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Grain Quality Parameters in Scented Rice Influenced by the Different Zinc Levels

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ABSTRACT
To study the effect of Zn nutrition on grain quality parameters in scented rice, with three treatments of zinc viz., 0, 25, 50 kg $ZnSO_4$ ha^{-1} and 4 aromatic rice genotypes viz. Chittimutyalu, Sumathi, Sugandha Samba and RNR-2354. The experiment was laid out in Randomized block design with factorial concept and replicated thrice. The results of the experiment was showed that basal application of zinc at 50 kg $ZnSO_4$ ha^{-1} and among the genotypes Sugandha Samba and RNR-2354 have showed fine grain quality parameters like hulling, milling, head rice recovery, kernel width, kernel length and kernel length after cooking.
Key words: *Zinc, Scented rice, Hulling, Milling, Kernel length and width*

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INTRODUCTION

Rice (*Oryza sativa L.*) is one of the most well-known food crops over the world and is the important diet for almost half of the human population in the global [1]. Yield and productivity of rice have significantly increased over last 60 years owing to improved cultivars almost in all agro climatic zones. Generally, yields of scented rice varieties were lower as compare to normal rice varieties. Scented rice varieties perform well under warm, humid and in good fertility soils. But in India 50% of the soils were zinc deficient. Zinc deficient soils lead to severe losses in yield and nutritional value. Zinc application in rice increase crop productivity and nutritional value. Zinc not only improves the quality of plants but also improves the energy value, crude protein and carbohydrate content. Zinc increases grain yield between 20 – 50% [5].

The majority of scented rice cultivars were short grained, some are medium grained, and only a very few are long grained. These varieties are highly thermo photosensitive, long duration types and low yielding performances. In scented rice grain quality parameters were most important to the people who involved in producing, processing and consuming rice. The essential grain quality parameters in scented rice were hulling, milling, head rice recovery and kernel length and width [3]. Zn is essential for several biochemical processes in rice plant, such as cytochrome and nucleotide synthesis, auxin metabolism, chlorophyll production, enzyme activation and membrane integrity. Zn- enrichment leads to more root surface area and the ability to change chemistry and biology of rhizosphere by releasing phytosiderophores from roots which ultimately increases Zn uptake [2]. In this existing and emerging challenges as how zinc nutrient influence on the grain quality, the following investigation was carried out to study the "Grain Quality Parameters in Scented Rice Influenced by the Different Zinc Treatments".

MATERIAL AND METHODS

The field experiment was laid out in a Factorial Randomized Black Design with four aromatic rice genotypes [Chittimuthyalu (V_1),Sumathi (V_2),Sugandha samba (V_3),RNR-2354 (V_4)] and three treatments [$ZnSO_4$ 0kg (Zn_0), $ZnSO_4$ 25 kg ha^{-1} (Zn_{25}), $ZnSO_4$ 50 kg ha^{-1} (Zn_{50})] were replicated thrice. For measuring of hulling, collect the sample of one hundred grams of well dried paddy (12-14% moisture) from each entry were dehulled in standard Satake dehuller and the weight of brown rice was recorded. Hulling percentage was computed by using the formula and expressed in per cent. The brown rice obtained after dehulling was subjected to milling for 90 sec i.e., 5 per cent milling in "Satake" polisher and the weight of polished rice was recorded. The polished kernels were passed repeatedly through a rice grader having 5 mm grooves to separate the brokens from the head rice kernels. Full rice and a length of three-fourth kernels were taken as whole polished rice for computation. For measuring the kernel length and breadth, randomly select ten polished kernels and recorded in mm using Dial micrometer. Kernel length after cooking was measured with use of graph sheet.

$$\text{Hulling (\%)} = \frac{\text{Weight of dehusked grain or brown rice (g)}}{\text{Weight of paddy (g)}} \times 100$$

$$\text{Milling (\%)} = \frac{\text{Weight of milled rice (g)}}{\text{Weight of paddy (g)}} \times 100$$

$$\text{Head rice recovery (\%)} = \frac{\text{Weight of whole polished rice (g)}}{\text{Weight of paddy (g)}} \times 100$$

