ADAPTABILITY, MILLING RECOVERY AND EATING QUALITY OF FORTY MASIPAG RICE CULTIVARS GROWN UNDER CPU EXPERIMENTAL FARM CONDITIONS DURING WET SEASON PLANTING

Erlinda B. Famoso

ABSTRACT

The study was conducted from October 23, 2006 to January 15, 2007 at the CPU farm in Tuburan Sulbod, Zarraga, Iloilo to evaluate the 40 MASIPAG rice cultivars as to their adaptability, milling recovery and eating quality. The treatments consisted of forty MASIPAG rice selections and were laid out in randomized complete block design replicated three times. Results of the study revealed that cultivars M1111 and M7821 had the earliest maturity at 113 DAE while M1194 was the latest (134 DAE) to mature. M1222 was the tallest at 151 cm, while, SW01VR, M11111 and M2272 were the shortest. 10 AG and Prakmalis produced the most number of productive tillers (19), whereas, 5AG had the least (4). The least non-productive tillers (3) were obtained from M2782, M1201, M2112, M2413, Sampaguita, M1924, M2193 while M1152 R produced the most (10). Red Borong gave the highest plot yield of 1032 g/1m2 which is equivalent to 10910 kg/ha. This is 8954 to 9295 kg/ha higher than the yields of M5BD1, 5 AG, M1222, which were the lowest yielders. Simpocot and M1372 had the highest milling recovery, whereas, M130, M2084 and Elon Elon Red had the lowest. Most of the cultivars were classified as Grade 1 in terms of their chalky grains and only M2413 (with 10.2 % chalky grains) was classified as Grade 3. M11111 had the most immature grains (13.7%) and Prakmalis produced the longest grains. The majority of the cultivars produced short grains (5.2 to 6.8 mm) and grains with intermediate width. Among the 40 cultivars, only BR210, 10AG, Sampaguita and M130 retained their aroma after cooking. M37W, M2782, and M130 were tender when cooked and Elon Elon Red, M2193, and M2782 were rated as tasty.

INTRODUCTION

In the 1970 and 1980, enormous investments were made in fertilizer and pesticide intensive "green revolution" agriculture development approach. Starting in the 90's, the focus shifted to investment in biotechnology and genetic engineering.

Organic agriculture got less attention in the mainstream strategy in agriculture. Oftentimes, it was out-dismissed in the mainstream policy debate.

In the Philippines, the advocacy for sustainable agriculture was mainly espoused by development Non-Government Organizations (NGOs) and Private Organizations (POs) as an off-shoot of the farmers' experiences in the "green revolution era". In the mids 80s one of the most innovative works on rice farming was initiated by MASIPAG (Magsasaka at Seyentipiko Para sa Ikauunlad ng Agham Pang-agrikultura) group of development oriented scientist and workers together with farmer groups (from http://www.organicriceorg/orgrice industry.html).

The MASIPAG was first implemented as a program by a group called Multi-Sectoral Forum (MSF), a discussion group of national scientists from the University of the Philippines at Los Baños (UPLB) who opposed the wrong directions of the government under the late strongman, former President Ferdinand E. Marcos. Its advocates and practitioners had proliferated in most of Luzon's provinces and in the Visayas and Mindanao regions even as they confronted head-on the massive effort to embrace further the of HYV for commercial and mass production of rice.

The MASIPAG, now a nationwide coordinative body and network of scientists' and farmers' groups and non-government organizations, blamed the Green Revolution Program of Marcos for the disappearance of some 4,000 varieties of traditional rice all over the country. It further noted that the traditional practices that went with the propagation of traditional rice varieties also disappeared.

Now, after 20 years, the MASIPAG network have already retrieved some 600 varieties of lost traditional rice that are now circulated, shared and propagated nationwide totally without chemical or synthetic inputs. The traditional rice varieties that vary from black to light yellow to golden to bright brown, and from aromatic to sticky, are put into trial propagation that requires assistance and cooperation from the other traditional rice variety advocates (from http://www.sunstar.com.ph/static/ilo/2005/12/05/bus/farmers.benefit.from.training.on.organic.rice.farming.technology.html). In a study conducted by Dusaran and Pabulayan (2002), most of the respondents fond the MASIPAG rice production technology as less expensive. The study further revealed that the most common MASIPAG rice selections the respondents preferred are Red Bolong and 5AG because of their high yield and good eating quality.

