Identification of High Quality Rice Breeding Lines with Export Potential

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INTRODUCTION

Sri Lanka achieved near self-sufficiency in rice in 2010. The country is likely to continue higher production of paddy and has to find ways to export rice to meeti requirements of the international market.

The main ice exporting countries according to the Food and Agricultural Organization are China, India, Indonesia, Bangladesh, Vietnam, Thailand, Myanmar, Philippines *etc*. These countries export rice to various world markets with or without adding value and generate foreign exchange. Most rice importers prefer long, slender, white grain varieties with varying degrees of stickiness, low to intermediate amylose content, soft gel consistency and aromatic rice with favorable sensory properties. Further, the fragrant and glutinous rice varieties ensure better market value (ADB, 2012). Therefore, breeding programs are conducted at Rice Research and Development Institute (RRDI) by obtaining relevant germplasm from International Rice Research Institute (IRRI) to identify promising quality rice lines having better export potential. In the present study several rice lines were compared based on physical, chemical and other important parameters to identify high quality rice lines to use potentially for exports.

MATERIALS AND METHODS

Eighteen high quality rice lines were tested along with the variety of Bg 94-1 as the standard variety. Experiment was conducted at the experimental field at RRDI, Batalagoda during the *Maha* 2016/17 and *Yala* 2017 season with a RCBD design. Pre-germinated seeds of tested lines were broadcasted in 6×3 m^2 plots. Recommendations of Department of Agriculture (DOA) for fertilizer application and pest and disease control were followed. For evaluating grain quality traits, mature seeds from each genotype were harvested individually and dried. Dehulled samples were used for grain quality

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evaluation at the grain quality laboratory of RRDI, Batalagoda. Grain length, grain width and grain length to width ratio were also recorded. Aroma was detected by the method described by Tragoonrung *et al.,* (1996). Amylose content (AC) (Juliano, 1971), gelatinization temperature (GT) (Little *et al.,* 1958) and gel consistency (Cagampang *et al.,* 1973) were measured according to the reported methods. Translucency/chalkiness of the samples was visually observed with the presence of white patches in the kernels. Besides that, the kernel elongation after cooking and kernel elongation ratio were also recorded. Hulling and milling values were determined based on the methods described in the quality training manual published by IRRI.

RESULTS AND DISCUSSION

Physical and milling qualities are immediately visible to consumers and are considered as major factors defining market value. Among recent accessions, brown rice percentage was to 77% and total milled rice outcome ranges from 64% to 74 %. Also, there is considerably high broken grain percentage (9.3 %). The reason for less milling outcome is due to the fact that the mills available in the country do not match well for milling of long grains. Therefore, the quality of rice produced by the millers is lower and ultimate farmer's outcome will be lesser. The accession Bg16-1923 is the only accession having short round grain shape and the rest belong to long slender and long medium grain shapes. Bg16-2560 and Bg16-686 are red pericarped grains and others are white in color. Results of descriptive statistics of cooking and eating qualities are depicted in Table 1. All the accessions are having intermediate chalkiness and translucency. The time required for cooking is determined by the gelatinization temperature and it is ranged as high, intermediate and low. Amylose content is mainly correlated with hardy texture and stickiness of rice after cooking. Sticky rice accessions consist of low amylose content after cooking while hard accessions contain high amylose content are after cooking. Tastes of tested accessions vary from slight weak (Bg16-686) to very strong taste (Bg16-1980) and 5 accessions (Bg16-1980, Bg16-2044, Bg16-2062, Bg16-2070 and Bg16-598) are moderately strong aromatic lines. Tendency of the cooked rice to harden upon cooling depend on gel consistency of the variety. All tested lines are slight to moderately tender. Cohesiveness of the lines is slight spread to moderately sticky. The most important sensory evaluation parameter with aspect of export potential is grain elongation and grain elongation ratio. Average raw rice length is 6 mm (except Bg16-1923) and elongates to 8 -11 mm, after cooking.

Table 1. Descriptive statistics of cooking and eating qualities of tested accessions

