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GRAIN AND SEED QUALITY EVALUATION OF RAINFEDLOWLAND NSIC RC RICE VARIETIES IN WESTERN PANGASINAN, PHILIPPINES

Jordan E. Mirador[1], Angelo V. Milaño[1], Randolf M. Mayo[1], Larry A. Santos[1,2], James Paul R. Labindao[1]

[1]Pangasinan State University
[2]lsantos@psu.edu.ph

Abstract – This study aims to evaluate the five rainfed lowland rice varieties in terms of paddy grain, seed and sensory qualities. The rice varieties were evaluated for paddy grain weight, milled rice and eating qualities. Data gathered were analyzed using analysis of variance for paddy grain and milled rice qualities while descriptive analysis was used for sensory and eating quality evaluation.

Weight of 1,000 paddy grains of the five varieties tested differed significantly. NSIC Rc 160 (25.61g) and NSIC Rc 302 (25.19g) are comparable but significantly different from the other varieties tested. Milled rice qualities did not differ significantly.

Among the sensory attributes evaluated for cooked rice, NSIC Rc 280 and NSIC Rc 400 were rated their color as like very much with mean scores of 4.25 and 4.29, respectively and all other sensory attributes rated as like slightly. All the five varieties evaluated, only NSIC Rc 280 preferred in the Western Pangasinan with overall acceptability mean score of 4.23.

Keywords – *Eating quality, full milled rice, Milling recovery, Paddy grain quality, Seed quality*

INTRODUCTION

Rice (*Oryza sativa L.*) is one of the major commodities in Philippine agriculture. It is the staple food of the Filipinos and a major source of livelihood consumed by over half of the world population[1], [2]. Ninety percent of the total producing rice is grown in developing countries mostly in Asia [3]. It provides 35%–60% of the dietary calories consumed by billions of people, making it inarguably the most important crop worldwide [4]. The demand for increasing rice production is particularly urgent, because the population of traditional rice-producing countries will require 160 M t per year by 2020 due to population growth [5] and 70% more rice or more than 5 billion of the world's anticipated 10 billion people will depend on rice as their principal food by 2025[4],[6].

Rice is a primary source of income and employment for more than 100 million households in Asia and other agricultural countries and is cultivated in at least 114, mostly developing countries in the world [7]. Quality is one of the key selection criteria highly prioritized by farmers and consumers of rice and therefore farmer select rice with traits that are desirable for consumption as well as for production and sale [8].

Moreover, grain quality is not just dependent on the variety of rice, but it also depends on the crop production environment, harvesting, processing and milling system [9]. The most suitable solution in increasing rice production is to improve the seed quality produce using proper timing method of harvesting, threshing, drying, rice milling and good facilities for storage to meet high-quality seeds and to give the best yield to rice farmers [10].

On the other hand, poor seed quality leads to low vigor and poor growth. They are also prone to weeds, insects, and diseases. The problem arises as most farmers in Asia keep their own seed and do not tend to do any seed processing to ensure varietal purity or seed quality [11].

The simple solution in increasing or improving rice production is to maintain the seed quality that they had produced from their farms hence give them the best yield for their next planting

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season. High-quality seeds come from proper maintenance of genetic purity and good growing conditions. Appropriate timing and method of harvesting and proper processing during threshing, cleaning, drying and storage would ensure sustainable and continuous cropping successes [12].

Maintaining rice grain and seed quality to meet the diverse interest groups in the rice sub-sector currently represents major challenges of rice development in many rice-producing areas of the world like the Philippines. There is limited or no information is available on the grain and seed quality of the different new varieties cultivated in rice-producing areas of Western Pangasinan. Thus, this research was undertaken to evaluate paddy grain, milled rice and eating qualities of selected new rice varieties in Western Pangasinan, Philippines.

MATERIALS AND METHODS

Five (5) varieties of paddy rice grain harvested in April 2017 from the farm located at Bamban, Infanta, Pangasinan were used in the study. The varieties evaluated were the following:1. NSIC Rc 18 (Check variety 1), 2. NSIC Rc 160 (Check variety 2), 3. NSIC Rc 280, 4. NSIC Rc 302, and 5. NSIC Rc 400. Three-kilogram of grain samples each of the variety with moisture content of 13-14% were collected for evaluation of grain and seed qualities.

Data Gathered

Paddy grain quality

Weight of 1,000 paddy grains. This was obtained by selecting and counting 1,000 paddy grains randomly from the samples and replicated three (3) times each variety[9], weighed and recorded separately. Samples were weighed using digital beam balance.

