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Mineral composition of red and white rice varieties: A comparative study

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Abstract

Rice (*Oryza Sativa L.*) is one of the most popular and important cereal crops. It is the staple food of more than three billion people in 39 countries, which comprises of nearly half of the world's population. The present research study was intended to explore the comparison between two varieties of rice in that the red rice and white rice. In the red rice and white rice, five different varieties of each variety (red and white rice) are taken for analysis and comparison between two varieties are done. This study was used for comparison of red rice varieties ie. Lal dhan, Jatto, Begami, Paddy karad, Roda Dhan and white rice varieties ie Sabour Surbhit, Sabour Ardhajal, Sabour Shree, Bhagalpur Katarni respectively. The mineral composition of red rice and white rice varieties were determined. Red rice have higher mineral composition as compared to the varieties of white rice. There was increase in calcium percentage of red rice by highest value of 18.55% in Begami variety, iron percentage of red rice by highest value of 8.50% in Begami variety, magnesium percentage of red rice by highest value of 193.09% in Begami variety, zinc percentage of red rice by highest value of 8.50% in Begami variety and phosphorous percentage of red rice by highest value of 302.38% in Paddy karad.

Keywords: Rice, Varieties, Red Rice, White Rice, Mineral Composition

1. Introduction

Rice (*Oryza Sativa L.*) is one of the most popular and important cereal crops. It is the staple food of more than three billion people in 39 countries, that comprises of nearly half of the world's population. Commercially more than two thousand varieties of rice are grown throughout the world (Bhattacharjee *et al.*, 2002) [3].

The rice plant belongs to the monocot genus *Oryza* of *Poaceae* family. The monocot genus *Oryza* includes 24 species, of which only two species are widely cultivated like, *Oryza Sativa* and *Oryza Glaberrima*, are cultivable and the rest 22 species are wild. Rice varieties i.e. sativa is further divided into three subspecies that are, Japonica, Indica, and Javanica. India is that producer of rice varieties which belongs to the subspecies Indica Department of Rural Development. Rice is an annual plant which usually grows to a height of about 0.5–2 m.

Micronutrient malnutrition affects more 2 billion people currently and the number is increasing. Mineral elements play a vital role in metabolism and maintenance of tissue function. Rice serves as staple food for more than half of the world's population and has great nutritional value in human life (Pinky *et al.*, 2015) [7]

The impact of iron, zinc and calcium fortification in rice through parboiling technique on its physicochemical properties were investigated by Chanu *et al.*, (2020) [5]. A fragrant long grain red rice variety named 'Red Fragrant' where excellent health properties are combined with attractive grain qualities has been developed in Sri Lanka (Abeysirwardena *et al.*, 2020) [8]

Material and methods

Selection of red and white rice varieties

The comparison of mineral composition of red rice varieties ie. Lal dhan, Jatto, Begami, Paddy karad, Roda Dhan and white rice varieties ie. Sabour Surbhit, Sabour Ardhajal, Sabour Shree, Bhagalpur Katarni respectively were determined.

Estimation of calcium, iron, magnesium and zinc

Calcium, iron, magnesium and zinc in acid digested samples were determined by Atomic Absorption Spectrophotometer according to the AOAC 2000.

$$\text{Minerals (mg/100 g)} = \frac{\text{Reading (conc. } \mu\text{g/ml)} \times \text{volume made}}{\text{Weight of sample (g)} \times 1000} \times 100$$

Estimation of phosphorous

Phosphorus was determined calorimetrically by using following method.

Reagents

- i. Ascorbic acid (10%)
- ii. Ammonium moly date (2.5%)
- iii. Reagent C: 6N H₂SO₄, water, 2.5 per cent ammonium moly date and 10 per cent ascorbic acid were mixed in the ratio of 1:2:1:1 (v/v), respectively. This reagent was prepared fresh.
- iv. Standard phosphorus solution: 0.351 g pure and dry anhydrous monopotassium dihydrogen orthophosphate was dissolved in a few ml of water and 10 ml 10N H₂SO₄. The volume was made to one liter with water. This stock contained 80 µg P/ml.
- v. Working standard phosphorus solution: Twenty-five ml

stock solution was diluted to one liter, which served as working standard solution and contained 2 µg P/ml. Two or three drops of chloroform were added to preserve the solution.