Accession	WB/ WC	Chalkn- ess	Trans- luce ncy	Moisture %	GT	Amylose content	Taste	Aro- ma	Cohe- sive- ness	Ten- der- ness	Ap- pear- ance	Grain elong. after cook mm	Grain elong. ratio
Bg 15TC16	1	1	1	10.9	2	3	5	4	4	5	6	9	1.5
Bg16-1923	1	1	1	12	2	1	4	2	4	4	4	9	2.3
Bg16-1980	1	1	1	10.5	1	3	6	5	3	5	6	10	1.5
Bg16-2022	1	1	1	11.7	3	3	4	4	4	4	5	10	1.5
Bg16-2044	1	1	1	11	2	3	5	5	3	4	5	9	1.5
Bg16-2050	1	1	1	11.7	2	3	4	4	3	4	4	9	1.5
Bg16-2062	1	1	1	10.9	3	1	5	5	4	5	5	11	1.5
Bg16-2070	2	1	1	11.6	1	1	5	5	3	4	6	9	1.3
Bg16-2560	1	1	1	11.1	2	1	4	4	3	4	6	9	1.3
Bg16-598	1	1	1	10.2	2	1	5	5	5	5	4	9	1.3
Bg16_686	3	1	1	11	1	3	3	4	4	4	5	11.9	1.6
Bg16-755	2	1	1	11.9	2	1	4	4	3	4	5	9	1.5
IR7947867332	1	1	1	12.6	2	3	4	5	4	4	5	12	1.8
IRO10A107	1	1	1	13.1	2	1	4	3	4	4	5	9	1.4
IRO4A395	1	1	1	13.5	2	1	4	4	4	4	5	10	1.5
IRO9A104	1	1	1	11.4	2	1	4	3	4	4	5	9	1.3
IRRI156	1	1	1	9.3	2	3	4	4	4	5	5	11	1.6
WAS169BB424	1	1	1	11.3	1	3	4	4	3	4	5	8	1.2
Bg 94-1	2	1	1	11.9	3	3	4	4	3	4	5	9	1.5

WB/WC-White bellies(2) -1, White bellies(2- 3) -2, White Centers-3, GT-Low-1, Intermediate-2, High-3, Chalkiness – Intermediate-1, Translucency -Intermediate - 1, Amylose Content – Low - 1, Intermediate - 2, High -3, Taste - 1-Very weak, 2-Moderatly weak, 3- Slight weak, 4-Slight strong, 5-Moderately strong, 6-Very strong, Aroma - 1-Very weak, 2-Moderatly weak, 3- Slight weak, 4-Slight strong, 5 -Moderately strong, 6 -Very strong, Cohesiveness - 1- Well spread, 2-Moderatly spread, 3- Slight spread, 4-Slight sticky, 5 - Moderately sticky, 6-Very sticky, Tenderness - 1- Very tough, 2-Moderatly tough, 3- Slight tough, 4-Slight tender, 5-Moderately tender, 6-Very tender, Appearance 1-Very weak, 2-Moderatly weak, 3- Slight weak, 4-Slight good, 5 –Moderately good, 6- Very good

The highest grain elongation ratio is recorded in Bg16-1923 (2.3), but it is a short round grain which does not match well with export potential criteria. The acceptable level is over 1.5 of grain elongation. The accession IR7947867332 elongates to 1.8 after cooking while the accession WAS169BB424 recorded the lowest value of 1.2.

Cluster analysis

Tested 19 promising lines are categorized into main two clusters at the similarity level of 50.64.

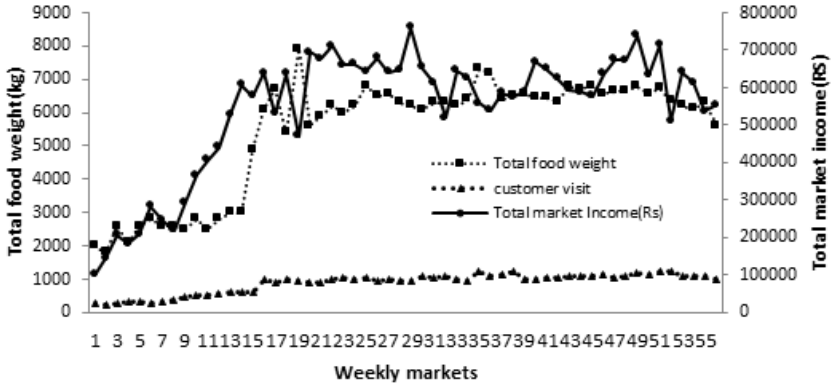

Figure 1. Dendrogram developed according to the similarities of Ward linkage and Euclidean distance method based on physical, chemical, eating & cooking of qualities of rice lines

The first cluster consists of single promising line (IR7947867332). It is a scented, white, long slender grain. Milling outcome is 77.1%. It has high AC, intermediate GT and 1.8 of grain elongation ratio. Accession Bg16-1923 clusters separately. It is a white, short round grain and total milling outcome is over 70%. Three accessions, IRRI156, Bg16-686 and IRO10A107 clustered together in sub cluster III. They are slightly strong aromatic lines and grain elongation ratio is 1.5. Brown rice percentage is over 78% and TMR is 74%.

CONCLUSION

Based on the results of physical, milling, chemical, eating and cooking quality evaluation, IR7947867332, Bg16-1923, IRRI156, Bg16-686 and IRO10A107 were identified as promising quality rice lines having a better export potential.

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