EUROPEAN ACADEMIC RESEARCH
Vol. IV, Issue 11/ February 2017

Impact Factor: 3.4546 (UIF)
DRJI Value: 5.9 (B+)

ISSN 2286-4822
www.euacademic.org

Grain Quality Evaluation of Traditional Aromatic rice varieties of Nepal

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Abstract:

Rice grain quality characteristics such as physical(hulling percentage, kernel length and breadth) along with chemical characteristics(Amylose content, Alkali spreading and clearing value, Gelatinization temperature) and Aroma of ten traditionally grown aromatic rice were studied. The higher hulling percentage was found on Jhinuwa while the ratio of L/B of the varieties ranged from 1.60-3.4. Similarly among the aromatic varieties AC was found ranging from where as Kernel elongation ratio was observed from 1.15-1.40. Among all the varieties studied it was found that Jorayal basmati has the longest grain size of 6.87. Among the varieties it was observed that Indrabeli and Jhinuwa Masino has strong emission of aroma then other. On the basis of all parameters it was found that these varieties could be used for commercial production.

Key words: Aromatic rice, Quality, Aroma, Amylose content, L/B

INTRODUCTION

Nepal is one the key places for the origin of aromatic rice varieties but very few farmers were growing such varieties although they have higher demand in the market. Nepal is endowed with a great diversity of rice germplasm in its vast agro-climatic territories with a variety of short, slender

aromatic rice varieties which are popular among the farmers of traditional rice growing areas. Aromatic rice consist a special group of rice accessions which are known for their specific aroma and fine grain quality which arises in its cooked condition (Ahuja et al., 1995; Khush and Dela Cruz, 1998). Aroma in rice grain is due to presence of more than 100 bio-chemical compounds (Petrov et al., 1996) out of which the most important chemical determining the aroma in rice is 2-Acetyl-1-Pyrroline (Buttery et al., 1983). Aromatic varieties are most appreciated by consumers and fetch higher market price then non aromatic rice varieties in world rice market (Singh et al., 2000). Quality Characters of rice grains reveled to complex physio-chemical properties. Excellent kernel shape along with length and breadth ratio of kernel plays an important feature of quality rice (Patil et al, 2003). Grain size and shape are the most desirable characters for determining the quality of rice and development of its varieties. Amylose content in rice is considered as main parameter determining the cooking and eating quality of rice (Juliano, 1972) which is specified by a single major locus with modification of some minor genes (Bollich and Webb, 1973). AC determines the hardiness and stickiness of cooked rice.

2. MATERIALS AND METHODS

2.1 The research site

The field experiment was conducted in the research farm of the Agriculture Botany department (NARC), Khumaltar, Lalitpur. Research was done from June 2013 to February 2014 in warm temperate region

2.1.1 Plant material

Out of the total 63 varieties 10 varieties were taken for further study in order to analyze Physical and chemical traits at lab of Department of Food Technology in NARC, Khumaltar.

2.2 Hulling percentage

125 gram of rice seeds from each sample genotype were de-hulled by using Standard Otake De-husker and the whole grain yield were calculated by using formula.

Hulling (%) = Amount of brown rice ÷ Amount of rough rice (sample rice) ×100

2.2.1 Milled rice recovery

Amount of rice after removing the barn is calculated and is termed as milled rice recovery.

2.3 Grain classification

Length and breadth of ten de-husked entire brown rice was measured by using dial micrometer and then classified into four distinct groups on the basis of their L/B ratios and kernel length

2.3.1 Shape

Shape	Slender	Medium	Round	Bold
L/B ratio	> 3.0	2.1-3.0	1.1-2.0	<1.1

(Standard Evaluation System for Rice, IRRI, 2002)

2.3.2 Size

Size	Extra Long	Long	Medium	Short
Length of Kernel(mm)	>7.5	6.6-7.5	5.51-6.6	<5.5

(Standard Evaluation System for Rice, IRRI, 2002)

2.3.3 Kernel elongation ratio

10 grains of each sample was taken and length was measured with the help of graph. Then the sample was placed in a test tube containing 15 ml tap water and left for 20 minutes. Then the test tubes containing samples were placed in water bath containing hot water and left for 20 minutes maintaining 80 º C temperatures. Then the test tubes were taken out from water bath and allowed to cool and the grains were transferred to filter paper and left for some time then elongation is measured by using micrometer.