Procedure

Mineral extract (0.1ml, obtained from acid digestion) was pipetted in a test tube and volume was made to four ml with water. Four ml reagent C was added and mixed well. The contents were incubated at 37°C in water bath for 90 minutes. It was removed and allowed to cool to room temperature and absorbance was read at 720 nm against a suitable blank. Standard curve was plotted using one to eight µg P.

Result and discussion

Calcium (mg/100g) of red and white rice varieties

The highest range of calcium in red rice varieties i.e Begami as well as the lowest range of calcium in varieties of white rice i.e. Sabour Ardhajal shown in table 3.1. The comparison with Raghuvanshi *et al.*, (2017) [4] was reported that the calcium of white rice and red rice was 7.94±0.17 and 8.71±0.65 respectively.

Table 3.1: Calcium (mg/100g) of red and white rice varieties

S. No.	Red rice genotypes	Calcium (mg/100g)	White rice genotypes	Calcium (mg/100g)
T ₀	Lal dhan	16.11	Sabour Surbhit	14.66
T ₁	Jatto	18.40	Sabour Ardhajal	14.65
T ₂	Begami	18.55	Sabour Deep	16.08
T ₃	Paddy karad	16.22	Sabour Shree	16.71
T ₄	Roda Dhan	16.70	Bhagalpur Katarni	14.83
	F-Test	NS	F-Test	NS
	C.D. at 0.5%	0.694	C.D. at 0.5%	0.277
	S.Ed (+)	0.301	S.Ed (+)	0.120

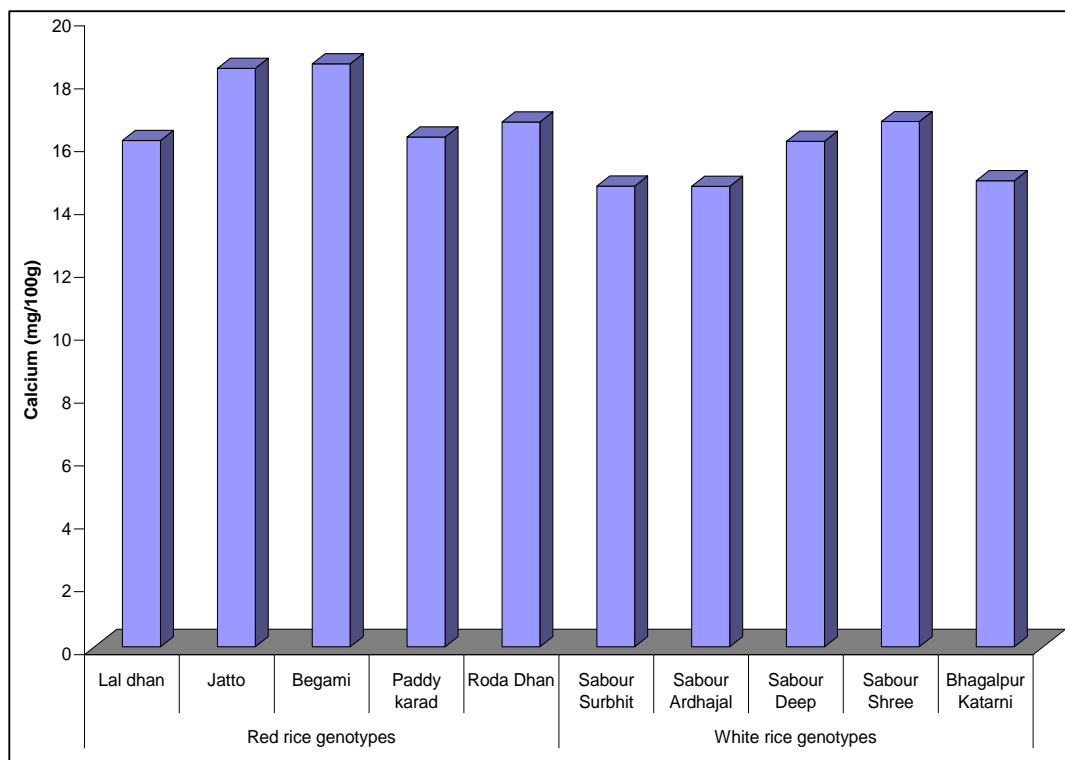


Fig 3.1: Calcium (mg/100g) of red and white rice varieties

Iron (mg/100g) of red and white rice varieties

In this the highest range of iron in red rice varieties i.e. Begami as well as the lowest range of iron in varieties of white rice i.e. Sabour Deep as shown in table 3.2. The