Organic rice is currently more expensive than conventional rice. As demand for organic rice increases, the cost of production should go down and there will be less need for marketing. Consumers who lead the way and patronize organic rice will reap the benefits from healthier and tastier meals right away (from http://www.organicriceorg/orgriceindustry.htm).

The study conducted by Famoso (2005) during wet season planting showed that among the 40 MASIPAG rice selections tested, M37 W gave significantly ($P<0.01$) higher yield of 5345 kg/ha. This was followed by M137 2 1 with 5237 kg/ha. The yields of these two selections were 15.9 to 33.5 % greater than the yields of other selections. Moreover, only these two selections exceeded the 5 t/ha national average yield of rice under Philippine conditions.

Arancon (1996, in PhilDHRRA, 2004) reported that some MASIPAG lines outyielded the check rice variety, PSB Rc 4. The corrected plot yield of MASIPAG cultivars ranged from seven to nine tons/ha for a two year experiment.

Despite the lack of moisture when the plants were in their maximum tillering to hard dough stages during the dry season planting, the yields of M137 2 1 and M37 W were 13.5 to 18.1 % higher than the wet season yields. Rice selections M137 2- 1 and M37 W in Group III were the highest yielders at 6187 and 6068 kg/ha, respectively (Famoso, 2006).

Lack of sunlight early in the growth and development of the rice plant normally does not limit grain yield except under excessively cloudy and cool conditions. However, panicle differentiation begins at a 42-day critical sunlight-requiring period. Low yields do occur in years of low sunlight caused by cloudy conditions and rain (Duy, Hirano, Sagawa & Kuroda, 2004).

Rice is a hygroscopic material and will change in moisture content in relation to temperature and the relative humidity of the surrounding air.

The moisture content of rough rice must be below 14 % before it can be safety stored. Rice is normally harvested at a moisture content of 20 % or more during the wet season. If the moisture content is not reduced to below 14 % shortly after threshing, grain quality deteriorates because of microbial activities and insect damage (Peng & Hardy, 2001).

One of the priority qualities of consumers for rice is its eating quality. The scented rice variety like Sampaguita is one of the potentials. However, very few efforts have been made to upscale the production (including research) where cultivation seems to be confined to limited pockets where farmers grow them for self-consumption or for special occasion (from http://www.organicriceorg/orgriceindustry.htm).

Milling recovery is the total milled rice obtained out of paddy. The maximum milling recovery is 69 to 70% depending on rice variety, but because of grain imperfections and the presence of unfilled grains, commercial millers are happy when they achieve 65% milling recovery. Village type rice mills have 55% or lower milling recovery (from http://www/org/ppfm/riceQuality/webhelp/OLY07.html).

Head rice recovery is the weight percentage of head rice (excluding brokens) obtained from a sample of paddy. Under controlled conditions head rice recovery can be as high as 84% of the total milled rice or 58% of the paddy weight. Commercial rice mills turn out 55% head rice on average, whereas head rice recovery of village type rice mills is in the order of 30% (from http://www/org/ppfm/ricequality/webhelp/OLY07.htm).

Grain quality determines the market price of rice. Rice varieties with low grain quality are not well accepted by farmers and consumers. Clear, vitreous, translucent kernels are demanded by all segments of the rice industry.

The nutritional value depends on the total quantity and quality of protein. Rice is an important source of protein and supplies more than 50% of the total protein consumed. However, the protein content of milled rice is relatively low. The milled rice proteins consist of at least 80 % or more of glutalin, 10 % globulin, and 5 % prolamin (Bangwaek, Vergara & Robles, 1994).

The protein content tends to be low when high solar radiations occur during grain development, and it is generally low in the dry season than in the wet season. The temperature, management and cultural practices during grain ripening is also reported to affect the protein content, as well as growing of rice in the puddled and unpuddled soil, and the time of harvest and is generally low at early harvest as compared to late harvesting (Qiao-quan, Wang, Chen, Cai, Hong & Gu, 2000).

With different factors affecting the growth and eating quality of forty MASIPAG rice cultivars, this study was conducted.

