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GROWTH AND YIELD POTENTIAL OF RICE (*Oryza sativa*) AS INFLUENCED BY CULTIVARS AND ZINC MANAGEMENT

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Abstract: *A field study was conducted to evaluate the growth and yield potential of rice as influenced by cultivars and zinc management during the rainy (kharif) season of 2010 and 2011 at Banaras Hindu University. The experiment was laid out in randomized block design with three replication. The treatments comprised of three rice cultivars and seven zinc management practices. Cultivars 'PHB 71' recorded significantly higher growth attributes, viz. plant height, tillers/hill^{1}with yield attributing parameters. PHB 71 also produced significantly higher yield over HUR 105 and HUBR 2-1 during both the years. Among the zinc management, application of Zn (EDTA) 0.25 kg ha^{-1} at basal + Zn (EDTA) 0.05% sprays at maximum tillering stage recorded significantly higher growth attributes, yield attributes and yield. However, it was statistically at par with Zn (EDTA) 0.5 kg ha^{-1} at basal + 0.5 kg ha^{-1} at maximum tillering stage. Cultivars and zinc management were failed to produce significant variation in respect of harvest index.*
Keywords: *Cultivars, growth, yield, zinc management, rice.*

Introduction: In India low productivity of rice is a major concern for food and nutritional security of more than 60% population which is dependent on rice. It has been identified that cereals are staple food of the maximum population of the world, but are lacking in some micronutrients which are responsible for certain kinds of illness [1]. Micronutrient nutrition often termed as "hidden hunger" has become more conspicuous since the introduction of "Green Revolution" [2]. These micronutrients deficiency can be overcome either by genetic engineering or by nutritional enrichment of cereals through agronomic manipulation. It is known that biofortification for a health purpose requires higher levels of micronutrients in grain and to achieve optimum crop yields [3]. The micronutrient malnutrition is mostly caused by iron, zinc, manganese, iodine etc.

Hence, keeping in the view, an experiment have been proposed to evaluate the effect of cultivars and zinc management on growth and yield of rice with an objective to find out both suitable variety and zinc management practice.

Materials and Methods

The experiment was conducted at Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University. The soil of experimental plot was sandy clay loam in texture and has low organic carbon (0.45% and 0.46%), low available nitrogen (197.6 and 203.5 kg ha^{-1}), medium available phosphorus (21.22 and 22.53 kg ha^{-1}) and potassium (220.321 and 223.72 kg ha^{-1}) with pH 7.35 at experimental period (2009-10 and 2010-11). The experiment was laid out in randomized block design with three replication consists of three varieties *viz.*, HUR 105 [V_1], HUBR 2-1[V_2] and PHB-71 [V_3] and seven zinc management treatments *i.e.* Control [Z_0], Zn (EDTA) @ 0.5 kg ha^{-1} at basal [Z_1], Zn (EDTA) @ 0.25 kg h^{-1} at basal + 0.25 kg ha^{-1} at maximum tillering stage[Z_2], Zn (EDTA) @ 1.0 kg ha^{-1} at basal [Z_3], Zn (EDTA) @ 0.5 kg ha^{-1} at basal + 0.5 kg ha^{-1} at maximum tillering stage[Z_4], Zn (EDTA) @ 0.05% 3 spray at 15 days interval (starting with maximum tillering stage)[Z_5] and Zn (EDTA) @ 0.25 kg ha^{-1} at basal + Zn (EDTA) @ 0.05% spray at maximum tillering stage[Z_6]. The seedlings of 25 days old were transplanted at 20 cm X 10 cm in puddled

soil condition. Plant height and tillers/hill among crop growth attributes were observed. Yield attributes and yield were also calculated and compared for the selection of superior treatment combination. The data generated for both years were analyzed statistically and drawn a valid conclusion.

Results and Discussion

Growth and Yield Attributes: Plant height, tillers/hill and number of panicle/m^2 recorded significantly higher with hybrid 'PHB 71' during both the years compared to 'HUR 105' and 'HUBR 2-1' (Table 1). This might be due to hybrid cultivars possess heterosis resulting in vigorous root system, greater source size, higher number of tillers and panicle/m^2. These results are in conformity with the findings [4-5].

Amongst the zinc management, application of Zn (EDTA) 0.25 kg ha^{-1} at basal + Zn (EDTA) 0.05% spray at maximum tillering stage (Z_6) recorded significantly higher plant, tillers/hill and number of panicle/m^2. However, it was at par with Zn (EDTA) 0.5 kg ha^{-1} at basal + 0.5 kg ha^{-1} at maximum tillering stage. The improvement in growth and yield attributes might be due to higher response of rice to applied Zn, which is absorbed by xylem and foliar applied Zn is easily absorbed and transported through phloem resulting higher plant height, number of tillers and nutrient uptake, responsible for higher photosynthates accumulation. Similar results were obtained [6].

Table 1: Growth and yield attributes of rice as influenced by cultivars and zinc management.