2.4 Chemical traits

2.4.1 Alkali spreading value and clearing test

Six de-husked brown rice from each sample was taken in a Petri-dish to check alkali spreading value and clearing test. 10 ml of 1.7% KOH solution is placed in Petri-dish where the sample of rice was placed with plenty of space and then covered by the lid and placed in a cardboard box maintaining 30°C temperature and left for 23 hours

2.4.2 Amylose content

100 mg of rice flour sample from each variety was taken and 1 ml of 95 % ethanol along with 9 ml of 1.0 N NaOH was added in the solution. The mixture was allowed to heat by keeping in heated water-bath for 10 minutes. The samples were then allowed to cool and then diluted to 100 ml by adding distilled water in it. From the suspension thus prepared 5 ml of sample solution was taken where 1 ml acetic solution was added to acidify the solution and later on 1.5 ml Iodine solution containing 0.2 % iodine and 2% potassium iodide was added and volume made to 100 ml with addition of distilled water. Samples were then kept at room temperature for 20 minutes. The reading of absorbance was taken with the help of spectrometer at 620 nm. NaOH solution was used as the control. AC of rice sampled varieties was calculated by comparing with standard graph (Perez and Juliano, 1978).

2.4.3 Gelatinization temperature

It was determined by using the relationship with alkali spreading value. The value rated for alkali spreading value based on the response shown by six rice kernels on 1.7% KOH kept at room temperature of 30°C for 23 hours. Alkali digestion value was used to find out the GT value.

2.5 Aroma test

2.5.1 Leaf aroma test

0.2 gm sample from each rice variety was weighed and cut down into small pieces which were placed in cleaned Petri-plates. 1.7% KOH solution was added and covered for 1 hour at room temperature.

2.5.2 Grain aroma test

40 grains from each variety was selected and put in Petri--dish in order to know the aroma of grains.1.7% KOH solution was added and covered for 1 hour at room temperature.

They are scored from 1-3 according to their aroma emission as 1 no aroma, 2 slight aroma and 3 high aroma (Standard Evaluation System for Rice, IRRI, 2002).

3. RESULT AND DISCUSSIONS

3.1 Physical parameters

Among the varieties taken into study it was found that the hulling percentage for the aromatic varieties ranged from 75-83 (Table 1). The highest hulling (83.24%) was found in Jhinuwa whereas lowest was observed in Indrabeli (75.03%). Higher hulling percentage is considered as well as it gives good head recovery. Rita and Sarawgi (2008) reported that the hulling percentage of 80 and more is preferred as with the increase in hulling percentage recovery of head rice recovery also increases. Among the varieties studied it was found the L/B ratio ranged from 1.6-3.8(Table 1). Of the all the highest L/B ratio was obtained in Jorayal Basmati whereas lowest was found in Gudgudo. Based on the L/B ratio the varieties were classified in three categories as Bold, Medium and Slender. Jhoryal Basmati was classified and Slender while Aanga, Chiniya puri, Indrabeli, Jhinuwa, Jhinuwa ghaiya and Jhinuwa Masino were

of medium type and Anjana, Gudgudo and Gudura were found to be of bold type (Table 2).

3.2 Chemical parameters

The alkali spreading (SV) and clearing value (CV) along with gelatinization temperature (GT) were calculated for all the varieties which were taken into consideration. Based on GT varieties were classified into high (75-79°C), intermediate (70-75°C) GT and low (55-69°C).Among the varieties it was found that Jhinuwa Ghaiya, Gudgudo and Gudura has intermediate GT whereas remaining has low GT (Table 3).

All rice varieties were examined for the amylose content (AC), among the varieties AC was ranged from 24.02%-27.78% (Table 3). Highest amount of AC was recorded in Aanga variety (27.78%) while lowest was observed in Indrabeli (24.02%). AC determines the hardiness and stickiness of cooked rice. AC higher than 25 % gives non sticky soft or hard cooked rice. Rice having AC 20-25 % gives soft and relatively sticky cooked rice (Anonymous, 2004). Although Shahidullah et al; 2009 reported most of the varieties have AC between 20.7-21.4% but Sarawgi et al., 2008 reported that AC could be17.67 %-27.89 % which is further supported by findings 18.6-28.0 % AC and 20-27.7 % (Aslam et al 1988).

3.3 Aroma

Aroma is one of the important trait in rice grain and has high demand in the national as well as international market. Among the ten varieties that were taken into consideration it was found that two varieties didn't emitted aroma in three tests while two varieties Indrabeli and Jhiniwa Masino emitted strong aroma whereas the remaining seven varieties were found to be mild aroma emitters (Table 4).