Objectives of the Study

The general objective of the study was to evaluate the forty MASIPAG rice selections as to their adaptability, milling recovery and eating quality when grown under CPU experimental farm conditions during wet season planting. Specifically, the study aims to:

1. appraise the forty MASIPAG rice selections based on their agronomic characteristics and yield components,
2. evaluate the milling recovery and physical attributes of forty MASIPAG rice cultivars,
3. assess the sensory qualities of forty MASIPAG rice cultivars, and,
4. determine the various grain quality characteristics of the forty MASIPAG rice cultivars,

Time and Place of the Study

The study was conducted from October 23, 2006 to January 15, 2007 at CPU, Zarraga farm, at Tuburan Sulbod, Zarraga, Iloilo.

METHODOLOGY

Land Preparation and Layout

The total experimental area of 388.06 square meters was plowed twice using a spiral plow attached to the handtractor to thoroughly prepare the field. One week before transplanting, the field was plowed again and harrowed to level the field prior to transplanting. A day before transplanting, a carabao-drawn harrow was used to incorporate the two sacks of D and T compost (1.27 % N, 2.97 % P_2O_5, 0.83 % K_2O, 0.86 % Ca, 0.34 % Mg, 167.0 ppm Zn, 53.57 ppm Cu, 4.02 ppm Mn, 2.04 % Si and 24.38 % organic matter) as source of nutrients of seedlings. The total area was divided into three blocks. Each block measuring 7.25 x 17.75 meters represented a replication. There were 40 plots per block, each measuring 1.5 x 1.5 meters. With a distance of 25 cm x 25 cm between hills, there was a total of 64 hills per plot. A one meter distance between blocks and 0.25 meter between plots were provided.

Experimental Treatments and design

The experiment was laid out in a randomized complete block design replicated three times. The 40 MASIPAG cultivars used as treatments were as follows:

1. Simpocot
2. Elon Elon Red
3. Binolongan
4. Azucena
5. M122 2
6. M12 21 B4
7. M241 3
8. M211 3
9. M227 2
10. M211 2
11. M202 5
12. BR-210
13. M120 1
14. M219 3
15. M208 4
16. M43 4 1
17. M137 2
18. Red Borong
19. 5AG
20. M11 20 3
21. M37-W
22. M115 2R
23. M78 2 1
24. M92 2 1
25. 10AG
26. M97 1 2
27. M126 1
28. M160 1
29. M192 4
30. M11-11 1
31. M5BD-1
32. GL3 1
33. Sampaguita
34. M278
35. M11 10 4
36. M119 4
37. Prakmalis
38. Dinorado
39. M130
40. SW 01VR

Collection of Seeds and Sowing of Seedling

Of the 40 MASIPAG rice cultivars, sixteen were collected from different farmer-members by MASIPAG personnel and handed to CPUCA. Twenty four other cultivars were collected from the 2006 dry season planting at Zarraga farm, Tuburan Sulbod, Zarraga, Iloilo. The seeds were soaked in clean tap water for 48 hours and were incubated at room temperature for another 48 hours. Water was changed every six hours to avoid rotten odor during soaking. The pre-germinated seeds of each cultivar were sown in a prepared seedbed raised at 5 cm and measured 0.5 x 0.5 meter. Water was maintained at 2 cm depth for 18 days to facilitate pulling.

Pulling, Transplanting and Replanting

The 18 day-old seedlings were pulled and divided into three parts to ensure seedlings were distributed to each plot per replication. One seedling was planted per hill with a space of 25 x 25 cm between rows and between hills at a depth of 2 to 3 cm. Replanting was done one week after transplanting.

Irrigation

Three days after transplanting, irrigation water was admitted and maintained at the depth of 3 cm until the seedlings were well established. Water level was gradually increased to 5 cm depth during the late vegetative and reproductive stages. Two weeks before harvest, water was drained to hasten maturity of grains and also to facilitate harvesting.

Crop Protection

Leaf miners at seedling stage were controlled using madre de cacao leaves at the rate of 1.5 kg of chopped leaves per 3 liters of water. The chopped leaves were soaked overnight, strained, then the solution was sprayed late in the afternoon. Mollusks were hand picked from the experimental area to avoid losses of seedlings. Weeds were controlled by handweeding and one passing of rotary weeder.

Roguing

Removal of off-types or mixture of other cultivars was done from vegetative to maturity stages to see to it that all possible mixtures were removed before the crop was harvested. Off-types were cut close to the root system. Plants with different characteristics or exhibited any difference in agronomic characteristics than the majority of the plants in a plot were considered off-type.