Milled Rice Quality

Weighed of 1,000 full milled rice. This was obtained by counting and selecting 1,000 full milled rice randomly, replicated 3 times each variety[2], weighed and recorded separately. Samples were weighed using digital beam balance.

Milling recovery percentage. This was determined after milling 4 kilogram-grains at 13-14 % moisture content using electric micro miller. Milling recovery was calculated using the formula[9]:

$$\text{Milling recovery (\%)} = \frac{\text{Weight of milled rice}}{\text{Total weight of grains}} \times 100$$

Eating quality

This was obtained by evaluating the cooked five (5) rice varieties. Each variety was cooked and weighed at 500g into 1-kg capacity electric rice cooker. The cooked rice was placed in disposable plates with different code names. There were thirty-six (36) respondents who participated; eighteen (18) university employees and eighteen (18) college students that answered seven (7) sensory attributes using the evaluation form, such as color, taste, aroma, mouth feel, consistency, texture and overall acceptability. They were measured using the following hedonic scales[13]:

5 - Like very much
4 - Like slightly
3 - Neither like nor dislike
2 - Dislike slightly
1 - Dislike very much

Statistical Data Analysis

Data collected for paddy grain and milled rice qualities were analyzed by analysis of variance using IRRI STAR version 2.0.1 at 0.05 level of significance in Completely Randomized Design. Pairwise mean comparison of treatments was done to compare the significant differences among the treatment means.

For eating quality, descriptive analysis was used for sensory evaluation of cooked rice using 5 point scale (5 - like very much; 4 - like slightly; 3 - neither like nor dislike; 2 - dislike slightly, 1 - dislike very much) [14].

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RESULTS AND DISCUSSION

Paddy Grain Quality

Weight (g) of 1,000 paddy grains. The test of 1000 grains weight is useful for comparative indication of coarseness of the grains and the total rice yield performance for farmers at market levels for measuring rice yield, hence, the heavier the grain weight indicates higher yield [15].

Analysis of variance shows a significant difference on weight of 1,000 paddy grains since the obtained p-value of 0.003 is less than 0.05 alpha level (Table 1). NSIC Rc 160 had the heaviest weight (25.61 g). However, it is significantly the same with NSIC Rc 302 and NSIC Rc 18 with values 25.19 g and 24.62 g, respectively. The differences in grain weight were probably caused by inherent variability in maturity, genetic makeup and grain size[15].

Table 1. Mean in weight of 1,000 paddy grain

Variety	Weight (g)of 1,000 paddy grain
NSIC Rc 18	24.62^{ab}
NSIC Rc 160	25.61^{a}
NSIC Rc 280	22.76^{c}
NSIC Rc 302	25.19^{a}
NSIC Rc 400	23.55^{bc}
cv (%)	2.91
p-value	0.003^{*}

**Significant at p-value < 0.05*

Means not sharing the same superscript letter in a column are significantly different at (P< 0.05) pairwise mean comparison test.

Milled Rice Quality

One of the most important aspects of rice grain quality is its milling yield. Weight of 1,000 full milled rice and milling recovery is presented in Table 2.

Weight of 1,000 full milled rice. The test of 1000 grains milled rice is used for comparative indication of milling yield performance for farmers at market levels[16].Weight of 1,000 full milled rice of five varieties evaluated were 17.73 g (NSIC Rc 18), 17.75 g (NSIC Rc 160), 16.50 g (NSIC Rc 280), 16.48 g (NSIC Rc 302), and 17.07 g (NSIC Rc 400) (Table 2). There is no significant differences (P>0.05) was observed within the check varieties and all the varieties tested in Western Pangasinan condition. The results of the evaluation conform within the range of 16-18 g conducted by [17] and [2]. The results of the study indicate that the five varieties evaluated performed similarly in the condition of Western Pangasinan, Philippines.

Milling recovery

In the post-production, rice milling activity is a crucial step. Its objective is to remove the husk and the bran layers, and produce an edible, rice kernel that is sufficiently milled and free of impurities [18] and [19]. The milling recovery of the five varieties evaluated exhibited a non-significant difference (P>0.05), it ranges from 55.00% (NSIC Rc 400) to 60.58% (NSIC Rc 160). The rates of milling recovery of the varieties evaluated are slightly lower than the ideal 65-70% as reported by [19], [6] and[20] may be due to grain imperfections and the presence of unfilled grains.