comparison with Raghuvanshi *et al.*, (2017) [4] was reported that the iron of white rice and red rice varieties was 7.65±0.22 and 13.45±0.60 respectively

Table 3.2: Iron (mg/100g) of red and white rice varieties

S. No.	Red rice genotypes	Iron (mg/100g)	White rice genotypes	Iron (mg/100g)
T ₀	Lal dhan	7.60	Sabour Surbhit	2.41
T ₁	Jatto	5.32	Sabour Ardhajal	2.56
T ₂	Begami	8.50	Sabour Deep	2.17
T ₃	Paddy karad	5.07	Sabour Shree	2.31
T ₄	Roda Dhan	5.15	Bhagalpur Katarni	2.36
	F-Test	NS	F-Test	NS
	C.D. at 0.5%	0.496	C.D. at 0.5%	0.028
	S.Ed (±)	0.215	S.Ed (±)	0.012

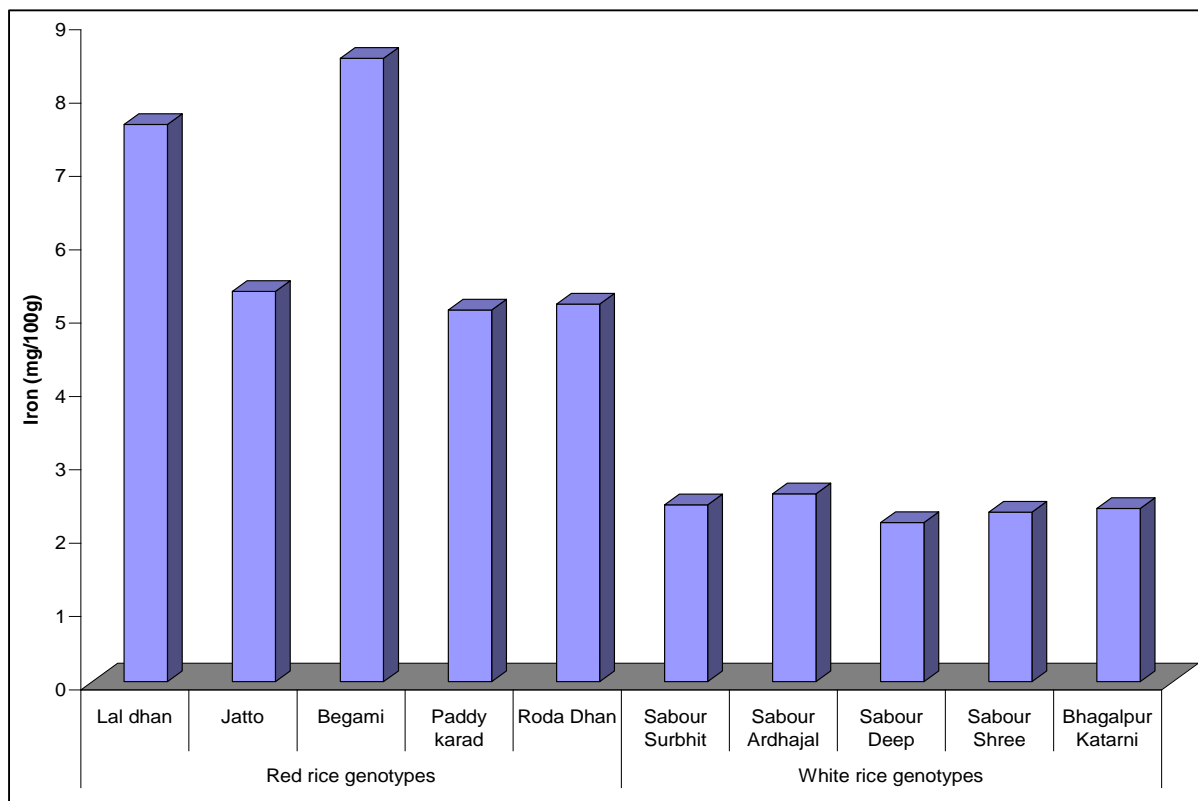


Fig 3.2: Iron (mg/100g) of red and white rice varieties

Magnesium (mg/100g) of red and white rice varieties

In this the highest range of magnesium in red rice varieties i.e Begami as well as the lowest range of magnesium in varieties of white rice i.e. Sabour Deep as shown in table 3.3.The

comparison with Raghuvanshi *et al.*, (2017) ^[4] was reported that the magnesium of white rice and red rice varieties was 46.45±0.649 and 192.27± 5.98 respectively.

