Effect of Integrated use Organic manure and Bio-fertilizers on crop productivity under Rice (*Oryza sativa L.*) crop

Comment [IGKA1]: Effect of integrated use of organic manure, inorganic fertilizer and Biofertilizers on rice production

ABSTRACT

Comment [IGKA2]: The abstract should be concise and It should briefly describe the purpose of the work, techniques and methods used, major findings with important data and conclusions

The present study conducted entitled, "Effect of Integrated use Organic manure and Bio-fertilizers on crop productivity under Rice (Oryza sativa L.) crop". Involved field experimentation conducted during Kharif season of year 2016-17 followed by laboratory analysis of the plant and soil samples in the department of agriculture chemistry and soil science, Udai Pratap Autonomous college, Varanasi (U. P). All grasses were removed from the experimental plots and soil samples have been taken from each replication plots at 30 DAT, 60 DAT and at harvesting. The experiment was conducted under randomized block design (RBD) with six treatment combinations. Treatments were replicated thrice making the total number of 18 plots.The effect of various treatments on dry matter production could be arranged in order of T6>T3>T5>T4>T2>T1 and the value were 70.25, 62.15, 59.45, 43.40, 41.25 and 35.59 gm-1 row length, respectively. Application of fertilizers alone or in combination with FYM increased grain and straw yield of rice significantly over control . Further, the yield was significantly superior under the use of organic manure and bio-fertilizers over the sole use of chemical fertilizers. On the basis of data, the superiority of the treatments may be arranged as T6>T3>T5>T4>T2 and T1. Like dry matter yield, rice grain and straw yield was also highest in treatment were 50% NPK was substituted through FYM to rice crop. The integrated use of fertilizers with FYM and bio-fertilizers might have added huge quantity of organic matter in soil that increased grain and straw yield.In general, higher number of tillers (15.25 m-1 row length), plant height (92.50 cm), dry matter at 60 DAT (70.25 gm-1 row length), grain yield (46.25 Qha-1) and straw yield (91.25 Qha-1) of were obtained with T6 treatment followed by T3>T5>T4>T2>T1 (control).

*Keywords:*Integrated use, Organic manure, Bio-fertilizers, Rice (Oryza sativa L.), physico-chemical properties.

1. INTRODUCTION

Comment [IGKA3]: In the text, citations should be indicated by the reference number in brackets[ ]

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Rice (Oryza sativa L.) is the prime food crop for more than 65 percent of the people and provides livelihood security to 70 percent of Indian population (Kulkarni et al., 2015). India has largest farm area (43.9) million ha-1 followed by china (30.30 mha), Indonesia (13.80 mha), Bangladesh (11.30 mha) and Vietnam (7.86 mha) and production of rice 106.5 million tons and productivity of rice 3576 kg ha-1 2015-16. (Food and agricultural organization, STAT 2016). With the advent of ever increasing demand, future projections for rice production is to be 170-180 million tons with an average productivity of 4030 kg ha-1 by the year 2020 **(Mishra et al., 2006).**

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Comment [IGKA8]: Correct spelling and grammar

Rice is grown in almost all state of India but its cultivation is mainly concentrated is river velleys, deltas and low lying coastal areas in India. Andhra Pradesh, Bihar, Madhya Pradesh, Utter Pradesh lead in the area. West Bengal (15.10%), Utter Pradesh (11.99%) and Punjab (11.33%) have the highest share in rice production (Directorate of economics and statistics DAC and FW).

Rice is primarily a high energy food. it is good source of Carbohydrates (80g), suger (0.12g), dietoryfiber (1.3g), fat (o.66g), protein (7.12g) in per 100g of grain (USDA Nutrient data base, (2015). Rice bran is used as cattle and poultry feed. Rice is grown under many different conditions and production systems, but submerged in water is the most common method used world wide.

Rice is the only cereal crop that can grown for long periods of time in standing water, 57% of rice is grown on irrigated land, 25% on rainfed Introduction [2] lowland, 10% on the upland, 6% in

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deep water, and 2% in tidal wetland. As the land area decreasing with time, increasing land use intensity with inadequate and imbalanced use of chemical fertilizers with little or no use of organic manure have caused severe fertility deterioration resulting in stagnating or even declining crop productivity **(Shormy et al., 2013).**

Integrated use of inorganic fertilizers, bio-fertilizers and farmyard manure seem to be the practicable alternative to the present malady of unsustainable agriculture. Farmyard manure is easily available, cheap, proven source of nutrition to agricultural crops and has been used by the farmers traditionally. Blue green algae has vital role in soil fertility improvement and consequently increasing growth and yield as a natural fertilizer **(Song et al., 2005).**