Harvesting and Threshing

Harvesting was done when 80% of the total plants in the effective experimental area (1m x 1m) showed full maturity. Plants were considered mature when the leaves were yellowing and the panicles were drooping. Harvested panicles were placed in separate and properly labeled sacks and threshed immediately by foot trampling.

Drying

Threshed grains were sundried immediately on a sack spread on cemented ground for three to four times to less than 14% moisture since it was rainy season.

Seed Cleaning and Storage

Seeds were cleaned using a blower to remove light and diseased grains, plant parts and weed seeds. The seeds were placed in clean sacks properly labeled with its designated cultivar name and replication number and placed inside the storage room for sensory evaluation.

Milling of Rough rice

Seeds from the three replications with cultivar name were combined prior to milling. Traveling milling machine was tried at Jereos Street La Paz, Iloilo City. Only forty percent of the total rice seeds in each plastic bag was milled but not totally dehulled resulting in hard and non-sticky rice when cooked. The milled rice seeds in each plastic bag were winnowed and all the undehulled rice grains were collected and stored.

Data Collected

The following data were collected.

1. Days to maturity. Number of days to maturity was determined by counting the number of days from emergence up to the time when 80 % of the panicles were golden yellow.
2. Plant height. Ten sample plants randomly selected from each plot were measured from the ground level to the tip of the panicle using a

meter stick. Height was taken before harvest.

3. Number of productive and non-productive tillers. This was counted simultaneously with height measurement from ten randomly selected sample plants per plot. Tillers were considered productive when it developed at least 80 % filled grains while non-productive tillers were those that did not produce panicles.

4. Yield per plot. All plants from the five inner rows of each treatment were harvested for plot yield. After threshing, drying and cleaning, the grains from each plot were weighed using a Toledo platform balance keeping a separate data for each treatment. A digital moisture tester borrowed from Western Visayas Integrated and Agricultural Research Center (WESVIARC) was used for moisture content determination.

5. Corrected yield. Corrected yield in kilograms per hectare was computed using the formula:

$$\underset{(kg/ha)}{\text{Corrected yield}} = \frac{\text{yield/plot (g)}}{1{,}000\ \text{g/kg}} \times \frac{10{,}000\ \text{m}^2\text{/ha}}{\text{plot area (m}^2\text{)}} \times \frac{100\ \text{AMC}}{100\ \ 14}$$

6. Milling potential. Milling potential of rough rice is the estimate of the quantityof total milled rice consisting of head rice and broken grains that can be produced from a unit of rough rice. To determine the milling yield, total yield available within three replications were combined and brought to the miller for milling. Head rice is the milled rice with length greater or equal to three quarters of the average length of the whole kernel. It is often expressed on a % paddy or rough rice basis (on 14% Moisture content basis).

The various components such as total milled rice and head rice were weighed to determine the milling yield and head rice recovery. Three 50-gram samples of milled rice were randomly collected from a plastic bag using three plastic cups and were used in calculating % head rice. Percent total milled rice and percent head rice were computed using the following formula:

$$\%\ \text{Total Milled Rice} = \frac{\text{weight of total milled rice (g)}}{\text{weight of rough rice (g)}} \times 100$$

$$\%\ \text{Head Rice} = \frac{\text{weight of head rice (g)}}{50\ \text{g}} \times 100$$

The milling potential was classified based on the following categories:

Milling potentials	Classification	Recommended value
% Total Milled Rice	Premium (Pr)	70.1 % and above
	Grade 1 (G1)	65.1 % - 70.0 %
	Grade 2 (G2)	60.1 % - 65.0 %
	Grade 3 (G3)	55.1% - 60.0 %
% Head Rice	Premium (Pr)	57.0 % and above
	Grade 1 (G1)	48.0 % - 56.9 %
	Grade 2 (G2)	39.0 % - 47.9 %
	Grade 3 (G3)	30.0 % - 38.9 %

7. Physical attributes. The physical attributes consisted of four parameters namely: % chalky grains, % immature grains, grain length and grain width. Chalky grains are whole or broken grains, one half or more of which is white like the color of chalk and is brittle. Immature grains are light green and chalky with soft texture. Grain length and grain width, on the other hand, are the length and width (in mm) of the rice grain.

