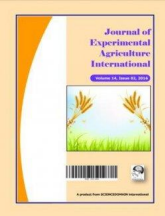

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Effect of Nova Aminochelated-zinc on Growth and Yield of Rice (*Oryza Sativa L.*)

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Authors' contributions

This work was carried out in collaboration among all authors. Author PVN designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors YSR and AKK managed the analyses of the study. Author YS and NB managed the literature searches. All authors read and approved the final manuscript

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ABSTRACT

A field experiment was conducted during the *kharif,* 2018 to study the effect of Nova Aminochelated-Zinc on growth, yield and yield components of rice. The experiment was laid out in Randomized Block Design with six treatments T_1: Control, T_2: Recommended Dose of Fertilizers (RDF) without Zinc, T_3: T_2+5 ml l^{-1} Nova Ami-Zinc @TI and PI, T_4:T_2+2.5 gm l^{-1} $ZnSO_4$ @TI and PI, T_5: 5 ml l^{-1} Nova Ami-Zinc @TI and PI, T_6: 2.5 gm l^{-1} $ZnSO_4$ @TI and PI. Experiment revealed that application of RDF+5ml l^{-1} Nova Ami-Zinc @ TI and PI (T_3) resulted in maximum Number of tillers m^{-2}, Total number of Grains Panicle^{-1}, Number of Filled Grains Panicle^{-1}, Test weight and Grain Yield but application of RDF+2.5 gm l^{-1} $ZnSO_4$ @TI and PI showed maximum height followed by application of RDF +5 ml l^{-1} Nova Ami-Zinc @ TI and PI.

Keywords: Paddy; filled grains; amino chelation; foliar application; nova agritech.

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ABBREVIATION

TI : Tillering Intiation
PI : Panicle Intiation
Ami-Zinc : Aminochelated Zinc

1. INTRODUCTION

Rice (*Oryza sativa* L.) is staple food for more than 60% of world population and it contribute 45% to the total food grain production in India [1]. Rice is one of highly sensitive crop to Zinc deficiency and Zinc limits growth and yield of rice. In India, zinc is considered as the fourth important yield limiting nutrient after nitrogen, phosphorus and potassium respectively. The critical limit of available zinc in the soil suitable for rice growth is 0.6 mg kg^{-1}. Forty three percent of Indian soils [2] are deficient in zinc.

Zinc is an essential element for normal growth and metabolism of plant plays an important role in membrane integrity, synthesis of carbohydrates. It is required for the activities of more than 300 plant enzymes such as dehydrogenase, carbonic anhydrase, superoxide dismutase, alkaline phosphatase and maintenance of cell turgidity, protein synthesis, auxin regulation and pollen formation [3-4].

Zinc fertilization to cereal crops improves productivity and grain Zinc concentration [5] thus contributes to grain nutritional value for human beings. Foliar application of Zinc is a simple way for making quick correction of plant nutrient status as reported for maize [6]. Foliar Zinc application resulted greater bioavailability of grain Zinc than soil application.

This study was aimed to investigate the effect of Nova Aminochelated Zinc on growth and yield of rice.

2. MATERIALS AND METHODS

This study was conducted in the *kharif,* 2018 at the Nova Agritech Ltd. Experimental farm, Kamareddy, Telangana, India. The experiment was laid out in Randomized block design with three replications. The rice cultivar BPT-5204 with duration 150 days was used for this study. The field selected for nursery was thoroughly ploughed. Dry seed was sown uniformly in the nursery bed on 11-07-2018. Later, the seed was covered immediately and then a light irrigation was given. The nursery was fertilized with a basal dose of one kg each of N, P and K 100 m^{-2}. The experimental field was ploughed twice with a tractor drawn puddler to obtain the required puddle after impounding 5 cm of standing water in the field. Water was drained out of the field in order to layout the plan of the experiment and divided into small plots with net plot size of 25 m^2 (5 m × 5 m) by raising bunds. Rice seedlings of 25 days old were transplanted in experimental plots keeping two seedlings per hill by adopting a spacing 20 cm × 15 cm on 07-08-2018. A recommended dose of 150 kg N, 60 kg P_2O_5 and 40 kg K_2O ha^{-1} was applied through urea, superphosphate and muriate of potash respectively. Entire quantity of phosphorus and half of potassium and one third of N were applied at the time of final land preparation just before transplanting. The remaining nitrogen was applied in equal splits at active tillering and anthesis stages. The remaining half of K was applied at anthesis stage. Foliar application of Zinc, sprays of $ZnSO_4$ and Nova Aminochelated Zinc were given (500 L ha^{-1}) with hand sprayer during morning hours between 7.30 A.M. and 8.30 A.M. The crop was grown under recommended package of practices and proper care was taken to protect it from weeds, insects, pests and diseases during entire cropping season. Data was recorded on established plants.

