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EFFECT OF ORGANIC AND INORGANIC SOURCES OF NUTRIENT IN COMBINATION WITH SOIL AND FOLIAR APPLICATION OF ZINC IN RICE (*Oryza sativa* L.)

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ABSTRACT
The experiment consisted of ten treatments laid out in Randomised Block Design and replicated thrice with two factors *viz* Factor A: $ZnSO_4$ at 15kg/ha, 25kg/ha and 0.5% foliar application at 30 and 60 DAT and Factor B: Organic manure at FYM 6t/ha, Vermicompost 2t/ha and Poultry manure 1980 kg/h. The significant and maximum value in growth parameters like number of tiller/hill (11.46), Plant dry weight (60.68 g), as well as yield attributes character like Number of grain/panicle (252.00), Test weight (33.03 g), and Grain yield (7.94 t/ha) was recorded maximum in Treatment 5 (90 kg N/ha + 2000 kg /ha VC + 25 kg/ ha $ZnSO_4$ at Transplanting). the maximum B:C *i.e.* 2.72 was found treatment 5 *i.e.* 90 kg N/ha + 2000 kg /ha VC + 25 kg/ ha $ZnSO_4$ at Transplanting which is followed by Treatment 3 (2.62) *i.e.*90 kg N/ha + 6 t/ha FYM + 15 kg/ha $ZnSO_4$ at Transplanting).

INTRODUCTION

Rice is the staple food crop for more than half of the world's population which supplies adequate energy in the form of calories and is a good source of thiamine, riboflavin, and niacin. But, it lacks other important vitamins such as vitamin A, minerals like iron and zinc which are essential to human health (Stalin *et al.*, 2011). However, more than 90% of the rice is produced and consumed in Asia, where it is a staple for a majority of the population, including the region's 560 million hungry people.

Generally, paddy requires large quantity of major nutrients like nitrogen, phosphorus and potassium in addition to secondary nutrients such as calcium and zinc for better growth and grain yield. The use of Organic fertilizers such as farm yard manure (FYM), vermicompost and Poultry manure can serve as a source of soil organic matter and source of nutrients needed for the growth and production of rice crops. However, it is difficult to have sufficient amount of Organic manure that can supply adequate amount of nutrients needed by crops. Thus the use of inorganic and organic sources of nutrient are import to ensure adequate and balanced supply of nutrient to crops. With integrated nutrient management approach, the inorganic fertilizer can be used to supplement readily available nutrients to plants at early growth stages, whereas organic fertilizers at later growth stages of plant growth that can boost yield and reduce the risk of losses (Mitiku *et al.*, 2014). Combined use of inorganic and organic fertilizers increases fertilizer use efficiencies, ensure balanced nutrient supply to crops and improve soil sustainability *etc.* (Kumar *et al.*, 2015; Singh *et al.*, 2011) The cost of inorganic fertilizer has been enormously increasing to an extent that they are out of much of the small and marginal farmers. With increase in cost of cultivation due to increase in labour cost and other input cost, there is need for a fresh look to exploit the organic farming approaches using the local manurial sources for growing rice without using much of purchased chemical fertilizers, pesticides which minimize environmental pollution and maintain the fertility of soil on sustainable basis.

Application of major nutrients through green manure or with other organic manure like FYM, Vermicompost, Poultry manure enhances the soil fertility as compared to mineral fertilizers alone (Panda and Singh, 1996). Combined use of organic manures and urea fertilizers check the nitrogen losses, conserve soil nitrogen by forming organo-mineral complexes, thus ensures continued nitrogen availability to rice plant. Organic manures are known not only for substituting costly inorganic fertilizers but also improve physical and chemical conditions of the soil. Addition of organic manures improve the organic carbon content of the soil (Nambiar *et al.*, 1992) which decides availability of nitrogen and other macro-micro nutrient of the soil. Organic sources of plant nutrients had a substantial residual effect and applied to the preceding crop benefit the succeeding crop to a great extent and system productivity becomes sustainable through integrated use of organic and inorganic sources of nutrients (Nambiar *et al.*, 1992; Singh and Yadav, 1992).

Keeping view of the above, field and laboratory investigations

were conducted on rice crop with the following objectives:

To find out the effect of nutrient and zinc in growth and yield of rice crop.