a. Grain length and width. Grain length and width were determined by measuring the length and width of ten (10) whole milled grains from each replicate using a vernier caliper. Based on the average length and width, the grains were classified into the following categories:

Grain length(mm)	Category	Grain Width(mm)	Category
7.5 and above	Extra long(EL)	more than 3.0	Slender(S)
6.6- 7.4	Long (L)	2.0-3.0	Intermediate
5.5- 6.5	Medium (M)	less than 2.0	Bold (B)
5.4 and below	Short (S)		

b. Chalky and immature grains. Determination of percent chalky and immature grains was done by weighing three, 50-gram samples from the total milled rice. Each 50-gram sample represented a replication. Chalky and immature grains were separated from each replicate and weighed. Percent chalky and immature grains were calculated as follows:

$$\% \text{ Chalky Grains} = \frac{\text{weight of chalky grain (g)}}{50 \text{ g}} \times 100$$

$$\% \text{ Immature Grain} = \frac{\text{weight of immature grain (g)}}{50 \text{ g}} \times 100$$

Percent chalky and immature grains were classified based on the following categories:

Physical attributes	Classification	Recommended Value
% Chalky Grains	Premium (Pr)	< 2.0 %
	Grade 1 (G1)	2.0 % - 5.0 %
	Grade 2 (G2)	5.1 % - 10.0 %
	Grade 3 (G3)	10.1 % - 15.0 %
% Immature Grains	Premium (Pr)	< 2.0 %
	Grade 1 (G1)	2.0 % - 5.0 %
	Grade 2 (G2)	5.1 % - 10.0 %
	Grade 3 (G3)	10.1 % - 15.0 %

8. Determination of preference scores for sensory evaluation. This was evaluated by consumer panel. An information sheet was distributed and accomplished by each evaluator. Score cards were explained to the evaluators to minimize error in answering the said forms during the evaluation. A photocopy of detailed score card was attached to an information sheet for the evaluator to refer.

Cooked rice samples were prepared by washing the raw milled rice two times before cooking. A rice cooker was used in cooking the 40 MASIPAG rice cultivars following the ratio of 1:1 (1 cup rice and 1 cup water). Cooked rice samples were placed in a styrofoam plate with proper number of 40 MASIPAG rice cultivar. The name of each selection was placed at the bottom of the styrofoam plate. The samples were placed on top of the table according to the experimental design. Bottled water (350 ml) and a teaspoon were provided to each evaluator. For sensory evaluation, the score card shown in Appendix A was accomplished. The 40 MASIPAG cultivars were rated as to aroma, off-odor, color, gloss, cohesiveness, tenderness, texture, and taste based on the following categories:

Aroma	5	very aromatic
	4	aromatic
	3	moderately aromatic
	2	slightly perceptible aroma
	1	no aroma
Color	4	white
	3	creamish white
	2	grayish white
	1	white with reddish or other colored streaks
Cohesiveness	3	sticky
	2	distinct grains stick together

	1	separated
Texture	3	smooth
	2	slightly smooth
	1	rough
Taste	3	tasty
	2	slightly perceptible taste
	1	bland
Off odor	4	sack-like
	3	old-like
	2	moldy
	1	rancid
Gloss	3	glossy
	2	moderately glossy
	1	dull/no gloss
Tenderness	3	tender
	2	tough
	1	hard

Analysis of Data. All data collected except for the determination of preference score for sensory evaluation were statistically analyzed using the analysis of variance for a randomized complete block design. Significant differences among treatment means were determined using the Duncan's multiple range test at the 5% level of probability.

RESULTS

Number of Days from Emergence to Maturity

The data in Table 1 shows a wide variation on the number of days from emergence to maturity. Cultivars M11-11-1 and M78-2-1 matured significantly ($P< 0.05$) the earliest at 113 days. These were followed closely by M122-2, 10 AG and M278-2 which matured at 114 DAE; M115-2R, M192-4 which matured at 115DAE; and 5 AG and M11-10-4 which matured at 116 DAE. M137-2, GL3-1, M227-2, M291-3, M202-5, M11-20-3, M130 and M160-1 (117 DAE) matured one to two days earlier than M37-W, Azucena (118 DAE), M219-3, Dinorado, and M211-3 (119 DAE). These were 2 to 11 days earlier than the rest of the cultivars with maturity period ranging from 120 to 129 days. M119-4 was significantly ($P< 0.05$) the latest to mature at 132 days which is 19 days later than the maturity period of M11-11-1 and M78-2-1. Both Red

Borong and Sampaguita were harvested at 129 DAE which did not significantly differ from the maturity period of M11 11 1.

