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Quality of red rice cultivars in different plant geometry and nutrient management

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Abstract

An experiment was carried out during *kharif* season of 2016 at Instructional cum Research Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh. The experiment was laid out in split plot design with three replications keeping two red rice cultivars viz., Bantha luchai and Mokdo with two spacing 20 cm x 10 cm and 15 cm x 10 cm in main plots and four nutrient management i.e application of 100% RDF, 75% RDF, 50% RDF + 50% RDN through FYM and 100% RDN through FYM in sub plots. The recommended dose of fertilizers for red rice was 80: 60: 40 kg ha^{-1} N, P_2O_5 and K_2O, respectively. The result revealed that red rice variety Mokdo with spacing 20 x 10 cm obtained significantly maximum quality parameter milling%, hulling, head recovery% and alkali value as compared to other varieties. As regards to nutrient management, soil application of 50% RDF + 50% RDN through FYM recorded maximum quality parameter milling%, hulling, head recovery% and alkali value.

Keywords: Milling, Hulling, Head recovery

Introduction

Rice (*Oryza sativa* L.) is the most important cereal crop in Asia. In the world, 85% of the total rice area is in Asia. Rice (*Oryza sativa* L.) production must increase 65% between the years 1990 and 2020 in order to keep pace with population growth in countries where rice is the main food crop (Fageria, 2007) [3]. India is the second largest producer and consumer of rice in the world. Area under rice crop in India is about 43.95 MT with production of 103 MT and productivity of 2424 kg ha^{-1} during 2013-14 (Anonymous, 2014) [2]. Chhattisgarh is known as “Rice bowl of India” and about 82% population of the state is dependent on agriculture for their livelihood. The total rice grown area in Chhattisgarh is 3.61 million hectares with production of 6.36 million tonnes and productivity of 2.0 tones ha^{-1} (Anonymous, 2013-14)[1].

Rice with a red bran layer is called red rice. Thought the color is confined to the bran layer, a tinge of red remains even after a high degree of milling. The color of the bran range from light to dark red. The bran layer contains polyphenols and anthocyanin and possesses antioxidant properties. The inner portion of red and white rice is alike and white. The zinc and iron content of red rice is 2-3 times higher than that of white rice (Ramaiah and Rao 1953) [5]. The nutrient requirement of red rice is lesser than the white rice but the nutritional quantity is much more in red rice than white rice.

Materias and Methods

The experiment was conducted at IGKV, Raipur during *kharif* 2016 and was laid out in split plot design with three replications keeping two red rice cultivars viz., Bantha Luchai and Mokdo with two spacing 20 x 10 cm and 15 x 10 cm in main plots and four nutrient management i.e soil application of 100% RDF, 75% RDF, 50% RDF + 50% RDN through FYM and 100% RDN through FYM in sub plots. The soil of experimental field was ‘*Vertisols*’, low in nitrogen (184.20 kg ha^{-1}), medium in phosphorus (10.12 kg ha^{-1}) and medium in potassium (252.6 kg ha^{-1}) contents with normal pH (6.8). The recommended dose of fertilizers for red rice was 80: 60: 40 kg ha^{-1} N, P_2O_5 and K_2O, respectively and applied through urea, single super phosphate and muriate of potash. Half dose of N, entire dose of P and K were applied after one week of transplanting and remaining half of the nitrogen through urea were top dressed at tillering and panicle initiation stage in equal amount. One seedling was transplanted in each hill at 20 cm x 10 cm and 15 cm x 10 cm spacing on 27 July 2016 and harvested on 7 November 2016.

Kernel length and breadth (mm)

Five hulled rice grain were taken randomly and average length and breadth were recorded in mm.

Kernel length: breadth ratio

This was calculated by the following formula

$$\text{Length: breadth ratio of kernel} = \frac{\text{Length of kernel}}{\text{Breadth of kernel}}$$

Kernel length and breadth after cooking (mm)

Five milled rice grain was taken from each treatment and was embedded in 12 ml of distilled water for 10-12 minutes followed by cooking for 15 minutes. Then cooked rice kernels were transferred to petri plates covered with filter paper. Then-cooked rice was taken and individually length and breadth was measured (Pellaiyar and Mohandass, 1981) [8].

