

Original Research Article

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Effect of Micronutrients on Yield and Yield Attributes of Hybrid Rice under Boro Cultivation in Lower Gangetic Alluvial Zone

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ABSTRACT

Keywords

Ammonium molybdate, Boro cultivation, Foliar application, Hybrid rice, Micronutrient.

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A field experiment was conducted during 2013-14 at Agricultural Experimental Farm of Calcutta University at Baraipur, 24-Paraganas (south), Kolkata to study the effect of micronutrient on yield and yield attributes of hybrid rice under boro cultivation in lower gangetic alluvial zone. NPK (40/120:60:60) + ZnSO₄ + Ammonium molybdate + Di-sodium-tetrahydrateoctaborate as foliar application at active tillering stage and panicle initiation stage respectively of hybrid rice crop growth have profound influence on the yield parameters such as grain yield (6.54t/ha), straw yield (6.79 t/ha) and biological yield (13.33 t/ha). Harvest index (49.07) was higher in NPK (40/120:60:60) + Ammonium molybdate + Di-sodium-tetrahydrateoctaborate. The yield attributing characters such as no. of panicles m⁻¹ (10.838) and filled grains panicle⁻¹ (99.00) were higher in the same treatment although no. of unfilled grains panicle⁻¹ (15.00) was less as compared to others. Length of panicle (27.50 cm) and total no. of grains panicle⁻¹ (120.33) were increased due to NPK (40/120:60:60) + ZnSO₄ + Ammonium molybdate at active tillering stage. Test weight (22.35 g) was higher in NPK (40/120:60:60) + ZnSO₄ + Di-sodium-tetrahydrateoctaborate applied in panicle initiation stage.

Introduction

Rice (*Oryza sativa* L.) is the premier food crop for the majority population in the world. It contributes 80% of the calories in the daily diet. Almost 90% of the rice is produced and consumed in Asia, and 96% in developing countries. India, the country having the largest rice area in the world has only 41% of the productivity reached in USA and 48% of that in China (Prasad and Pandey, 2005). However, India has the largest area (43.91 M.ha) under rice in the world, followed by China (31.5 M.ha.). Rice occupies 46.5% of the area under cereals, contributing 42% of

the total food grain production in India (Singhal, 2006). In West Bengal, rice is grown in about 5.84 million hectares contributing 14.50% share of the India's rice area and ranks first producing 14.39 million tonnes i.e. 19.81% of India's total production and average yield comes to 2.50 tonnes per hectares. Zn has synergistic effect with N in rice. Zn plays an important role in nitrogen metabolism, protein synthesis (Alloway, 2008). Thus, for higher productivity, optimum dose of Zn application is essential to meet the demand of rice plant.

Nitrogen plays the most important role for realizing higher yield potential of rice (Sharma and Das, 1994). Considering the fact that growth intimately connected with the productivity of the crop, a critical analysis of various growth parameters influence by the application of combine effect of nitrogen, phosphorus and zinc with molybdenum responded on crop growth and productivity, the rate of increase in height accelerated, uptake of nutrients and which in turn increased the yield and yield attributing characters (Sen and Dasgupta, 1969).

Materials and Methods

The field experiment was conducted during rabi season of 2013-2014 at the Agricultural Experimental Farm of Calcutta University at Baraipur, 24-Paraganas (south). The soil was clay loam with pH-7.0 having organic carbon 0.725%, Total N 0.18 %, P_2O_5 31.00 kg/ha and K_2O 260.00 kg/ha.

The experiment consisted of eight treatment combinations T₁ (NPK (120:60:60)), T₂ NPK (40/120:60:60) + $ZnSO_4$ (25 kg/ha), T₃ NPK (40/120:60:60) + Ammonium molybdate 0.2%, T₄ NPK (40/120:60:60) + Di-sodium-tetrahydrate octaborate 0.2%, T₅ NPK (40/120 : 60 : 60) + $ZnSO_4$ + Ammonium molybdate, T₆ NPK (40/120:60:60) + $ZnSO_4$ + Di-sodium-tetrahydrate octaborate, T₇ NPK (40/120: 60:60) + Ammonium molybdate + Di-sodium-tetrahydrate octaborate, T₈ NPK (40/120:60:60) + $ZnSO_4$ + Ammonium molybdate + Di-sodium-tetrahydrate octaborate.