RESULTS AND DISCUSSION

The hulling percentage was significantly influenced by zinc levels. With the increase in the zinc levels there was an increase in the hulling percentage (table 1). Highest hulling percentage of 73.07% with 50 kg $ZnSO_4$ ha^{-1} followed by 71.32% with 25 kg $ZnSO_4$ ha^{-1} were recorded where as lowest test weight of 66.62% was recorded with control treatment. Among the aromatic rice genotypes studied there was significant difference for Hulling percentage. Among the four genotypes, RNR-2354 (V4) has recorded maximum hulling percentage (73.10%) followed by Sugandha Samba (V3) (72.15%), while the lowest hulling percentage (67.99%) was recorded in Sumathi (V2). Interaction effect between aromatic rice genotypes and zinc levels was highly significant for hulling percentage. In genotype Sugandha Samba (V3) at 50 kg $ZnSO_4$ ha^{-1} treatment highest hulling percentage of 75.69 was observed where as in genotype Sumathi (V2) lowest hulling percentage of 61.74% was recorded with control. The zinc application increased the transfer enzymes activity which in turn will increase the accumulation of carbohydrates, proteins and lipids in the grains, subsequently minimizes the hull weight and thickness. Yadav *et al.* [6] observed that increased hulling percentage at high level of $ZnSO_4$ as compared to control. Similar results were also reported by reported by Metwally [4].

The milling percentage significantly increases with different zinc levels. Highest milling percentage of 66.39% with 50 kg $ZnSO_4$ ha^{-1} followed by 65.45% with 25 kg $ZnSO_4$ ha^{-1} were recorded where as lowest milling percentage of 63.24% was recorded with control treatment. Among the aromatic rice genotypes studied there was significant difference for milling percentage. Genotype Sugandha Samba (V3) has recorded maximum milling percentage (69.98%) followed by Sumathi (V2) (66.35%), while the lowest milling percentage (61.13%) was recorded in Chittimuthyalu (V1). Interaction effect between aromatic rice genotypes and zinc levels was highly significant for milling percentage. In genotype Sugandha Samba (V3) at 50 kg $ZnSO_4$ ha^{-1} treatment highest milling percentage of 73.10% was observed where as in genotype Chittimuthyalu (V1) lowest milling percentage of 60.95% was recorded with control. Milling percentage was increased with the Zn application were also reported by Metwally [4] and Yadav *et al.* [7].

The head rice recovery percentage was significantly influenced by zinc levels. With the increase in the zinc levels there was an increase in the head rice recovery percentage (table 1). Highest head rice recovery percentage of 65.01% with 50 kg $ZnSO_4$ ha^{-1} followed by 62.89% with 25 kg $ZnSO_4$ ha^{-1} were recorded where as lowest head rice recovery of 57.69% was recorded with control treatment. Among the aromatic rice genotypes studied there was significant difference for head rice recovery percentage. Genotype Sugandha Samba (V3) has recorded maximum head rice recovery percentage (66.32%) followed by Sumathi (V2) (64.18%), while the lowest head rice recovery percentage (56.89%) was recorded in Chittimuthyalu (V1). Yadav *et al*, [6] was attributed to improvement in protein content and quality parameters due to application of Zn in the form of zinc enriched urea. Metwally [4] and Yadav *et al*. [6] have also reported similar results. The kernel length was significantly influenced by zinc levels. With the increase in the zinc levels there was an increase in the kernel length (table 2). Highest kernel length of 5.38 with 50 kg $ZnSO_4$ ha^{-1} followed by 5.33 with 25 kg $ZnSO_4$ ha^{-1} were recorded where as lowest kernel length of 5.17 was recorded with control treatment. Among the aromatic rice genotypes studied there was significant difference for kernel length. Genotype Sumathi (V2) has recorded maximum