Kernel length: breadth ratio after cooking

This was calculated by the following formula

$$\text{Kernel length: breadth ratio after cooking} = \frac{\text{Kernel length after cooking}}{\text{Kernel breadth after cooking}}$$

Hulling%

Rice samples were cleaned and then 3 g of grain sample was shelled with the Satake Sheller. The samples were hulled and weights of de-hulled grains were recorded. The formula is as follows:

$$\text{Hulling\%} = \frac{\text{Weight of the dehusked kernel (g)}}{\text{Weight of husked grain (g)}} \times 100$$

Milling%

The hulled samples were milled and weight of milled grains was recorded. The formula is as follows:

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

Head rice recovery%

After milling, the whole and broken grains were separated. The% of head rice or unbroken rice grain were determined based on the initial weight of the rough rice% of total rice or sum total of head rice and all classes of broken rice. The formula is as follow:

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

Alkali value

It was measured in terms of alkali disintegration using 7-point numerical spreading scale as suggested by Little *et al*. (1958). Six milled rice kernel were evenly placed in petriplates containing 1.7% KOH solution at 30 ± 10 ˚C for 23 hours and the spreading scale was recorded in following manner.

Score		Spreading
1	-	Kernel not affected
2	-	Kernel swollen
3	-	Kernel swollen, collar incomplete and narrow
4	-	Kernel swollen, collar complete and wide
5	-	Kernel split or segmented, collar complete and wide
6	-	Kernel dispersed, merging with collar
7	-	All kernel dispersed and inter mingled

Results and Discussion

Quality parameters

Grain quality in rice is very difficult to define. Preferences for quality vary from one community to another as the concept of quality defers according to the preparation for which the rice grains are to be used. Rice is only one cereal that is consumed mainly as whole milled and boiled grain. Some of the quality characteristics desired by the grower, miller and consumer may be the same but each of them may have different emphasis on various quality parameters. For example, millers wish high% head recovery on milling. Consumers want quality on the grain appearance, size and shape of the grain, test, tenderness and flavour after cooking.

The data with respect to kernel length (mm) are presented in Table 1.1. The effect of red rice variety and plant geometry on kernel length was found significant. Mokdo + 20 cm x 10 cm was recorded significantly higher kernel length (5.41 mm) which was statistically at par with variety Mokdo + 15 cm x10 cm (5.33 mm), minimum kernel length was observed with Bantha luchai + 15cm x10 cm (5.03mm). In case of nutrient management, the kernel length was found significant. Application of 50% RDF + 50% RDN through was FYM recorded significantly higher kernel length (5.38 mm). However it was statistically at par with 100% RDF (5.32 mm) and minimum (5.08mm) kernel length was observed with 100% RDF.

The effect of red rice varieties and plant geometry on kernel breadth (mm) was significant. Mokdo + 20 cm x 10 cm recorded significantly higher kernel breadth (2.50 mm) and it was statistically at par with Mokdo + 15 cm x 10 cm (2.47 mm) and minimum kernel breadth (2.33 mm) was observed with Bantha luchai + 15 cm x10 cm. In case of nutrient management, the kernel breadth was found significant. 50% RDF + 50% RDN through FYM was recorded significantly higher kernel breadth (2.53 mm) and minimum (2.26 mm) kernel breadth was observed with 100% RDN through FYM.

The kernel length and breadth ratio was not influenced significantly due to different rice variety, plant geometry and nutrient management. However the high value of kernel L/B ratio was recorded with Bantha luchai + 20 cm x 10 cm and with application of 75% RDF. The effect of rice varieties and plant geometry on kernel length after cooking was found significant. The kernel length after cooking was significantly higher with Mokdo + 20 cm x 10 cm (7.41 mm). Minimum kernel length (6.43 mm) after cooking was recorded with Bantha luchai + 15cm x10 cm. The kernel breadth after cooking, kernel L/B ratio after cooking and hulling (%) was not influenced significantly due to different rice variety, plant geometry and nutrient management. Significantly higher milling% (61%) was recorded with variety Mokdo + 20 cm x 10 cm and it was statistically at par with Mokdo + 15 cm x 10 cm (58%). Minimum milling% (54%) was recorded with Bantha luchai + 15 cm x10 cm. In case of nutrient management, the milling% was not influenced significantly due to different nutrient management. The effect of rice varieties and plant geometry on head rice recovery% was significant. The head rice recovery% was significantly higher (48%) with Mokdo + 20 cm x 10 cm which was statistically at par with Mokdo + 15 cm x 10 cm (46%). Minimum head rice recovery% was recorded with Bantha luchai + 15 cm x 10 cm. The higher grain yield with wider spacing might be due to higher yield, quality parameters, these results are in accordance with the findings of Rao *et al*. (2005) [5], Satyavarma *et al*. (2009) [6] and Manonnmani and Jacquilin(1995) [7].

