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Assessment of Different Quality Parameters of Local Scented Rice (*Oryza sativa* L.) Grain as Influenced by Various Nutrient Management Practices in the New Alluvial Zone of West Bengal

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Abstract A field experiment was conducted to assess the different quality parameters of local scented rice as influenced by various nutrient management practices in the New Alluvial Zone of West Bengal. The experiment was carried out in split plot design taking three cultivars of scented rice viz. Gobindabhog (V_1), Kalonunia (V_2) and Dehradoon (V_3) in the main plots and six levels of nutrient management viz. 25% Recommended NPK as Chemical Fertilizer + 75% Recommended NPK as Vermicompost (T_1), 50% Recommended NPK as Chemical Fertilizer + 50% Recommended NPK as Vermicompost (T_2), 75% Recommended NPK as Chemical Fertilizer + 25% Recommended NPK as Vermicompost (T_3), 100% Recommended NPK as Chemical Fertilizer (T_4), 100% Recommended NPK as Vermicompost (T_5) and Control (T_6) in the sub plots in all possible combinations replicated thrice. The highest amylose content of the rice grains was found under the varietal treatment Dehradoon (V_3) with the nutrient management T_4 (100% recommended NPK as chemical fertilizer) while the other quality parameters viz. head rice recovery kernel length before and after cooking and the elongation ratio was highest under T_5 nutrient management (100% recommended NPK as Vermicompost).

Keywords Rice, Nutrient management, Variety, Quality.

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Introduction

Rice (*Oryza sativa*), one of the most important food crops in the world, forms the staple diet of 2.7 billion people. Aromatic rices are different from normal rices in various ways. They have fragrance and other grain quality characteristics and their requirement of environmental condition are also different. Aromatic or scented (fragrant) rice's have occupied a prime position in Indian society not only because of their high quality, but also because they had been considered auspicious. Earlier, a large number of such rice's were collectively known as Basmati (bas = aroma). Over the years the definition of Basmati has changed and

Table 1. Effect of variety and nutrient management on the amylose content in the grain and the head rice recovery percentage.

Treatments	Amylose content (%)			Head rice recovery (%)		
	2010	2011	Pooled	2010	2011	Pooled
Variety (V)						
V_1: Gobindabhog	17.40	17.50	17.45	65.44	65.39	65.42
V_2: Kalonunia	19.72	19.82	19.77	62.88	62.97	62.92
V_3: Dehradoon	21.60	21.61	21.60	60.37	60.43	60.40
SEm (±)	0.004	0.006	0.004	0.122	0.114	0.084
CD	0.017	0.022	0.012	0.480	0.449	0.273
Nutrient management (T)						
T_1: 25% RDF+75% VC	19.59	19.69	19.64	63.57	63.18	63.38
T_2: 50% RDF+50% VC	19.92	19.94	19.93	63.12	63.14	63.13
T_3: 75% RDF+25% VC	19.69	19.77	19.73	62.85	62.96	62.91
T_4: 100% RDF	20.15	20.32	20.23	62.30	62.56	62.43
T_5: 100% VC	19.50	19.55	19.53	63.65	63.75	63.70
T_6: Control	18.57	18.59	18.58	61.91	61.98	61.94
SEm (±)	0.012	0.009	0.007	0.091	0.114	0.073
CD	0.034	0.026	0.021	0.263	0.328	0.206

it is increasingly restricted to long slender grain type with moderate to strong aroma accordingly, the small and medium grain aromatic rice's are being regarded as a separate class of non-Basmati aromatic rice. India has had immense wealth of these rices, but a lot has already been lost as an aftermath of the green revolution where major emphasis was on yield rather than quality. However the area under scented rice is on rapidly on the increase due to the increasing demand in the world as well as domestic market due to their premium quality [1]. Quality rices are not only characterized by aroma but several other traits like grain length and width, elongation after cooking, amylose content, gelatinization temperature. An aromatic rice variety may grow and yield satisfactorily in a wide area but its quality traits are expressed best in its native area of cultivation. Expression of aroma and other quality traits are quite dependent upon environmental factors, and also it depends largely on nutrient management practices. Though we do not have much control over the environmental factors the nutrient management practices can be altered. Keeping this in mind this present experiment was set up to assess the different quality parameters of rice grain as influenced by various nutrient management practices.

