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SHORT COMMUNICATION

Profiling Pigmented Rice Germplasm for Iron and Zinc Concentration

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The low level of micronutrients such as iron (Fe) and zinc (Zn) in cereals crops is a widespread nutrition and health problem in developing countries like Africa and South Asian countries. Nutrition enrichment is one of the important processes, for enhancing the micronutrient content like Fe and Zn content and their bioavailability in small grained crops like rice. Evaluation on wild genotypes for Fe and Zn content is the initial step of determining their nutritional availability. In this study, we examined 37 accessions of pigmented rice genotypes and performed their diversity analysis along with three ruling check varieties for Fe and Zn concentration. Iron concentration ranged from 4.4 to 19.6 mg/Kg and zinc concentration from 12.0 to 49.0 mg/Kg.

Key Words: Diversity, Iron, Pigmented rice, Variability, Zinc

Introduction

Black rice might have originated in Sri Lanka, Philippines, Bangladesh, Thailand, Myanmar and Indonesia. Black rice has diversity in terms of color due to anthocyanin content and other morphological characters (Chaudary and Tran, 2001). The content of iron (Fe) and zinc (Zn) in rice depends on the grain size (Zhang *et al*. (2012). Aromatic long grain basmati rices are known to be high in iron content. The high or low content of mineral elements in grain largely determines the nutrient value of rice. Single grain selection of narrow grains tend to increase the content of Zn, Mn and P; long grains tend to increase the content of Fe and Mn; short grains tend to increase content of Zn and P; while selection of single plants with bigger grain weight tends to increase the content of P. The iron content varied from 6.30 to 24.40 mg/kg and zinc content from 13.50 to 58.40 mg/kg

The highest Fe (Iron) content (ranged from 18 to 22 mg/kg) and Zn (Zinc) content (24 to 35 mg/kg) were found in aromatic rice varieties such as Jalmagna, Zuchem and Xua Bue Nuo Additional research using F2 derived populations demonstrated that the aromatic trait was not pleiotropic for iron or zinc concentrations (Gregorio *et al.,* 2000).

Objective

To profile pigmented rice for Fe and Zn concentration.

Materials and Methods

Genotypes: Investigation consisted of 37 genotypes with medium and long duration traditional paddy varieties from Tamil Nadu and Kerala states of India, and three improved varieties namely CR1009, IR20 and CO (R) 50 (Table 1.). These genotypes were selected based on the grain characters (Fig. 1), and collected from different sources, namely Paddy Breeding Station (Coimbatore), Hybrid Rice Evaluation Centre (Gudalore), Centre for Indian Knowledge System (CIKS) in Sirkali and Sharadashram, Ulunthurpet of Tamil Nadu.

Micronutrient analysis: For biochemical quality analysis well-grounded and fine flour samples were obtained using small volume (150 mg) powder mixer and used for biochemical analysis. One gram of powdered grain sample mixed with was 12 ml of triple acid mixture (9:2:1 Nitric acid: Sulphuric acid: Perchloric acid) and cold digested overnight. The digested samples were heated till the solution turned from brown color to colorless. The extract was diluted to 100 ml and used for the estimation of micronutrients. The extract was

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Table 1. Source of genotypes with mean performance of Iron and Zinc