Fig. 1. An overview of experimental field

Table 1. Treatments details of the experiment

T_1	Control
T_2	RDF with No Zinc
T_3	T_2 +5 ml l^{-1} Nova Ami-Zinc @TI and PI
T_4	T_2+ 2.5 gm l^{-1} $ZnSO_4$ @TI and PI
T_5	5 ml l^{-1} Nova Ami-Zinc @TI and PI
T_6	2.5 gm l^{-1} $ZnSO_4$ @TI and PI

2.1 Statistical Analysis of Data

The collected data were analyzed statistically following analysis of variance (ANOVA) technique suggested by Panse and Sukhatme [7] for randomized block design. The statistical hypothesis of equalities of treatment means was tested by F-test at 5 per cent level of significance.

3. RESULTS AND DISCUSSION

3.1 Number of Tillers m^{-2}

Number of tillers m^{-2} at maximum tillering stage was significantly affected by different zinc treatments under experiment. The treatment received RDF + 5ml l^{-1} Nova Ami-Zinc @ TI and PI (T_3) recorded significantly the maximum number of tillers fallowed by RDF + 2.5 gm l^{-1} $ZnSO_4$ @TI and PI (T_4). Rest of the treatments were comparable in number of tillers but differed significantly over the control. At after panicle initiation, the treatment which received RDF + 5ml l^{-1} Nova Ami-Zinc @TI and PI (T_3) showed their superiority over the rest of the treatments. The results agree with the findings of many researchers [8,9,10,11] who reported that application of zinc significantly increased the number of tillers in rice.

3.2 Plant Height

Results revealed that different treatments of Zinc element, had significant effect on rice plant height (Table 2). Such that treatment of T_2+2.5 gm l^{-1} $ZnSO_4$ @TI and PI with the mean of 101.30 centimeter and the treatment of the control with the mean of 58.33 centimeter had the maximum and minimum height respectively. Plant height response to Zinc application was more pronounced, significantly higher growing efficiency was recorded with Zinc and the lowest without Zinc application [12]. Generally, foliar application of zinc, can improve the growth of the rice through increasing the concentration and its transfer through plant sap results in increasing growth and development of rice [13].

3.3 Total Number of Grains Panicle^{-1}

The highest number of total grains panicle^{-1} (239) was registered with the application of RDF + 5 ml l^{-1} Nova Ami-Zinc @TI and PI (T_3). T_3 differed significantly with the all other treatments. The lowest number of total grains (104) recorded in control (T_1). These results are in agreement with the results of Nampoodiri and Ramasubramonian [14], Reddy et al. [15] where in they observed the favourable positive influence of foliar application of zinc on increasing number of grains panicle^{-1}.

3.4 Number of Filled Grains Panicle^{-1}

The data indicates significant differences between the treatments for their effect on the number of filled grains panicle^{-1}. The maximum number of filled grains panicle^{-1} was recorded in the treatment receiving RDF + 5 ml l^{-1} Nova Ami-Zinc @TI and PI (T_3) (195 filled grains panicle^{-1}). This was followed by RDF + 2.5 gm l^{-1} ZnSO4 @TI and PI (T_4) (174 filled grains panicle^{-1}). The lowest was observed in control (T_1) (65 filled grains panicle^{-1}). These results are in conformity with the findings of Ravikiran and Reddy [16]. Whereas reduction in the number of filled grain panicle^{-1} was recorded under zinc stress condition. Similar results were observed by Khan et al. [17].

3.5 Test Weight (1000 grain weight)

The data on the 1000 grain weight in rice as influenced by the treatments indicated non significant differences between the treatments. A slight increase in 1000 grain weight could be due to efficient participation of zinc in the number of metabolic processes involved in the production of healthy seed. This increase in seed weight upon zinc fertilization could be attributed to enhanced zinc uptake and translocation of sugars and higher carbohydrate accumulation in seed. Similar results have been reported by Anand [18] in sorghum and Abdoli et al. [19] in wheat.

3.6 Grain Yield (Kg ha^{-1})

Results showed that grain yield of rice differed significantly due to Zinc treatments. The highest grain yield (6193 kg ha^{-1}) was recorded with the application of RDF + 5 ml l^{-1} Nova Ami-Zinc @TI and PI (T_3). T_3 significantly superior to the rest of the treatments. The grain yield of a genotype depends on the total drymatter and its

Table 2. Effect of nova Ami-zinc on growth, yield and yield components

Treatments	Total No. of tillers m^{-2}		Plant height(cm)		Total no of grains $panicle^{-1}$	Number of filled grains $panicle^{-1}$	Test weight	Grain yield ($kg\ ha^{-1}$)
	Tillering stage	Panicle intiation stage	Tillering Stage	Panicle intiation stage				
T_1	234.0	172.0	58.3	71.0	104.0	65.0	18.6	1846
T_2	413.0	375.0	85.0	106.6	214.0	159.0	20.4	5963
T_3	435.0	424.0	96.6	116.5	242.3	195.0	20.7	6193
T_4	417.0	383.0	101.3	120.0	220.0	174.0	20.5	6012
T_5	347.5	301.0	70.0	90.5	145.5	135.0	19.7	3243
T_6	324.0	286.0	72.5	84.3	139.7	122.0	19.5	3191
SEm±	10.53	4.54	3.99	3.41	6.73	6.27	0.09	52.26
CD(0.05)	33.19	14.33	**N.S**	10.76	21.18	19.76	0.28	164.69
CV	5.04	2.43	8.57	6.02	6.57	7.66	0.78	2.05