Treatment	Plant height (cm)		Tillers/hill		Panicle (No./m^2)	
	2010	2011	2010	2011	2010	2011
Cultivars						
HUR-105	107.02	107.67	9.04	9.37	334.24	337.54
HUBR 2-1	109.29	110.24	8.78	9.09	325.10	328.01
PHB-71	118.32	119.30	10.43	10.92	370.96	375.40
SEm ±	2.19	2.24	0.13	0.14	5.30	5.61
CD (P = 0.05)	6.27	6.40	0.38	0.39	15.14	16.04
Zinc management						
Control (no application of zinc fertilizer)	88.67	90.18	7.11	7.38	255.00	257.35
Zn (EDTA) @ 0.5 kg ha^{-1} at basal	103.66	104.13	8.59	8.97	324.27	327.60
Zn (EDTA) @ 0.25 kg ha^{-1} at basal + 0.25 kg ha^{-1} at maximum tillering stage	115.94	116.18	9.87	10.26	359.11	362.50
Zn (EDTA) @ 1.0 kg ha^{-1} at basal	114.47	115.93	9.85	10.24	358.33	362.00
Zn (EDTA) @ 0.5 kg ha^{-1} at basal + 0.5 kg ha^{-1} at maximum tillering stage	117.86	118.92	10.13	10.55	370.33	374.56
Zn (EDTA) @ 0.05% 3 spray at 15 days interval (starting with maximum tillering stage)	114.14	115.33	9.77	10.13	352.69	356.02
Zn (EDTA) @ 0.25 kg ha^{-1} at basal + Zn (EDTA) @ 0.05% spray at maximum tillering stage	126.08	126.13	10.59	11.01	384.29	388.83
SEm ±	3.35	3.42	0.20	0.21	8.09	8.57
CD (P = 0.05)	9.57	9.78	0.58	0.60	23.12	24.50

Yield and Harvest Index: The cultivar 'PHB 71' was recorded significantly higher grain, straw and biological yield over HUR 105 and HUBR 2-1 (Table 2). However, harvest index was not affected significantly during both the years. Better growth parameters and yield attributes of hybrid helped in recording significantly higher grain yield. Improvement in yield mainly due to the production of higher number of tillers and grains by rice hybrid as compared to inbred cultivars was due to efficient utilization and conversion of resources into assimilates [7].

Table 2: Yield and harvest index of rice as influenced by cultivars and zinc management

Treatment	Grain		Straw		Biological		Harvest index (%)	
	2010	2011	2010	2011	2010	2011	2010	2011
HUR-105	5553.38	5661.43	8058.86	8207.43	13612.24	13868.86	41.00	41.08
HUBR 2-1	5412.71	5537.24	7814.28	7922.85	13226.99	13460.09	40.87	41.06
PHB-71	6346.95	6487.14	9010.82	9163.46	15357.77	15650.61	41.42	41.54
SEm ±	97.22	100.25	214.61	215.11	280.39	281.76	0.64	0.68
CD (P = 0.05)	277.89	286.54	613.39	614.83	801.41	805.35	NS	NS
Zinc management								
Control (no application of zinc fertilizer)	4295.56	4368.22	6395.47	6435.47	10691.02	10803.69	40.20	40.45
Zn (EDTA) @ 0.5 kg ha^{-1} at basal	5126.67	5220.00	7408.68	7552.01	12535.34	12772.01	41.08	41.22
Zn (EDTA) @ 0.25 kg ha^{-1} at basal + 0.25 kg ha^{-1} at maximum tillering stage	6045.56	6184.44	8586.20	8738.48	14631.76	14922.93	41.30	41.43

Zn (EDTA) @ 1.0 kg ha^{-1} at basal	5975.56	6128.89	8563.02	8738.02	14538.57	14866.91	41.28	41.37
Zn (EDTA) @ 0.5 kg ha^{-1} at basal + 0.5 kg ha^{-1} at maximum tillering stage	6332.11	6470.56	9044.60	9189.60	15376.71	15660.16	41.32	41.41
Zn (EDTA) @ 0.05% 3 spray at 15 days interval (starting with maximum tillering stage)	5964.44	6092.00	8537.29	8685.63	14501.74	14777.63	41.18	41.26
Zn (EDTA) @ 0.25 kg ha^{-1} at basal + Zn (EDTA) @ 0.05% spray at maximum tillering stage	6657.22	6802.78	9527.32	9679.54	16184.54	16482.32	41.32	41.43
SEm ±	148.51	153.13	327.81	328.58	428.30	430.40	0.98	1.03
CD (P = 0.05)	424.48	437.69	936.97	939.17	1224.18	1230.19	NS	NS

Application of Zn (EDTA) 0.25 kg ha^{-1} at basal + Zn (EDTA) 0.05% spray at maximum tillering stage (Z_6) produced maximum grain and straw yield as compared with other treatments but remained at par with Zn (EDTA) 0.5 kg ha^{-1} at basal + 0.5 kg ha^{-1} at maximum tillering stage (Z_4) during both the year. Harvest index also failed to produce significant variation amongst the zinc management. Improvement in yield mainly because of chelated zinc showed high solubility and stability of Zn and increased the movement of Zn ions in to the plants to increase the grain yield. These results were in accordance with Cakmak and Naik and Das [7-8].

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