Table 3.3: Magnesium (mg/100g) of red and white rice varieties

S. No.	Red rice genotypes	Magnesium (mg/100g)	White rice genotypes	Magnesium (mg/100g)
T ₀	Lal dhan	192.31	Sabour Surbhit	49.69
T ₁	Jatto	191.32	Sabour Ardhajal	49.26
T ₂	Begami	193.09	Sabour Deep	48.69
T ₃	Paddy karad	192.66	Sabour Shree	51.51
T ₄	Roda Dhan	192.38	Bhagalpur Katarni	52.32
	F-Test	NS	F-Test	NS
	C.D. at 0.5%	0.433	C.D. at 0.5%	0.156
	S.Ed (±)	0.188	S.Ed (±)	0.068

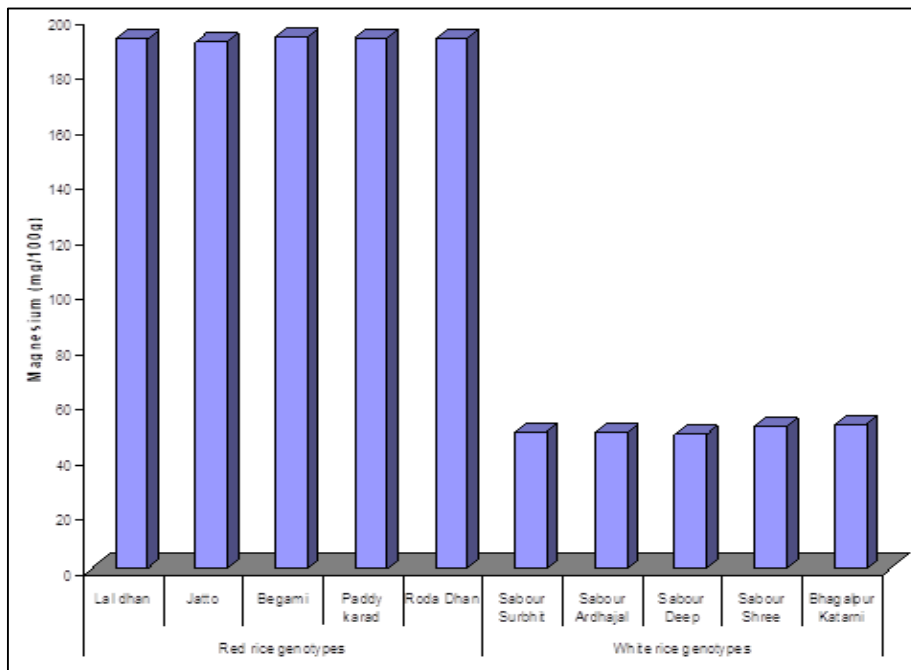


Fig 3.3: Magnesium (mg/100g) of red and white rice varieties

Zinc (mg/100g) of red and white rice varieties

In this the highest range of zinc in red rice varieties i.e. Begami as well as the lowest range of zinc in varieties of white rice i.e. Bhagalpur Katarni as shown in table 3.4. The

comparison with Raghuvarshi *et al.*, (2017) [4] was reported that the zinc of white rice and red rice varieties was 1.49 ± 0.039 and 1.91 ± 0.036 respectively.