Eating Quality

The mean scores results for the eating quality using the different attributes for sensory evaluation of the five cooked rice varieties is shown in Table 2.

Colour. Colour in rice has a higher influence on consumer preferences, some like white colour and some yellowish colour in believe that it could contain more nutrients than white colour[16]. The means scores results for the five varieties evaluated ranged from 3.61 to 4.29 corresponding to like slightly to like very much, respectively. All the five varieties evaluated were rated as like slightly to like very much, meaning this sensory attribute is not a problem for the consumers.

Taste. The sensory evaluation for taste rated as like slightly in all the five varieties with mean scores ranged from 3.73 to 4.13. The similarities in taste mean scores were possibly of the same in protein and amylose contents.

Aroma. One of the most important rice quality as preference of the consumers is aroma. Fragrant or scented rice that obtains a premium price

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in international markets is characterized by its natural fragrance or pleasant aroma and good taste quality [21]. The different five varieties evaluated were classified as like slightly with mean scores ranging from 3.68 to 4.06.

Mouth feel of cooked rice. The mean scores of mouth feel for cooked rice of the five different varieties ranged from 3.59 to 4.13, described as like slightly. The five varieties may have similarities in terms of physicochemical properties and genetic make-up that conforms to evaluation of the panelists.

Consistency. Consistency is an important trait to consumers in different countries because most rice is preferred and consumed in a whole grain form[16]. The five varieties evaluated have mean scores ranged from 3.56 to 4.07 with a description of like slightly.

Texture. The texture of cooked rice mean scores of the different five varieties tested ranged from 3.56 to 4.19, that described as like slightly by the panelists. This could be attributed to the same physicochemical properties and genetic make-up that conforms to the evaluation of the panelists.

Overall acceptability. The weighted mean scores in the overall acceptability for the five rice varieties tested ranged from 3.59 to 4.23 corresponding to NSIC Rc 302 and NSIC Rc 280, respectively. The two check varieties tested, NSIC Rc 18 and NSIC Rc 18were described as like slightly with weighted mean scores of 3.75 and 4.02, respectively. Among the new lowland varieties tested in the locality, NSIC Rc 160 was described as like very much by the panelists with mean score of 4.23. This may be attributed to a physical characteristic like color which might probably one of the most important preferences by the panelists.

Table 2. Milled rice quality data on means in weight for 1,000 full milled rice and milling recovery

Variety	Weight (g) of 1,000 full milled rice	Milling recovery (%)
NSIC Rc 18	17.73	57.92
NSIC Rc 160	17.75	60.58
NSIC Rc 280	16.50	56.33
NSIC Rc 302	16.48	55.42
NSIC Rc 400	17.07	55.00
cv (%)	3.42	5.26
p-value	0.052^{ns}	0.222^{ns}

^{n}ot significant at p-value <0.05

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Table 2. Sensory evaluation of different cooked milled rice

Sensory Attribute	Variety				
	NSIC Rc 18	NSIC Rc 160	NSIC Rc 280	NSIC Rc 302	NSIC Rc 400
Colour	3.71	3.98	4.25	3.61	4.29
Taste	3.88	3.91	4.01	3.73	4.13
Aroma	3.68	3.88	4.02	3.72	4.06
Mouth feel	3.84	3.83	4.07	3.59	4.13
Consistency	3.66	3.85	4.02	3.56	4.07
Texture	3.70	3.88	4.16	3.56	4.19
Overall acceptability	**3.75**	**4.02**	**4.23**	**3.59**	**4.18**

Legend:

Rating scale	Description
4.21 - 5.00	- Like very much
3.41 - 4.20	- Like slightly
2.61 - 3.40	- Neither like nor dislike
1.81 - 2.60	- Dislike slightly
1.00 - 1.80	- Dislike very much

CONCLUSION AND RECOMMENDATION

The five varieties showed variability in weight of 1,000 paddy grains no significant differences of the five varieties in terms for weight of 1,000 full milled rice and milling recovery. Paddy grain qualities have been found similar performances of the five varieties evaluated in Western Pangasinan. The rates of milling recovery of the varieties evaluated are slightly lower than the ideal 65-70% may be due to grain imperfections and the presence of unfilled grains.

Among the sensory attributes for the five varieties evaluated, NSIC Rc 280 and NSIC Rc 400 rated by panelists as like very much for colour. All other sensory attributes were rated as like slightly. In terms of overall acceptability, only NSIC Rc 280 was acceptable and may be attributed to physical characteristic like color which might probably one of the most important preferences by the panelists.

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