Table 1. Number of Days from Emergence to Maturity of 40 MASIPAG Rice Cultivars at Harvest.

Rice Cultivars	Mean	Rice Cultivars	Mean
Simpocot	125^{f}	M37 – W	118^{cd}
Elon Elon Red	127^{g}	M115 – 2R	115^{b}
Binolongan	126^{fg}	M78 – 2 – 1	113^{a}
Azucena	119^{d}	M92 – 2 – 1	125^{f}
M122 – 2	114^{b}	10AG	114^{b}
M12 – 21 – B4	128^{g}	M97 – 1 – 2	127^{g}
M241 – 3	117^{c}	M126 – 1	122^{de}
M211 – 3	119^{d}	M160 – 1	117^{c}
M227 – 2	117^{c}	M192 – 4	115^{b}
M211 – 2	123^{e}	M11- 11 – 1	113^{a}
M202 – 5	117^{c}	M5BD – 1	126^{fg}
BR - 210	125^{f}	GL3 – 1	117^{c}
M120 – 1	123^{e}	Sampaguita	129^{gh}
M219 – 3	119^{d}	M278 – 2	114^{b}
M208 – 4	126^{fg}	M11 – 10 – 4	116^{bc}
M43 – 4 – 1	124^{ef}	M119 – 4	132^{h}
M137 – 2	117^{c}	Prakmalis	120^{de}
Red Borong	129^{gh}	Dinorado	119^{d}
5AG	116^{bc}	M130	117^{c}
M11 – 20 – 3	117^{c}	SW –`01VR	127^{g}

[abcdefgh] Treatment means followed by the same letter superscript are not significantly different over each other at the 5% level of probability.

Plant Height

The Duncan's multiple range test on final height measurement of 40 MASIPAG cultivars revealed that M1222 was relatively the tallest at 151 cm, although this was almost the same as the heights of M2113, Azucena (149 cm), 10 AG (148 cm), and Red borong (147 cm). On the other hand, SWO1VR, M11111 and M2272 were significantly the shortest at 88 and 87 cm, respectively. Nine other cultivars namely; M1201, M11203, M2782, M9222, M5BD1, M11104, M1194 and M2193 had similar heights ranging from 94 to 99 cm. The rest of the cultivars had average heights varying from 100 to 126 cm (Table 2). During height measurement, it was observed that some of the MASIPAG cultivars were as tall as the person taking the data. This was the characteristics of traditional varieties which were utilized as parentals of the tested cultivars.

Table 2. Average Plant Height of Forty MASIPAG Rice Cultivars at Harvest.

Rice Cultivars	Mean	Rice Cultivars	Mean
	--cm--		--cm--
Simpocot	124^{d}	M37 – W	109^{fg}
Elon Elon Red	138^{b}	M115 – 2R	101^{gh}
Binolongan	121^{e}	M78 – 2 – 1	103^{gh}
Azucena	149^{a}	M92 – 2 – 1	94^{h}
M122 – 2	151^{a}	10AG	148^{ab}
M12 – 21 – B4	133^{cd}	M97 – 1-2	125^{d}
M241 – 3	123^{d}	M126 – 1	101^{gh}
M211 – 3	149^{a}	M160 – 1	121^{e}
M227 – 2	87^{i}	M192 – 4	94^{h}
M211 – 2	126^{d}	M11- 11 – 1	88^{i}
M202 – 5	103^{gh}	M5BD – 1	94^{h}
BR - 210	116^{ef}	GL3 – 1	123^{d}
M120 – 1	99^{h}	Sampaguita	107^{fg}
M219 – 3	93^{hi}	278 – 2	96^{h}
M208 – 4	115^{ef}	M11 – 10 – 4	94^{h}
M43 – 4 – 1	113^{af}	M119 – 4	94^{h}
M137 – 2	124^{ad}	Prakmalis	136^{c}
Red Borong	147^{ab}	Dinorado	121^{e}
5AG	105^{gh}	M130	122^{e}
M11 – 20 – 3	96^{h}	SW – 01VR	88^{i}

[Abcdefghi] Treatment means followed by the same letter superscript are not significantly different over each other at the 5% level of probability.