Phosphate solubilising bacteria (PSB) has the capacity to solubilise and mineralize the residual or fixed phosphorous, increases phosphorus availability in the soil. Integrating nutrient management (INM) aimes for efficient and judicious use of all the major source of plant nutrients in an integrated manner **(Farouue and Takeya, 2007).**

on the other hand, continuous application of organic fertilizer such as FYM, PSB and BGA on rice field resulting low yield and low N and K content at the mid tillering stage of rice plant **(Javier et al., 2004).**Combined use of organic manure and inorganic fertilizer help in maintaining yield stability through correction of marginal deficiencies of secondary and micronutrients, enhancing efficiency of applied nutrients and providing favourable soil physical condition. **(Gill and Walia 2014).**

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2. MATERIAL AND METHODS

Comment [IGKA11]: Material and methods can be divided into subsection. For example, 2.1. Growth condition, 2.2. Application of fertilizer, 2.3. Data collection, 2.4. Plant analysis, etc...

The present study entitled, **"**Effect of Integrated use Organic manure and Bio-fertilizers on crop productivity under Rice (Oryza sativa L.) crop" involves field experimentation conducted during Kharif season of year 2016-2017. The field experiment was conducted during kharif season of 2016-2017 at the research plot of the Department of Agricultural Chemistry and Soil Science, Udai Pratap (Autonomous) College, Varanasi. The soils of Varanasi formed on alluvial, deposited by river Ganga have predominance of illite, quartz and feldspar mineral. Illite minerals are partly inherited from micas which are predominant in the sand and silt fraction.

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Varanasi is found under sub-tropical climate and situated in eastern U.P., India. The precipitation in this region is normally spread over period of three and four months ie. from the last week of June to the second week of October. The period from November to February is generally cool and dry. The summer season from third week of March to June is hot and dry. The distribution of average annual rain fall is 96.65 mm of which 80% from June to September, 5.7% from October to December, 3.3% from January to February and 3.0% from March to May. The experiment was conducted under randomized block design (RBD) with six treatment combinations. Treatments were replicated thrice making the total number of 18 plots.

There were six treatments which consisted of various levels of P and PSB Details of treatments and their combinations are given below. T1 = Control (no input) T2 = 100% NPKS T3 = 100% NPKS+FYM (10 Ton ha-1) +Bio-fertilizer (PSB+BGA) T4 = 125% NPKS T5 = 150% NPKS T6 = 50% NPKS+FYM (10 Ton ha-1) + Bio-fertilizer (PSB+BGA) *RDF = Recommended dose of fertilizer (120 kg N ha-1 , 60 kg P2O5 ha-1 and 60 kg K2O ha-1).

Comment [IGKA13]: Please show more detail about the fertilizer applied in each treatment. For example T2, N:P:K:S=... : ... : .... : ....% (ton/ha) ; T3, NPKS : FYM = ...:.....(...ton/ha), etc.

Field was prepared by ploughing, three cross harrowing followed by planking onset of mansoon. Around each plot bunds were made in the plots. Full care was taken to leveled the plots uniformly and grasses removed from the plot.

Nitrogen, phosphorus, potash and sulphur were applied by chemical fertilizers as per treatments. Half dose of nitrogen (60 kg ha-1) and full dose of phosphorus and potassium were applied as basal application at the time of sowing. Rest half dose of nitrogen (60 kg ha-1) applied at ear head initiation stage as top dressing. PSB and BGA was applied as per treatments at the time of transplanting.

Comment [IGKA14]: It should be very clear which treatment was applied with this inorganic fertilizer.

Healthy rice seedlings were transplanted in line with a spacing of 20 × 15 cm (row × plant). The irrigation was given whenever required to maintain appropriate level of moisture in the field during experimentation period.

Weeding and other intercultural operations were performed mechanically by hand and when required to maintain good cropping condition. The height of 4 marked plants in all the plots were recorded at different growth stages viz; 30, 60 and 90 days after transplanting (DAT) from the base of plant to the tip of the upper most fully matured leaf. The average of all observations in each plot worked out and designed as mean plant height. Number of tillers per plots at different growth stages (30, 60 and 90 DAT) were recorded from the marked plants in each plot. The crop was harvested at maturity and allowed to dry in sun. Separate bundles were made for each plot and weighed. After a week of harvesting bundles were weighed and threshed by hand. After threshing the bundles of each plot, grain and straw yield were recorded plot wise. Straw and grain yield were presented in qha-1 .