S.No.	Genotype	Ac.No	Source	Iron (mg/kg)	Zinc (mg/kg)
1	Rajamudi	LC1301	Sharadashram, Ulunthurpet	14.80	37.00
2	Athur kitchali	LC1302	Sharadashram, Ulunthurpet	16.20	40.50
3	Thengai poo samba	LC1303	Sharadashram, Ulunthurpet	4.60	19.34
4	Valaan	LC1304	Sharadashram, Ulunthurpet	5.60	14.00
5	Kothandam	LC1305	HREC, Gudalore	4.88	15.88
6	Athira	LC1306	HREC, Gudalore	11.60	14.66
7	Karuvelli	LC1307	HREC, Gudalore	11.00	27.50
8	Karunguruvai	LC1308	CIKS, Sirkali	14.60	36.50
9	Arupatham samba	LC1309	Sharadashram, Ulunthurpet	19.60	49.00
10	Seeraga samba	LC1310	CIKS, Sirkali	14.40	36.00
11	Kullakar	LC1311	CIKS, Sirkali	9.20	23.00
12	Thondi	LC1312	HREC, Gudalore	7.60	19.00
13	Mappilai samba	LC1313	CIKS, Sirkali	10.00	25.00
14	Maranell	LC1314	HREC, Gudalore	8.40	21.00
15	Cheruli	LC1315	HREC, Gudalore	11.40	28.50
16	Kaliyan samba	LC1316	Sharadashram, Ulunthurpet	6.20	15.50
17	Kandasala	LC1317	Sharadashram, Ulunthurpet	11.00	27.50
18	Kappakar	LC1318	Sharadashram, Ulunthurpet	11.20	28.00
19	Kottara samba	LC1319	Sharadashram, Ulunthurpet	8.00	20.00
20	Karuppu kavuni	LC1320	CIKS, Sirkali	11.20	28.00
21	Nootripathu	LC1321	PBS, Coimbatore	**4.40**	18.66
22	Vellai chithiraikar	LC1322	PBS, Coimbatore	4.80	**12.00**
23	Sivappu chithiraikar	LC1323	PBS, Coimbatore	18.60	46.50
24	Mohini samba	LC1324	PBS, Coimbatore	15.40	38.50
25	Rasakadam	LC1325	PBS, Coimbatore	12.60	31.50
26	Kakarathan	LC1326	PBS, Coimbatore	14.00	35.00
27	Karthigai samba	LC1327	PBS, Coimbatore	11.80	29.50
28	Ottadayan	LC1328	PBS, Coimbatore	9.40	23.50
29	Sivappu sirumani	LC1329	PBS, Coimbatore	11.00	27.50
30	Kattikar	LC1330	PBS, Coimbatore	8.40	21.00
31	Purple puttu	LC1331	PBS, Coimbatore	18.40	46.00
32	Norungan	LC1332	PBS, Coimbatore	16.20	40.50
33	Kallurundai kar	LC1333	PBS, Coimbatore	8.40	21.00
34	Vel samba	LC1334	PBS, Coimbatore	6.20	15.50
35	Uppu molagai	LC1335	PBS, Coimbatore	12.00	30.00
36	Kallundai	LC1336	PBS, Coimbatore	8.60	21.50
37	Chinna puncha	LC1337	HREC, Gudalore	9.60	24.00
38	Swarna	LC1338	PBS, Coimbatore	12.20	30.50
39	CR1009	Variety	PBS, Coimbatore	8.00	20.00
40	IR 20	Variety	PBS, Coimbatore	10.40	26.00
41	CO (R) 50	Variety	PBS, Coimbatore	10.20	25.50

Fig. 1. Panicle diversity of different rice genotypes

also diluted to 50 ml and fed to the Atomic Absorption Spectrophotometer. The recorded optical density values were converted into micronutrient concentration (Fe and Zn) using standard curve at the wavelength of 213.86 nm and expressed in ppm unit.

Zinc content estimation: Similar procedure to that iron was followed and the available iron content in the sample was read. Data were recorded is replicated samples.

Result and Discussion

Fe content varied from 4.44 mg/kg (Nootripathu) to 19.60 mg/kg (Arupatham samba) with a grand mean of 10.78 mg/kg (Fig. 1) (Table 1). The extreme ranges of zinc (Zn) content were 12.00 mg/kg (Vellaichittiraikar) and 49.00 mg/kg (Arupatham samba) with a grand mean of 27.07 mg/kg The iron (Fe) content was observed to be high in the genotypes Arupatham samba, Karunkuruvai, seeraga samba, Mohini samba, Kakarathan and Karthigai samba; and low in Vel samba, Nootripathu, Vellai chithiraikar, CR 1009, Thengai poo samba, Valaan and Thondi. High Zinc (Zn) content was exhibited in Arupatham samba, athur kitchali, Rajamudi, seeraga samba, Sivappu chithirai kar, Mohini samba, purple puttu and Norungan; and low Zn for Vellai chithirai kar, Kattikar, Vel samba, CR 1009, Kottara samba, kaliyan samba, Kothandam, Athira and valaaan. The similar results were quoted in results from Gregario *et al.* (2000) who evaluated 1,138 brown rice genotypes for grain iron and zinc content at International Rice Research Institute (IRRI), Philippines. The iron content varied from 6.30 to 24.40 mg/kg and zinc content from 13.50 to 58.40 mg/kg. The highest iron content (ranged from 18 to 22 mg/kg) and zinc content (24 to 35 mg/kg) were found in aromatic rice varieties, such as Jalmagna, Zuchem and Xua Bue Nuo. Kennedy *et al.* (2002) reported that the range of iron content in rice was 0.70 to 6.35 mg/100 g.

In conclusion, the iron content was estimated higher in the genotypes Arupatham samba, Karunkuruvai, seeraga samba, Mohini samba, Kakarathan and Karthigai samba. High zinc content was exhibited in Arupatham samba, Athur kitchali, Rajamudi, seeraga samba, Sivappu chithirai kar and Mohini samba. In this analysis, we have identified both Iron and Zinc to be of higher value in Arupatham Samba and Mohini Samba genotypes. These genotypes may contribute to future Fe and Zn biofortified programmes.

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