Materials and Methods

A field experiment was conducted at 'C' Block Farm, Kalyani, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal during the *kharif* seasons of 2010 and 2011, to study the effect of nutrient management on the quality aspect of scented rice cultivars in the New Alluvial Zone of West Bengal. The farm is situated at 23°N latitude and 89° E longitudes with an average altitude of 9.75 m above MSL. A total of 54 plots, each of size 3.5 m × 4.5 m were taken. The experiment was laid out in split plot design taking three cultivars of scented rice viz. Gobindabhog (V_1), Kalonunia (V_2) and Dehradoon (V_3) in the main plots and six levels of nutrient management viz. 25% Recommended NPK as Chemical Fertilizer + 75% Recommended NPK as Vermicompost (T_1), 50% Recommended NPK as Chemical Fertilizer + 50% Recommended NPK as Vermicompost (T_2), 75% Recommended NPK as Chemical Fertilizer + 25% Recommended NPK as Vermicompost (T_3), 100% Recommended NPK as Chemical Fertilizer (T_4), 100% Recommended NPK as Vermicompost (T_5) and Control (T_6) in the sub plots in all possible combinations replicated thrice. Pre germinated seeds @ 40 kg/ha of the different scented rice cultivars were used. The 28 days old seedlings were then transplanted into the experimental field maintaining a spacing of 20 cm × 10 cm. The following parameters were studied from the experiment:

Head rice recovery (HRR): The head rice recovery was calculated using the following formula

$$HRR = (W_4 / W_1) \times 100$$

Where W_4 and W_1 are the weights of head rice and rough rice respectively.

Length of kernel before cooking : Ten kernels each of rice were taken and their length was mea-

Table 2. Effect of variety and nutrient management on the kernel length (before and after cooking) and the elongation ratio.

Treatments	Kernel length (mm) before			Kernel length (mm) after			Elongation ratio		
	1st year	2nd year	Pooled	1st year	2nd year	Pooled	1st year	2nd year	Pooled
Variety (V)									
V_1: Gobindabhog	4.13	4.13	4.13	7.11	7.14	7.12	1.72	1.73	1.72
V_2: Kalonunia	5.14	5.17	5.16	8.29	8.39	8.54	1.61	1.62	1.62
V_3: Dehradoon	6.62	6.62	6.62	10.19	10.23	10.21	1.54	1.54	1.54
SEm (±)	0.007	0.007	0.005	0.008	0.007	0.005	0.004	0.003	0.002
CD	0.026	0.029	0.016	0.030	0.029	0.017	0.015	0.010	0.007
Nutrient management (T)									
T_1: 25% RDF+75% VC	5.35	5.35	5.35	8.64	8.72	8.68	1.63	1.64	1.64
T_2: 50% RDF+50% VC	5.37	5.39	5.38	8.71	8.72	8.72	1.64	1.64	1.64
T_3: 75% RDF+25% VC	5.24	5.29	5.27	8.39	8.52	8.45	1.61	1.62	1.62
T_4: 100% RDF	5.32	5.33	5.33	8.49	8.53	8.51	1.61	1.62	1.62
T_5: 100% VC	5.41	5.44	5.43	8.90	9.02	8.96	1.66	1.67	1.66
T_6: Control	5.07	5.06	5.07	8.05	7.99	8.02	1.60	1.59	1.60
SEm (±)	0.006	0.006	0.004	0.006	0.003	0.003	0.003	0.003	0.002
CD	0.018	0.017	0.012	0.018	0.008	0.010	0.010	0.010	0.007

sured with the help of a graph paper. The average was then taken.

Length of kernel after cooking: A small amount of rice was cooked and then the lengths of ten kernels were taken in a similar way as mentioned above. The average value was then taken.

Elongation ratio (ER): The length of ten randomly selected kernels were taken and cooked. After cooking the length was again measured using a graph paper and the elongation was calculated using the formula

$$ER = \frac{\text{Length of kernel after cooking (mm)}}{\text{Original kernel length (mm)}}$$

Amylose content: Amylose content of the rice was estimated following standard method.

Statistical analysis and interpretation of results was done by calculation values of SEm (±) and CD at 5% . For comparison of *F* and *t* table values for determination of critical differences, Fisher and Yates table were consulted.