All grasses have been removed from the experimental plots and soil samples have been taken from each replicated plots initial, 45 DAT and after harvesting. Khurpi and auger was used as sampling tools. The samples were collected in plastic bags. Soil samples were brought to the laboratory, air dried, crushed and passed through 2 mm rounded sieves. The sieved samples were stored in the labeled polythene bag plot wise for conducting selected laboratory analysis.

A soil water suspension was prepared in the ratio of 1:2.5 (10 g soil and 25 ml of distilled water) and pH was recorded with the help of glass electrode digital pH meter (Jackson, 1967). Electrical conductivity of soil sample was measured in 1:2.5 soil and water suspension at 250C temperature by TDS meter (Bower and Wilcox, 1965). Organic carbon was determined by the modified Walkley and Black's rapid titration method (Walkley and Black's, 1934). The available soil nitrogen was determined by the alkaline permanganate method (Subbiah and Asija, 1956). The available phosphorus in soil was determined by the Olsen's method (Olsen's et al., 1954). The available potassium was determined by ammonium acetate method (Honway and Heidel, 1952).

Plant samples drawn at 45 days after transplanting and harvesting of crop were dried in shade and chapped into pieces and then kept in oven at 700C for 12 hours for make free from moisture. Oven dried plant samples were ground in grinder. After mixing well, the ground samples were kept in labelled samples bags for analysis. Primarily 0.5 gram ground plant sample was digested in sulphuric acid and perchloric acid with the ratio of 9:1 and digested sample were used to determine the nitrogen, phosphorus, potassium and nickel content in plant. Nitrogen in the plant samples was determined by micro Kjeldahl's method (Jackson, 1973). Phosphorus was determined colorimetrically as described by Jackson (1973). Potassium in the plants samples was determined by flame photometer procedure (Jackson, 1973). The data collected from field and laboratory studies were analyzed statistically using standard procedure of randomized block design (RBD), (Cochramand cox, 1959). Critical difference (C.D.) and standard error of mean were calculated to determine the significance among treatment mean.

3. RESULTS AND DISCUSSION

Table-1indicated that effect of Integrated use organic manure and bio-fertilizers on crop productivity under rice (Oryza sativa L.) the resultobtained in respect of the effect of the various treatments of organic manure and bio-fertilizers on dry matter, straw and grain yields of rice has been presented in table. Application of fertilizers alone or in combination with FYM increased the dry matter, grain yield and straw yield of significantly over control. Dry matter yield of rice revealed that different treatments significantly increased the dry matter yield of wheat over control. The dry matter production was significantly higher in treatment where 50% NPKmight be applied with FYM as compare to chemical fertilizers alone attributed to higher number of tillers and plant height under integrated application of chemical fertilizers, organic manure and bio-fertilizers applied plot. Similar results were observed by **vimera et al. (2012)** and **kumar et al. (2012)**. The effect of various treatments on dry matter production could be arranged in order of T6>T3>T5>T4>T2>T1 and the value were 70.25, 62.15, 59.45, 43.40, 41.25 and 35.59 gm-1 row length, respectively. Application of fertilizers alone or in combination with FYM increased grain and straw yield of rice significantly over control (table). Further, the yield was significantly superior under the conjoint use of chemical fertilizers, organic manure and

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bio-fertilizers over the sole use of chemical fertilizers. On the basis of data, the superiority of the treatments may be arranged as T6>T3>T5>T4>T2 and T1. Like dry matter yield, rice grain and straw yield was also highest in treatment were 50% NPK was substituted through FYM to rice crop. The integrated use of fertilizers with FYM and bio-fertilizers might have added huge quantity of organic matter in soil that increased grain and straw yield. This might be due to the improvement in physico-chemical properties of soil that resulted in increased productivity by increasing availability of nutrients. **Chaudhary and thakur (2007**), **Ghose et al.(2003), Singh et al.(2014) and Chesti et al.(2015)** also observed the significantly effect of chemical fertilizers, organic manure and bio-fertilizers on rice crop. A like grain yield, straw yield also recorded significantly higher in T6 (50% NPKS +FYM (10 ton ha-1)+bio-fertilizers (PSB+BGA) as compared to other treatments. The effect of various treatments on straw yield could be arranged in order of T6>T3>T5>T4>T2>T1 and value were 91.75, 86.25, 79.25, 75.75, 70.75 and 62.00 q ha-1 respectively. The beneficial effect of organic manure (FYM) on yield might be due to additional supply of plant nutrient as well as improvement in physical and chemical properties of soil. **Satish et al. (2011)** and **Satyanarayana et al. (2002**).