Conclusion

Variety Mokdo with spacing 20 cm x 10 cm recorded maximum kernel length, breadth and kernel length after cooking. Application of 50% RDF + 50% RDN through FYM recorded maximum kernel length and breadth after cooking. However were not influenced significantly due to nutrient management. Variety Mokdo with spacing 20 cm x 10 cm and application of 50% RDF + 50% RDN through FYM kernel results revealed that the kernel L/B ratio and kernel L/B ratio after cooking was not influenced significantly due to different varieties, plant geometry and nutrient management. Hulling%, milling% and Alkali value were not influenced significantly due to varieties, plant geometry and nutrient management. The head rice recovery% was observed maximum with variety Mokdo when planted at 20 cm x 10 cm spacing. However the head rice recovery% was not influenced significantly due to nutrient management.

Table 1: Effect of plant geometry and nutrient management on qualities of red rice cultivars

Treatment	Before cooking			After cooking						
	Kernel length (mm)	Kernel Breadth (mm)	Kernel L/B ratio	Kernel length (mm)	Kernel Breadth (mm)	Kernel L/B ratio	Hulling%	Milling%	Head rice recovery%	Alkali value
Variety + plant geometry										
Bantha luchai + 20 cm x 10 cm	5.17	2.35	2.21	6.52	2.68	2.36	67	56	33	4
Bantha luchai + 15 cm x 10 cm	5.03	2.33	2.17	6.43	2.70	2.39	66	54	32	5
Mokdo + 20 cm x 10 cm	5.41	2.50	2.17	7.41	2.87	2.64	70	61	48	6
Mokdo + 15 cm x 10 cm	5.33	2.47	2.17	7.28	2.80	2.55	69	58	46	6
SEm±	0.06	0.04	0.05	0.18	0.06	0.10	2	1	2	0
CD at 5%	0.22	0.13	NS	0.61	NS	NS	NS	NS	7	NS
Nutrient management										
100% RDF	5.32	2.47	2.17	6.90	2.73	2.47	68	56	40	5
75% RDF	5.17	2.26	2.30	6.85	2.75	2.45	68	56	39	5
50% RDF + 50% RDN (FYM)	5.38	2.53	2.13	7.08	2.87	2.50	69	59	41	4
100% RDN (FYM)	5.08	2.39	2.13	6.81	2.70	2.53	68	58	39	5
SEm±	0.07	0.05	0.05	0.12	0.07	0.06	1	2	2	0
CD at 5%	0.22	0.14	NS	NS	NS	NS	NS	NS	NS	NS

Reference

1. Anonymous, FAO, STAT Database, Food & Agriculture Organizations of the United Nation, Rome, Italy. 2013-14, 48-49.
2. Anonymous, Krishi Darshika. Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.), 2014.
3. Fageria NK. Yield physiology of rice. Journal of Plant Nutrient. 2007; 30:843-879.
4. Ramaiah K, Rao MVBN. Rice Breeding and Genetics. ICAR Science Monograph 19. Indian Council of Agricultural Research, New Delhi, India, 1953.
5. Rao KS, Moorthy BTS, Manna GB. Plant populations for higher productivity in Basmati type scented rice. Internat. Rice Res. Newsletter. 2005; 15:26.
6. Satyavarma N, Raghavulu R, Ramakrsihna Reddy T. Effect of spacing and number of seedling per hill on *Kharif* rice. Andhra Agricultural Journal. 2009; 38:97-98.
7. Manonnmani V, Jacquiline AS. Storage potential of rice seeds. Oryza. 1995; 32:133-135.
8. Pillaiyar P, Mohandoss R. On the completion of cooking in rice. Indian J Nutrition and Diet. 1981; 18:121-122.