To find out the Economics of different treatment combination.

MATERIALS AND METHODS

The experiment was carried out during Kharif season of 2019 at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj (U.P.) which is located at 250 24' 42" N latitude, 810 50' 56" E longitude and 98 m altitude above the mean sea level. the soil of the experimental field was sandy loam in texture having pH 7.7, medium in available NPK but low in organic carbon *i.e.* 0.04%. The experiment was conducted in Randomized Block Design consisting of 10 treatments combinations with 3 replications and was allocated randomly in each replication. The experiment was conducted using Rajendra Bhagwati variety of rice. the rice nursery was raised on 24 th June 2019 and transplanted on 14 July with a spacing of 20 cm × 15 cm.

Statistical analysis

The experiment data was collected to analyse statistical by Fishers method of Analysis (ANOVA) as outline by Gomen and Gomez (2010). Critical Difference (CD) value were calculated whenever the F test value was found significant at 5% level. Standard error of mean {SE(m) ±} was computed in all cases.

RESULTS AND DISCUSSION

The significant and maximum number of tillers/hill (11.46) was found in treatment number 5[90 kg N/ha + 2t/ha Vermicompost + 25 kg/ha $ZnSO_4$ at Transplanting]. However, treatment number 4 [90 kg N/ha + 6 t/ha FYM + Foliar spray of 0.5% $ZnSO_4$ at 30 & 60 DAT], treatment number 10 [90 kg N/ha + 1980kg/ha Poultry Manure + Foliar spray of 0.5% $ZnSO_4$ at 30 & 60 DAT] and treatment number 3[90 kg N/ha + 6 t/ha FYM + kg/ha $ZnSO_4$ at Transplanting] found to be statistically at par with treatment number 5 [90 kg N/ha + 2t/ha Vermicompost + 25 kg/ha $ZnSO_4$ at Transplanting].

The more number of tillers might be due to Vermicompost application which caused dual benefit of improving the physical environment of rhizosphere region and adequate supply of available nutrients to the plant. Similar result was found by Thirunavukkrasu and Vinoth 2013, Sarker *et al*. 2015. Khan *et al*., 2003. Revealed that application of manures in combination with Zn increased the tiller of rice. They also finded that the application of Zn with FYM/ GM + NPK increased the number of Tillers/m^2 significantly over the treatments without Zn. Similar results were reported by Yaseen *et al*. (1999) and This is in agreement with findings of Joshi *et al*. (2013) and Yousefi and Sadeghi (2014)

The application organic source of nutrients as basal application produce higher growth parameter that result in significant and higher dry weight of 60.48 g in treatment 5 (90 kg N/ha + 2t/ha VC + 25 kg/ ha $ZnSO_4$ at Transplanting) However the treatment was found most significant among all these treatment.

The increase in plant dry weight might be due to direct, higher availability and translocation of nutrient during development phase of crop growth, which accelerate the metabolic and physiological activity of a plant and put up more growth by assimilating more amounts of nutrient and facilitated more photosynthesis process and ultimately increase the growth parameters *viz*. LAI, Dry weight, CGR and RGR of rice crop. Kumar *et al*. (2017).

The significant and maximum No. of grain/panicle 252.0 was

Table 1: Please write Table 1. Effect of organic and inorganic sources of nutrient in combination with soil and foliar application of ZnSO4 in Rice.