Results and Discussion

Amylose content in rice grain

Amylose content was significantly influenced by the different varietal treatments used in both the years of experimentation and in the pooled data (Table 1). The highest amylose content was recorded in the varietal treatment Dehradoon (V_3) irrespective of the years of observation and the pooled data followed by Kalonunia (V_2) but they differed significantly from each other. The lowest amylose content was recorded in varietal treatment Gobindabhog (V_1) which different significantly from the other two treatments during both the years of recording observation and the pooled data.

The maximum amylose content in rice grain was obtained in the treatment that received sole inorganic treatment (T_4) in both years of experiment and in pooled data (Table 1). Among the combined organic and inorganic treatments the nutrient management T_2 gave the highest amylose content and it differed significantly from the sole inorganic treatment followed by T_3 in both years of investigation and the pooled data. However, the lowest value of amylose content

was recorded when the crop was raised without any nutrient management (T_6) which differed significantly from all the other nutrient management treatments.

Head rice recovery

Significant effect of the varietal treatment used was seen on the head rice recovery percentage (HRR %) in both years of experiment and the pooled data (Table 1). Among the three varietal treatments used the highest head rice recovery % was noted in Gobindabhog (V_1) irrespective of years of observation and the pooled data. This was followed by the varietal treatment Kalonunia (V_2) but they differed significantly from each other. The lowest HRR% was observed with Dehradoon (V_3) and it differed significantly from the other two varietal treatments during 2010, 2011 and their pooled data.

The HRR% was significantly affected by the different levels of nutrient management in the two years of conducting investigation and the pooled data (Table 1). The highest HRR% was recorded by the sole organic treatment (T_5) followed by T_1 during both the years of experiment and in pooled data and they significantly differed from each other [2]. The lowest HRR% was recorded with T_6 where no nutrient was supplied to the crop and it differed significantly from the other treatments during both the years of experiment and the pooled data. The higher uptake of nutrients, particularly nitrogen in the organic treatment probably led to increased grain protein content. It is a known fact that the protein content imparts strength to the grain, which results in higher head rice recovery [3].

Kernel length before and after cooking and elongation ratio

The different varietal treatments showed significant effect on the kernel length before cooking, after cooking and the elongation ratio in both the years and in the pooled data (Table 2). The kernel length before and after cooking was highest in the varietal treatment Dehradoon (V_3) in both the years of experiment as well as pooled data. This treatment was followed by Kalonunia (V_2) and they differed significantly from each other. The highest elongation ratio was recorded in the varietal treatment Gobindabhog (V_1) followed by Kalonunia (V_2) and they differed significantly from each other irrespective of the year of taking observation and in pooled data.

The kernel length before cooking, after cooking and the elongation ratio varied significantly due to the different nutrient management treatments during the two years and the pooled data (Table 2). The highest kernel length before and after cooking and elongation ratio was recorded with sole organic treatment (T_5) followed by nutrient management treatment T_2. The values of kernel length after cooking with nutrient management treatments T_1 and T_2 were at per with each other during the 2nd year. The highest elongation ratio was recorded with the sole organic treatment T_5 followed by T_2 during both years of experiment and in pooled data. However they differed from each other significantly. The treatments having organics showed tendency of higher elongation ratio in comparison to sole inorganic treatment [4].

Conclusion

The amylose content of the rice grains was found to have the highest value (22.15%; pooled data) under the varietal treatment Dehradoon (V_3) with the nutrient management T_4 (100% recommended NPK as chemical fertilizer). The maximum head rice recovery (66.40%; pooled data) was noted under the varietal treatment Gobindabhog (V_1) with T_5 nutrient management (100% recommended NPK as vermicompost). The highest kernel length before cooking (6.82 mm; pooled data) and the kernel length after cooking (10.94 mm; pooled data) were recorded under the varietal treatment Dehradoon (V_3) with T_5 nutrient management (100% recommended NPK as vermicompost). The elongation ratio recorded its highest value (1.74; pooled data) under the varietal treatment Gobindabhog (V_1) with T_5 nutrient management (100% recommended NPK as vermicompost). It may therefore be concluded from the experiment that the inclusion of organics in the nutrient management practices improved the grain quality of rice which is desirable to farmers to fetch a higher market price. This may be attributed to the fact that the organic manures provide regulated supply of nutrients by releasing them

slowly and thereby increasing the nutrient availability and the corresponding uptake by the plant [5].

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