CONCLUSIONS

The paper has done research on physical and chemical characteristics of ten local aromatic rice of Nepal. From where it has found that Jhinuwa has the highest hulling percentage of 83.24% while two varieties Indrabeli and Jhinuwa Masino are has strong aroma emission capacity. Furthermore it was found that Jorayal Basmati has the longest grain size of 6.87 which would have good market demand. The present study on the local aromatic rice of Nepal shows that these varieties have potential to reach consumers preferences and also could be used for breeding activities to develop new varieties and in many other research programs in the days to come for the improvement of various grain quality traits.

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Table 1 the hulling percentage, Milled rice recovery along with grain quality parameters

Genotypes	H%	MRR	KL	KB	KER	L/B
Aanga	79.92^{abc}	72.2^{ab}	5.831^{abcde}	2.547^{a}	1.303^{a}	2.251^{ab}
Anjana	80.49^{ab}	74.26^{ab}	5.599^{bcde}	2.622^{a}	1.349^{a}	2.09^{ab}
Chiniya Puri	79.24^{abc}	70.57^{abc}	5.437^{bcde}	2.484^{a}	1.35^{a}	2.237^{ab}
Gudgudo	80.27^{ab}	69.12^{abc}	3.944^{e}	2.37^{a}	1.407^{a}	1.609^{b}
Gudura	77.63^{abc}	73.53^{ab}	4.792^{bcde}	2.57^{a}	1.154^{a}	1.886^{b}
Indrabeli	75.03^{bcd}	67.87^{abc}	5.31^{bcde}	2.027^{a}	1.236^{a}	2.647^{ab}
Jhinuwa	83.24^{a}	67.75^{abc}	5.487^{bcde}	2.202^{a}	1.311^{a}	2.474^{ab}
Jhinuwa Ghaiya	75.61^{bcd}	71.26^{ab}	5.418^{bcde}	2.369^{a}	1.24^{a}	2.311^{ab}
Jhinuwa Masino	81.35^{a}	72.58^{ab}	5.857^{abcde}	2.058^{a}	1.292^{a}	2.771^{ab}
Jorayal Basmati	76.12^{abc}	67.01^{abc}	6.873^{abcd}	1.936^{ab}	1.402^{a}	3.415^{ab}

Superscript letters (a-e) indicate significant differences ($p<0.5$) among varieties whereas mean with same letter with the column varieties are not significantly different ($p<0.5$).

Table 2 The grain size and shape based on kernel length and breadth

Genotype	L/B	Grain Shape	K.L.	Grain Size
Aanga	2.251	Medium	5.831	Medium
Anjana	2.09	Bold	5.599	Medium
Chiniya Puri	2.237	Medium	5.437	Short
Gudgudo	1.609	Bold	3.944	Short
Gudura	1.886	Bold	4.792	Short
Indrabeli	2.647	Medium	5.31	Short

Jhinuwa	2.474	Medium	5.487	Short
Jhinuwa Ghaiya	2.311	Medium	5.418	Short
Jhinuwa Masino	2.771	Medium	5.857	Medium
Jorayal Basmati	3.415	Slender	6.873	Long

Table 3. The alkali spreading and clearing value, Gelatinization temperature and amylose content in aromatic rice

Name of Genotypes	C. V	S.V	GT	AC
Aanga	4,5	6	Low	27.78^{ab}
Anjana	5,6	7	Low	26.85^{ab}
Chiniya Puri	4,5	6	Low	26.62^{ab}
Gudgudo	5,6	7	Intermediate	25.87^{ab}
Gudura	2,3	4	Intermediate	24.09^{ab}
Indrabeli	5,6	7	Low	24.02^{ab}
Jhinuwa	5,6	6	Low	26.62^{ab}
Jhinuwa Ghaiya	2,3	4	Intermediate	23.83^{ab}
Jhinuwa Masino	5,6	7	Low	24.32^{ab}
Jorayal Basmati	5,6	7	Low	26.14^{ab}

Superscript letters (a-b) indicate significant differences ($p<0.5$) among varieties whereas mean with same letter with the column varieties are not significantly different ($p<0.5$).

Table 4. The aroma emissions on various conditions

Name of Genotype	Grain Aroma	Leaf Aroma	Cooking Aroma
Aanga	Mild	Mild	Mild
Anjana	Mild	Mild	Mild
Chiniya Puri	Mild	Mild	Mild
Gudgudo	Mild	Mild	Mild
Gudura	Mild	Mild	Mild
Indrabeli	Mild	High	High
Jhinuwa	Absence	Absence	Absence
Jhinuwa Ghaiya	Mild	Mild	Mild
Jhinuwa Masino	High	Mild	High
Jorayal Basmati	Absence	Absence	Absence