The experiment was laid out in Randomized Block Design replicated three times. A Common dose of Nitrogen, Phosphorus & Potassium at the rate of 120:60:60 kg/ha was applied to all plots in equal proportion, one third Nitrogen and full dose of phosphorus and potassium was applied at the time of

transplanting. The remaining nitrogen was applied in two equal splits at tillering and panicle initiation stages. The seedlings were transplanted at a spacing of 20 cm x 15 cm and one seedling were planted hill⁻¹ at a depth of 2-3 cm of 35 days old seedlings were transplanted in the main field. Observations were recorded on grain yield, straw yield, biological yield, harvest index and yield attributing characters. Analysis of variance for individual characters was done by the procedures suggested by Panse and Sukhatme (1985).

Results and Discussion

Yield attributes

Application of micro nutrients viz. molybdenum and boron as foliar spray at active tillering stage and panicle initiation stage respectively of rice had profound effect on yield attributing characters i.e. grain yield, straw yield, biological yield and harvest index of hybrid rice under Table-1.

Highest grain yield (6.54 t ha⁻¹), straw yield (6.79 t/ha) and biological yield (13.33 t/ha) was recorded with NPK (40/120:60:60) + $ZnSO_4$ + Ammonium molybdate + Di-sodium-tetrahydrate octaborate.

The yield attributes increased owing to micro nutrients like Zn, Mo and B fertilization which might took part in metabolism of plants as an activation of several enzymes and in turn directly and indirectly affected the synthesis of carbohydrate and protein. The finding corroborated the reports of Chaudhury *et al.*, (2007), Keram *et al.*, (2014) and Praneeth *et al.*, (2015). Harvest index (49.07) was higher in NPK (40/120:60:60) + Ammonium molybdate + Di-sodium-tetrahydrate octaborate. This is in confirmation with earlier workers Ramanujam and Rao (1971) and Dewal and Pareek (2000).

Table.1 Effect of different treatments on grain yield, straw yield, biological yield and harvest index of Hybrid rice cv. KRH-1

Treatments	Grain yield(t/ha)	Straw yield (t/ha)	Biological yield (t/ha)	Harvest index
T ₁	5.05	5.55	10.60	47.46
T ₂	5.23	5.64	10.87	48.13
T ₃	5.42	5.94	11.36	47.71
T ₄	5.44	5.94	11.38	47.80
T ₅	5.77	5.99	12.06	47.84
T ₆	6.18	6.56	12.74	48.51
T ₇	6.40	6.50	12.90	49.62
T ₈	6.54	6.79	13.33	49.07
SEM(±)	0.06	0.12	0.16	0.43
C.D at 5%	1.05	0.36	0.49	1.31

t-Tonnes, ha-Hectare

Table.2 Effect of different treatments on yield attributes of Hybrid rice cv.KRH-2

Treatments	No. of Panicle (m ⁻¹)	Length of panicle (cm)	total grains (No/panicle)	filled grains (No/panicle)	Unfilled grain (No /panicle)	Test weight (g/1000 grains)
T ₁	266.67	26.76	110.00	88.00	23.00	21.44
T ₂	280.00	27.12	110.67	88.68	20.00	21.14
T ₃	280.00	27.43	120.00	95.00	18.00	21.94
T ₄	293.33	27.65	118.00	97.00	16.00	21.83
T ₅	303.66	27.95	123.00	97.00	16.00	22.48
T ₆	320.00	27.82	116.00	98.00	16.00	22.67
T ₇	320.00	27.90	117.00	98.00	16.30	22.29
T ₈	346.66	27.50	120.33	99.00	15.00	22.35
SEM(±)	10.83	0.27	2.21	2.27	1.55	0.24
C.D at 5%	32.77	NS	6.71	6.88	4.70	0.75

NS-Not significant

Yield Attributing Traits

Application of Mo and B as foliar spray at active tillering (30DAT) and boron at panicle initiation stage (60DAT) of hybrid rice had found effect on yield attributing characters of rice recorded under Table-2. The yield attributing characters such as no. of panicles m⁻¹ (10.838) and filled grains panicle⁻¹ (99.00) were higher in the same treatment although no. of unfilled grains panicle⁻¹ (15.00) was less as compared to others. Length of panicle

(27.50 cm) and total no. of grains panicle⁻¹ (120.33) were increased due to NPK (40/120:60:60) +ZnSO₄+ Ammonium molybdate at active tillering stage.

The result confirmed the findings of Ali *et al.*, (2014) and Singh *et al.*, (2000). Test weight (22.35 g) was higher in NPK (40/120:60:60) +ZnSO₄ + Di-sodium-tetrahydrateoctaborate applied in panicle initiation stage. Similar effect has also been reported by Sarvanan and Ramanathan (1988).

Based on the experiment it can be concluded that rice can be cultivated with the application of NPK (40/120:60:60) + ZnSO₄ + Ammonium molybdate + Di-sodium-tetrahydrateoctaborate for better yield and yield attributing characters.

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