kernel length (6.48) followed by RNR-2354 (V4) (5.49), while the lowest kernel length (4.03) was recorded in Chittimuthyalu (V1).
The kernel width was significantly influenced by zinc levels. With the increase in the zinc levels there was an increase in the kernel width (table 2). Highest kernel width of 1.76 with 50 kg $ZnSO_4$ ha^{-1} followed by 1.68 with 25 kg $ZnSO_4$ ha^{-1} were recorded where as lowest kernel width of 1.67 was recorded with control treatment. Among the aromatic rice genotypes studied there was significant difference for kernel width. Genotype Chittimuthyalu (V1) has recorded maximum kernel width (1.89) followed by Sugandha Samba (V3) (1.72), while the lowest kernel width (1.54) was recorded in Sumathi (V2). Interaction effect between rice genotypes and zinc levels was significant for kernel width. In genotype Chittimuthyalu (V1) at 50 kg $ZnSO_4$ ha^{-1} treatment highest kernel width of 1.96 was observed where as in genotype Sumathi (V2) lowest kernel width percentage of 1.50 was recorded with control.
The kernel length after cooking was significantly influenced by zinc levels. With the increase in the zinc levels there was an increase in the kernel length after cooking (table 2). Highest kernel length after cooking of 9.30 with 50 kg $ZnSO_4$ ha^{-1} followed by 9.02 with 25 kg $ZnSO_4$ ha^{-1} were recorded where as lowest kernel length after cooking of 8.74 was recorded with control treatment. Among the aromatic rice genotypes studied there was significant difference for kernel length after cooking. Genotype Sumathi (V2) has recorded maximum kernel length after cooking (11.73) while the lowest kernel length after cooking (7.11) was recorded in Chittimuthyalu (V1).

Table 1: Scented rice grain quality parameters (Hulling, Milling and head rice recovery) influenced by zinc supply

Treatments		Hulling (%)	Milling (%)	Head rice recovery (%)
V_1Zn_0		65.73	60.95	53.36
V_1Zn_{25}		68.6	61.21	57.53
V_1Zn_{50}		69.98	61.22	59.8
V_2Zn_0		61.74	64.36	58.67
V_2Zn_{25}		69.47	66.89	65.54
V_2Zn_{50}		72.77	67.8	68.31
V_3Zn_0		67.06	65.45	59.7
V_3Zn_{25}		73.68	71.38	68.19
V_3Zn_{50}		75.69	73.1	71.09
V_4Zn_0		71.94	62.19	59.04
V_4Zn_{25}		73.53	62.33	60.3
V_4Zn_{50}		73.84	63.45	60.86
Mean of varieties				
V_1		68.1	61.13	56.89
V_2		67.99	66.35	64.18
V_3		72.15	69.98	66.32
V_4		73.1	62.66	60.06
Mean of zinc levels				
Zn_0		66.62	63.24	57.69
Zn_{25}		71.32	65.45	62.89
Zn_{50}		73.07	66.39	65.01
Variety (V)	SEM+_	0.48	0.49	0.6
	CD(.05)	1.41	1.44	1.77
Zinc (Zn)	SEM+_	0.42	0.43	0.52
	CD(.05)	1.22	1.25	1.53
Interaction (Zn x V)	SEM+_	0.83	0.85	1.05
	CD(.05)	2.44	2.5	3.07

Table 2: Scented rice grain quality parameters (Kernel breadth, length and length after cooking) influenced by zinc supply

Treatments		Kernel breadth (mm)	Kernel length (mm)	Kernel length after cooking (mm)
V_1Zn_0		1.84	3.95	7.01
V_1Zn_{25}		1.87	4.06	7.07
V_1Zn_{50}		1.96	4.08	7.25
V_2Zn_0		1.5	6.36	11.22
V_2Zn_{25}		1.53	6.53	11.85
V_2Zn_{50}		1.59	6.56	12.13
V_3Zn_0		1.72	5.06	8.28
V_3Zn_{25}		1.64	5.2	8.43
V_3Zn_{50}		1.81	5.27	8.73
V_4Zn_0		1.63	5.31	8.45
V_4Zn_{25}		1.68	5.55	8.72
V_4Zn_{50}		1.68	5.6	9.1
Mean of varieties				
V_1		1.89	4.03	7.11
V_2		1.54	6.48	11.73
V_3		1.72	5.18	8.48
V_4		1.66	5.49	8.76
Mean of zinc levels				
Zn_0		1.67	5.17	8.74
Zn_{25}		1.68	5.33	9.02
Zn_{50}		1.76	5.38	9.3
Variety (V)	SEM+_	0.01	0.06	0.17
	CD(.05)	0.04	0.18	0.49
Zinc (Zn)	SEM+_	0.01	0.05	0.14
	CD(.05)	0.03	0.16	0.42
Interaction (Zn x V)	SEM+_	0.02	0.11	0.29
	CD(.05)	0.06	NS	NS

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