Table-1 Effect of integrated use of organicmanureandbio-fertilizersondrymatter(gm^{-1}rowlength),grain andstrawyield (Qha^{-1})ofricecrop

Treatment	Drymatterat60 (DAT) (g m^{-1}row)	Grainyield(Qh a^{-1})	Strawyield(Qh a$^{-1)}$
T_1	35.59	26.25	62.00
T_2	41.25	31.00	70.75
T_3	62.15	43.25	86.25
T_4	43.40	34.25	75.75
T_5	59.45	37.00	79.25
T_6	70.25	46.25	91.75
SEm±	**0.065**	**0.114**	**0.135**

CD(P=0.05)	**0.205**	**0.306**	**0.426**

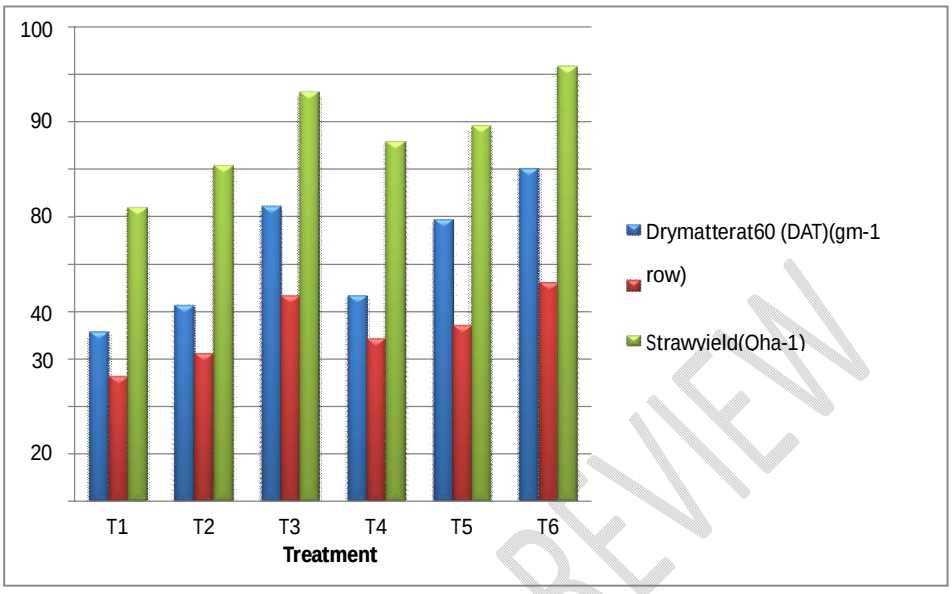

Fig-1Effectofintegrateduseofchemicalfertilizers,organicmanureandbio-fertilizersondrymatter(gm^{-1}rowlength),grain andstrawyield (Qha^{-1}) ofrice crop

Comment [IGKA20]: This data has already shown in table 1.

4. SUMMARY AND CONCLUSIONS

An experiment was undertaken with rice crop on sandy loam soil during kharif season (2016) to investigate the effect of integrated use of chemical fertilizers, organic manure and bio-fertilizers on soil properties, growth, yield and nutrient uptake by rice crop. The treatment were T1 (control), T2 (100% NPKS),T3 [100% NPKS +10 ton ha-1 FYM + Bio-fertilizers (PSB+BGA)], T4 (125% NPKS),T5 (150% NPKS) and T6 [50% NPKS + 10 ton ha-1 FYM + Bio-fertilizers (PSB +BGA)].The rice experiment was laid out in randomized block design (RBD) with three replication.

In general, higher number of tillers (15.25 m-1 row length), plant height (92.50 cm), dry matter at 60 DAT (70.25 gm-1 row length), grain yield (46.25 Qha-1) and straw yield (91.25 Qha-1) of were obtained with T6 treatment followed by T3>T5>T4>T2>T1 (control).

It is concluded that application of 50% NPKS + 10 ton FYM ha-1 + Bio-fertilizers PSB + BGA not only produced higher yield of rice, but also inhanced soil fertility as compared inorganic fertilizers alone. Higher nutrients availability was also recorded in inorganic fertilizers, organic manure and bio-fertilizers treated plots.

REFERENCES

Comment [IGKA21]: References must be listed and numbered in the order that they appear in the text.Do not number the references alphabetically. Every reference referred in the text must also present in the reference list and vice versa

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