T_1: Control; T_2: RDF without Zinc; T_3: T_2+5 ml l^{-1} Nova Ami-Zinc @TI and PI; T_4:T_2+2.5 gm l^{-1} $ZnSO_4$ @TI and PI; T_5: 5 ml l^{-1} Nova Ami-Zinc @TI and PI; T_6: 2.5 gm l^{-1} $ZnSO_4$ @TI and PI. SEm- Standard error of the mean CD- Critical Difference; CV- Coefficient of Variation; N.S- Not significant

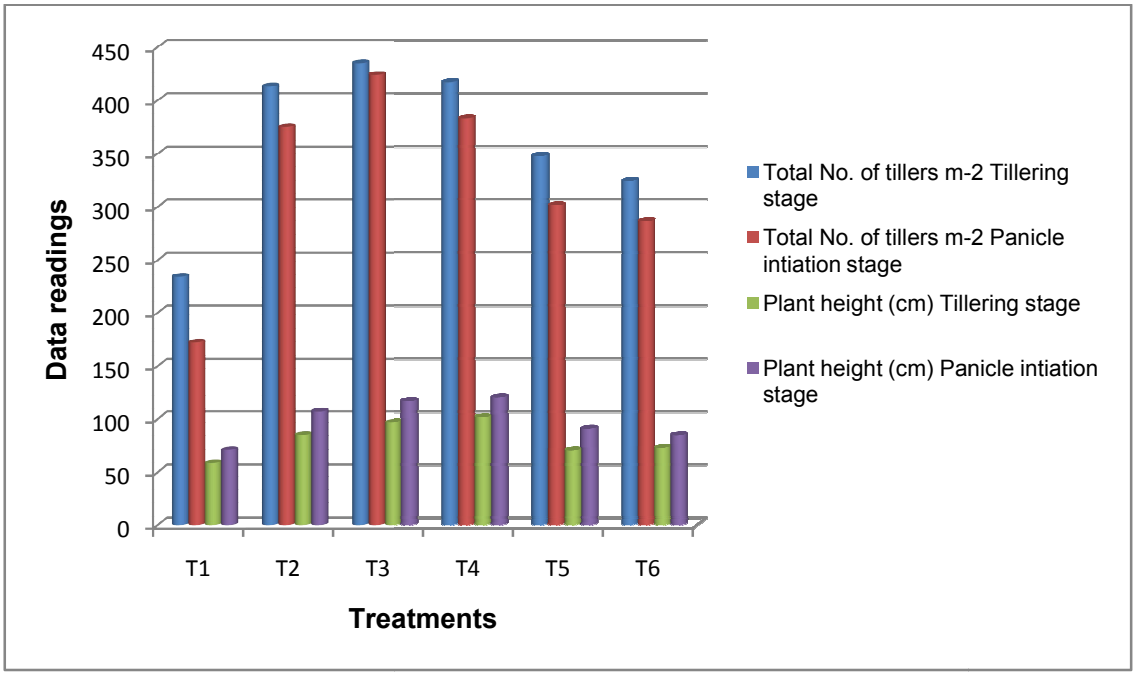

Fig. 2. Influence of Nova Ami-Zinc on Growth components of rice. Total number of tillers differed significantly at 5% level of significance

distribution after anthesis, as the major portion of the drymatter produced during post anthesis period is translocated to the panicle. Foliar application of zinc might have raised drymatter transformation from source (store parts) to sink and thus, significantly reflected in grain yield [20]. Higher grain yield with zinc fertilizer application might be due to the fact that zinc plays an important role in biosynthesis of IAA and initiation of primordial for reproductive part which have favored the metabolic reaction within plant [21]. According to the reports of Bandara et al. [22] and Fageria and Baligar [23]. Zinc foliar application resulted in increasing the grain yield of the rice in comparison with control treatment.

4. CONCLUSION

From the overall results it could be concluded that under field conditions rice crop fertilized with foliar Nova Aminochelated Zinc at tillering initiation and panicle initiation along with

recommended N:P:K application significantly influenced parameters tested viz., maximum Number of tillers m^{-2}, Total number of Grains Panicle^{-1}, Number of Filled Grains Panicle^{-1}, Test weight and Grain yield. The magnitude of increase in grain yield over control was 3.35 and 3.25 times in T_2+5 ml l^{-1} Nova Ami-Zinc @TI and PI and T_4:T_2+2.5 gm l^{-1} $ZnSO_4$ @TI and PI respectively. Therefore, it can be opined that T_3 was very effective than rest of the treatments.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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