavy nutrient demand of crop. Presently, the addition of N through organic manure in Uttar Pradesh is around 5kgha^{-1} which is practically in significant**(Punitha *et al.*, 2021).**

Poultry manure, if properly handled, is a valuable organic source of essential plant nutrients and soil amendment to improve soil quality. Poultry manure primarily source of N, P and K but also contains Ca, Mg, S and micronutrients. Poultry manur by farmers for crop

production since times immemorial. Conversely, organic manure can alone cope with heavy nutrient demand of crop. e contains 3.03% N, 2.63% P_2O_5 and 1.4% K_2O. Poultry manure has long been recognized as perhaps the most desirable of these natural fertilizers because of its high N content**(Bolan*et al.*, 2010).**

Organic Matter directly or indirectly makes the physical, chemical, and microbiological environments of soil for growth of crop**(Fageria 2012).** FYM, CWC and PM improves the physical condition of soil by increasing water holding capacity for maximum utilization of water, aeration, tilth and soil structure. It also improves the chemical and biological condition of soil by increasing CEC and providing various vitamins, hormones and organic acids which are very important for soil aggregation and for beneficial micro-organism which are involved in various biochemical processes and release of nutrient**(Buysee*et al.*, 1013).**

Therefore, an integrated nutrient approach involving use of various source of plant nutrients such as chemical fertilizer, biological sources of nutrient, organic manures and green manure help to maintain soil health and sustain crop productivity. However, it is imperative to use technology in integrated manure so that the potential yield of rice could be realized on sustain basis **(Jat *et al.*, 2015).**

2. Materials and Methods

2.1 Experimental Site

To carry out the present investigation the experiment was conducted at Crop Research Farm Nawabganj, C. S. Azad University of Agri. and Tech., Kanpur, during *kharif* season of 2018.Which lies between the parallel of 25.26° and 26.58°north latitude and 79.31° and 80.34° east longitude. It is situated at an elevation of 124 meters above the sea level in the alluvial belt of Gangetic plains of central Uttar Pradesh.

2.2 Edaphic Condition

The soil was moist, well drained with uniform plane topography. The soil of the experimental field was alluvial in origin, sandy loam in texture and slightly alkaline in reaction having pH 7.8(1:2.5 soil: water suspension method given by **Jackson, 1973**), low in organic carbon percentage in soil is 0.46 per cent (Walkley and Black's rapid titration method given by **Walkley and Black, 1934**), mediumin available nitrogen 269 kg ha^{-1} (Alkaline permanganate method given by **Subbiah and Asija, 1956**), medium in available phosphorus as sodium bicarbonate-extractable P was 9.85kg ha^{-1} (Olsen's calorimetrically method**, Olsen *et al.*,**

1954), medium in available potassium was 165 kg ha^{-1} (Flame photometer method given by **Hanwey and Heidel, 1952**),

2.3 Experimental Details

The experiment was conducted Randomized Block Design, 27 treatment combination with three replication.

Table no.-1: Treatment details

Treatment	Treatment combination
T_1	Control
T_2	100% RDF (120:60:60)
T_3	75% RDF+25% N as FYM
T_4	75% RDF+25% N as CWC
T_5	75% RDF+25% N as PM
T_6	75% RDF+25% N as FYM+CWC
T_7	75% RDF+25% N as CWC+PM
T_8	75% RDF+25% N as FYM+PM
T_9	75% RDF+25% N as FYM+CWC+PM

Where,

RDF (Recommended Dose of Fertilizers): NPK (120:60:60)

FYM: Farm Yard Manure

PM: Poultry Manure

CWC: City Waste Compost

2.4 Raising of Nursery

Treated seed were sown in the nursery on 16 June, 2018 before sowing the field was prepared with three cross ploughing with country plough followed by planking and then the nursery beds were prepared above the ground levels of about 5cm.

2.5 Uprooting of Seedling

The nursery was given light irrigation before uprooting of seedlings. The seedling was uprooted on 11 July, 2018 for transplanting in the experimental field.

2.6 Transplanting of Seedling

Transplanting of 26 days old seedlings was done on 12 July, 2018 in 4-5 cm standing water with plant geometry of 20×10 cm in regular rows and hills. Two seedlings were planted per hill.

2.7 Fertilizer Application

In respect of inorganic sources of fertilizer half of the total amount of nitrogen and total amount of P and K were applied just before the transplanting. Rest half nitrogen was applied in two split doses in standing crop as tillering and panicle initiation stages. In respect of organic sources of nutrient addition, full amount of FYM, CWC and PM were applied as per treatment just a week before transplanting.

2.8 Observations recorded

2.8.1 Grain yield (q ha^{-1})

The total weight of clean and dried grains from each plot was weighed with the help of electronic balance in kg/ha and converted into q/ha.