Table 3.4: Zinc (mg/100g) of red and white rice varieties

S. No.	Red rice genotypes	Zinc (mg/100g)	White rice genotypes	Zinc (mg/100g)
T ₀	Lal dhan	7.54	Sabour Surbhit	1.55
T ₁	Jatto	5.19	Sabour Ardhajal	1.59
T ₂	Begami	8.50	Sabour Deep	1.51
T ₃	Paddy karad	5.21	Sabour Shree	1.35
T ₄	Roda Dhan	5.74	Bhagalpur Katarni	1.32
	F-Test	NS	F-Test	NS
	C.D. at 0.5%	0.566	C.D. at 0.5%	0.028
	S.Ed (+)	0.245	S.Ed (±)	0.012

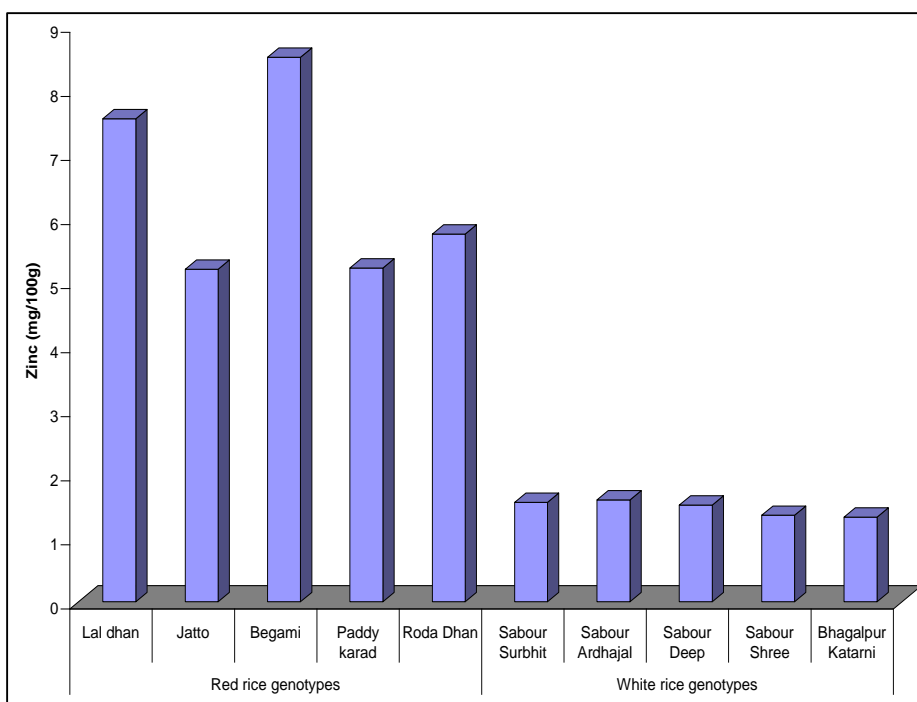


Fig 3.4: Zinc (mg/100g) of red and white rice varieties

Phosphorus (mg/100g) of red and white rice varieties

In this the highest range of phosphorus in red rice varieties i.e.

Jatto as well as the lowest range of phosphorus in varieties of white rice i.e. Sabour Deep as shown in table 3.5.

Table 3.5: Phosphorus (mg/100g) of red and white rice varieties

S. No.	Red rice genotypes	Phosphorus (mg/100g)	White rice genotypes	Phosphorus (mg/100g)
T ₀	Lal dhan	284.54	Sabour Surbhit	169.30
T ₁	Jatto	310.60	Sabour Ardhajal	167.15
T ₂	Begami	274.52	Sabour Deep	165.00
T ₃	Paddy karad	302.38	Sabour Shree	173.54
T ₄	Roda Dhan	248.40	Bhagalpur Katarni	174.93
	F-Test	NS	F-Test	NS
	C.D. at 0.5%	4.561	C.D. at 0.5%	1.212
	S.Ed (+)	1.978	S.Ed (+)	0.526