Treatments	Tiller/hill at 100 DAT	Plant dry weight at 100 DAT (g/hill)	No. of Grain/ panicle	Test weight (g)	Grain yield (t/ha)	Benefit cost ratio
1. Farmers practices (120 N: 60 P: 60 K,) kg/ ha.	10.4	54.17	219	32.25	6.94	2.58
2. 90 kg N/ha + 6 t/ha FYM + 25 kg/ha $ZnSO_4$ at Transplanting	10.33	56.77	215	31.97	7.17	2.48
3. 90 kg N/ha + 6 t/ha FYM + 15 kg/ha $ZnSO_4$ at Transplanting	10.73	58.18	213.5	30.46	7.7	2.62
4. 90 kg N/ha + 6 t/ha FYM + Foliar spray of 0.5% . ZnSO4 at 30 & 60 DAT	11.16	59.22	238.66	32.02	7.35	2.48
5. 90 kg N/ha + 2t/ha Vermicompost + 25 kg/ha $ZnSO_4$ at Transplanting.,	11.46	60.48	252	33.03	7.94	2.72
6. 90 kg N/ha + 2t/ha Vermicompost + 15 kg/ha $ZnSO_4$ at Transplanting	10.66	55.08	213.33	31.14	7.17	2.49
7. 90 kg N/ha + 2t/ha Vermicompost + Foliar spray 1of 0.5% $ZnSO_4$ at 30 & 60 DAT	10.6	56	203.5	31.49	6.91	2.42
8. 90 kg N/ha + 1980kg/ha Poultry Manure + 25 kg/ha $ZnSO_4$ at Transplanting	9.73	52.95	206	30.16	6.81	2.39
9. 90 kg N/ha + 1980kg/ha Poultry Manure + 15 kg/ha $ZnSO_4$ at Transplanting	10	56.27	206.83	30.37	6.96	2.45
10. 90 kg N/ha + 1980kg/ha Poultry Manure + Foliar spray of 0.5% $ZnSO_4$ at 30 & 60 DAT.	10.8	54.21	240.16	31.03	7.47	2.54
F test	S	S	S	S	S	-
SE(m) ±	0.26	0.36	6.03	0.13	0.2	-
CD (P=0.05)	0.79	1.09	18.07	0.41	0.62	-

found in treatment 5 (90 kg N/ha + 2t/ha VC + 25 kg/ ha $ZnSO_4$ at Transplanting) However treatment number 4[90 kg N/ha + 6 t/ha FYM + Foliar spray of 0.5% $ZnSO_4$ at 30 & 60 DAT] and 10 [90 kg N/ha + 1980kg/ha Poultry Manure + Foliar spray of 0.5% $ZnSO_4$ at 30 & 60 DAT.] was found to be statistically at par with the treatment 5 (90 kg N/ha + 2t/ha VC + 25 kg/ ha $ZnSO_4$ at Transplanting).

The significant and maximum test weight *i.e.* 33.03g was found in treatment 5(90 kg N/ha + 2t/ha VC + 25 kg/ ha ZnSO4 at Transplanting) which was found to be most significant among all the treatments.

The increase in number of grain/panicle and test weight might be due to application of vermicompost and there interaction with N level based on RDF, it clearly indicates that the treatment could have favour the increase in number of filled grain/panicle in term which increase the yield this might be due to increase in uptake of nutrient as a result of enhance availability of the soil (Thirunavukkrasu and Vinoth 2013)

The significant higher grain yield of 7.947 t/ha was recorded in treatment 5 [90 kg N /ha + 2t /ha VC + 25 kg/ha $ZnSO_4$ at Transplanting], However treatment number 3[90 kg N/ha+ 6t/ha FYM + kg/ha $ZnSO_4$ at Transplanting], treatment number 10[90 kg N /ha + 1980kg /ha PM + Foliar spray of 0.5% $ZnSO_4$ at 30 & 60 DAT] and treatment number 4[90 kg N/ha + 6 t/ha FYM + Foliar spray of 0.5% $ZnSO_4$ at 30 & 60 DAT] was found to be statistically at par with treatment number 5[90 kg N/ha + 2t/ha VC + 25 kg/ha $ZnSO_4$ at Transplanting].

The increased grain can also be ascribed to the effect of adequate availability of NPK in soil solution, may cause increase in root growth, thereby increasing uptake of nutrients. Higher yield due to combined application of inorganic fertilizers and organic manures might have attributed to sustained nutrient supply and also as a result of better utilization of applied nutrients through improved micro environmental conditions, especially the activities of soil micro-organisms involved in nutrient transformation and fixation. Similar results were opined by Satyanarayana *et al*., 2002, Sudha and Chandini 2003, Virdia and Mehta 2008. Patel *et al*., 2012

The maximum Benefit cost ration (2.72) of Rice was found in Treatment No 5 [Farmers practices (90 kg N/ha + 2000 kg /ha VC + 25 kg/ ha $ZnSO_4$ at Transplanting.] which was followed by treatment 3 *i.e.* 2.62

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