2.8.2 Straw yield (q ha^{-1})

Straw yield of each plot can be obtained by deducting the grain yield from the respective biological yield and expressed in q/ha.

2.8.3 Protein Content

Protein content was calculated by multiplying N% content by the factor 6.25.

2.8.4 Protein Yield

Protein yield (kg ha^{-1}) = Protein content × Yield(kg ha^{-1}) /100.

2.9 Statistical Analysis: The data on various characters studied during the course of investigation were statistically analysed for randomized block design. Wherever treatment differences were significant (“F” test), critical differences were worked out at five per cent probability level. The data obtained during the study were analysed statistically using the methods advocated by **Gomez and Gomez (1984).**

3. Result and Discussion

3.1 Yield Attributing Characters

Among the yield attributing characters viz; no. of tillershill^{-1} and test weight (g), of ricewere studied. Maximum no. of tillers hill^{-1} (58.15) and test weight (27.24 g), of rice was recorded from T_7 [75% RDF+25% N as CWC+PM] which were statistically at par with T_8 [75% RDF+25% N as FYM+PM] and significantly higher than T_1 [Control] treatment. Minimumno. of tillers hill^{-1} (45.34) and test weight (21.71 g), of rice was recorded from T_1 [Control]. Similar findings were reported by **Chaudhary *et al*., (2008),Baishya *et al*., (2015)and Moe *et al*., (2017).**

Table no.-2: Effect of integrated nutrient management on yield attributes of rice

Treatment	No. of tillers hill^{-1}	Test weight (g)
T_1	45.34	21.71
T_2	52.39	22.85
T_3	51.22	23.30
T_4	52.25	23.70
T_5	55.19	26.33
T_6	54.51	25.41
T_7	58.15	27.24
T_8	56.93	26.62
T_9	53.47	25.83
S.E.m±	0.36	0.16
C.D. (P= 0.05)	0.78	0.34

3.2 Productivity Parameters

The data revealed that maximumgrain yield (51.92 q ha^{-1}) and straw yield (62.30 q ha^{-1}), of wheatwas recorded from T_7 [75% RDF+25% N as CWC+PM] which were statistically at par with T_8 [75% RDF+25% N as FYM+PM] but significantly superior over other treatments. However, the minimum grain yield (27.95 q ha^{-1}) and straw yield (34.56 q ha^{-1}), of ricerecorded with T_0 [Control].The result gave clear data that use of organic manures in combination with inorganic fertilizers RDF (120:60:60 NPK) and zinc produce the highest yield. These result are accordance with the finding of **Bajpai *et al.*, (2006), Sharma *et al.*, (2009),Ghosh (2007) and Kumar *et al.*, (2022)**

Table 3. Effect of integrated nutrient management on productivity parameters of rice

Treatment	Grain Yield (q ha^{-1})	Straw Yield (q ha^{-1})
T_1	27.95	34.56
T_2	46.21	55.14
T_3	44.32	53.18
T_4	46.72	56.06
T_5	49.37	59.73
T_6	47.02	56.43
T_7	51.92	62.30
T_8	49.72	59.67
T_9	48.14	57.76
S. Em±	1.31	1.82
C.D. (P= 0.05)	1.97	2.89

3.3 Quality parameters

The data presented in table 4 revealed that application of fertilizers with organic manures i.e. FYM, CWC and PM increased the protein content in rice. The highest protein content i.e. 8.50 % was obtained in treatment combination 75 % RDF + 25 % N as CWC + PM (T_7) and lowest was observed in control (T_1) i.e. 6.88 %. The highest protein yield (441.32 kg ha^{-1}) was obtained from treatment combination of 75 % RDF + 25 % N as CWC + PM and lowest was observed in control (T_1) i.e. 192.29 kg ha^{-1}. These results are in confirmation with finding of

Raikar *et al*., (2010)and Kandeshwari&Thavaprakash (2016)

Table 4. Effect of integrated nutrient management on quality parameters of rice

Treatment	Protein content (%)	Protein Yield (kg ha^{-1})
T_1	6.88	192.29
T_2	7.67	354.43
T_3	7.75	343.48
T_4	7.81	364.88
T_5	8.18	403.84
T_6	8.06	378.98
T_7	8.50	441.32
T_8	8.25	410.19
T_9	8.12	390.89
S. Em±	0.295	1.486
C.D. (P= 0.05)	0.610	4.494

Conclusion

Based on the finding of the present study, it can be inferred that application of T_7 [75% RDF+25% N as CWC+PM] resulted maximum yield attributes, yield and quality parameters which results more yield of rice crop during kharif season in central zone of Uttar Pradesh. It is strongly recommended that farmer of the central U.P adopt the dose of T_7 [75% RDF+25% N as CWC+PM] doses for better crop yield.

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