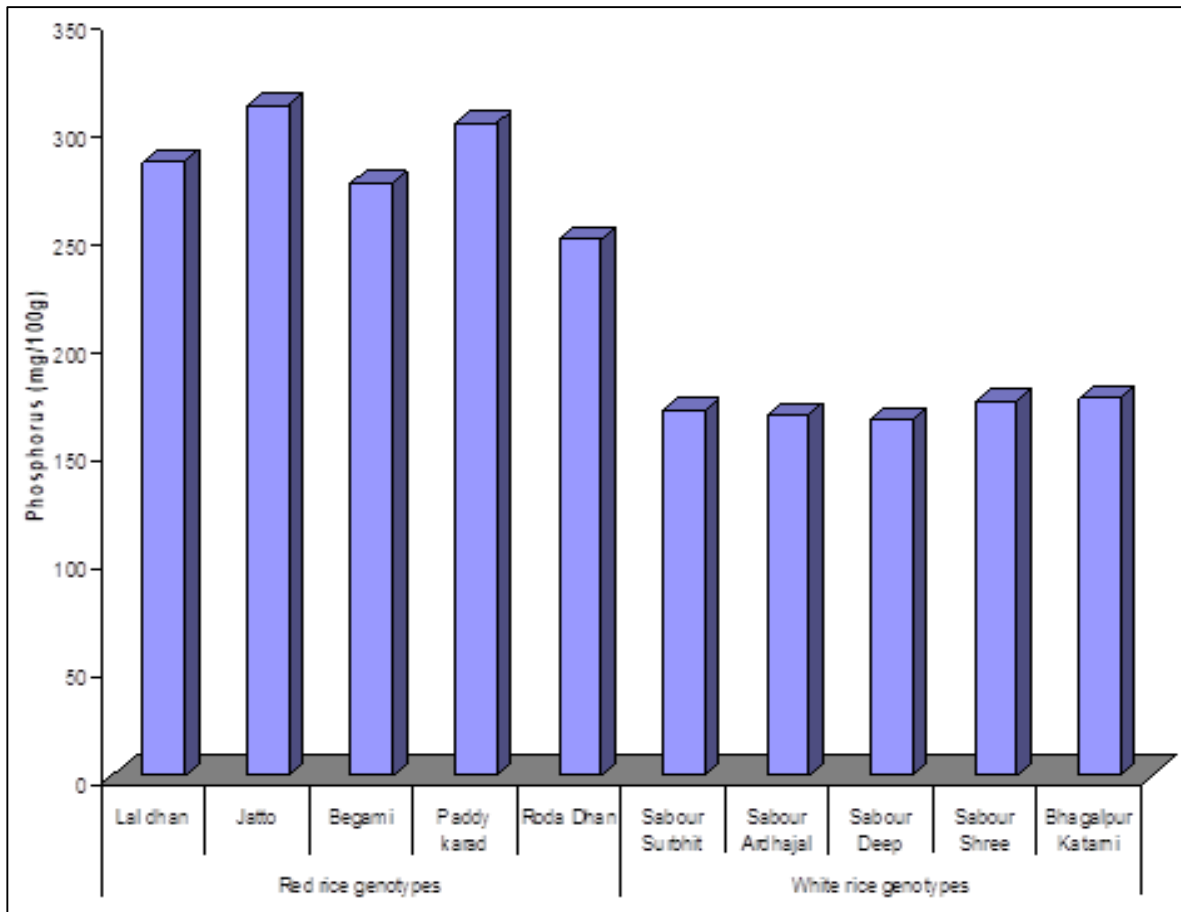


Fig 3.5: Phosphorus (mg/100g) of red and white rice varieties

Conclusion

This study was used for the comparison red rice varieties are Lal Dhan, Jatto, Begami, Paddy karad, Roda Dhan and white rice varieties are Sabour Surbhit, Sabour Ardhajal, Sabour Shree, Bhagalpur Katarni respectively.

It was observed that in the red rice varieties, Begami have highest content of calcium and Sabour Surbhit have the lowest content of calcium among all the varieties of white rice. It was found that in both iron and magnesium, the red rice variety which held the greatest value is Begami and the white rice variety which held the lowest value is Sabour Deep. The highest range of zinc in red rice varieties is obtained by Begami as well as the lowest range of zinc in varieties of white rice is obtained by Bhagalpur Katarni. The study also concludes that Jatto has highest range of phosphorus in red rice varieties and lowest range of phosphorus in varieties of white rice is Sabour Deep.

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