Number of Productive and Non-productive Tillers

The 40 MASIPAG rice cultivars developed an average of 4 to 19 productive tillers while 10 AG and Prakmalis produced the most (19 and 16, respectively). Azucena ranked third with 14 productive tillers although, statistical analysis showed that they did not markedly differ with those of M130, M1194, M11104, M1152R and M2782 which produced 11 productive tillers. Dinorado which produced 10 productive tillers had comparable number of productive tillers to M2113, Sampaguita, M11203, M1201 and M2112 which produced eight. Eighteen cultivars had productive tillers ranging from 5 to 7 while 5 AG developed the least number of productive tillers with only four.

For the number of non-productive tillers, M1152R produced the most at 10 unproductive tillers which is comparable to that of Azucena (9 tillers) which ranked second. M126-1, M130, 5 AG, M2084, Simpocot and SW01VR produced between 6 to 7 non-productive tillers which are almost the same as those produced by seventeen cultivars except M2782, M1201, M2112, M2413, Sampaguita, M1924, and M2193 which produced the least of only 3 non-productive tillers. These results are all shown in Table 3.

Table 3. Number of Productive and Non-productive Tillers of MASIPAG Rice Cultivars at Harvest.

Rice Cultivars	Number of Tillers		Rice Cultivars	Number of Tillers	
	Productive	Unproductive		Productive	Unproductive
Simpocot	8^{d}	7^{b}	M37 – W	6^{f}	5^{bc}
Elon Elon Red	5^{g}	4^{c}	M115 – 2R	11^{c}	10^{a}
Binolongan	8^{d}	6^{b}	M78 – 2 – 1	5^{g}	6^{b}
Azucena	14^{bc}	9^{ab}	M92 – 2 – 1	6^{f}	4^{c}
M122 – 2	9^{d}	5^{bc}	10AG	19^{a}	6^{b}
M12–21–B4	7^{c}	4^{c}	M97 – 1 – 2	7^{c}	5^{bc}
M241 – 3	5^{g}	3^{d}	M126 – 1	9^{d}	7^{b}
M211 – 3	9^{d}	6^{b}	M160 – 1	8^{d}	5^{bc}
M227 – 2	9^{d}	5^{bc}	M192 – 4	7^{c}	3^{d}
M211 – 2	8^{d}	3^{d}	M11- 11 – 1	7^{c}	4^{c}
M202 – 5	6^{f}	4^{c}	M5BD – 1	6^{f}	5^{bc}
BR - 210	8^{d}	4^{c}	GL3 – 1	7^{c}	5^{bc}
M120 – 1	8^{d}	3^{d}	Sampaguita	9^{d}	3^{d}
M219 – 3	7^{c}	3^{d}	M278 – 2	11^{c}	3^{d}
M208 – 4	7^{c}	4^{b}	M11 – 10 – 4	11^{c}	6^{b}
M43 – 4 – 1	5^{g}	4^{c}	M119 – 4	11^{c}	4^{c}
M137 – 2	7^{c}	6^{b}	Prakmalis	16^{ab}	6^{b}
Red Borong	7^{c}	5^{bc}	Dinorado	10^{d}	6^{b}
5AG	4^{h}	7^{b}	M130	11^{c}	7^{b}
M11 – 20 – 3	8^{d}	4^{c}	SW – 01VR	6^{f}	6^{b}

[abcdefghi] Treatment means followed by the same letter superscript are not significantly different over each other at the 5% level of probability.

Actual Plot Yield

The actual plot yield presented in Table 4 reveals that Red Borong produced a grain yield of 1032 g/1m^2 and outyielded the other 39 cultivars.

The yield of Red borong was 122 to 320 g/1m^2 higher than the yields of six cultivars namely; GL31 with 910 g/1m^2, M2112 with 888 g/1m^2, M11111 with 878 g/1m^2, SW01VR with 874 g/1m^2, 10 AG and M2025 with 827 g/1m^2. Moreover, Elon Elon Red (781 g/1m^2), M9712 (749 g/1m^2), M1601 (747 g/1m^2), M1372 (746 g/1m^2), M37W (745 g/1m^2), Azucena (713 g/1m^2) and M1201 (709 g/1m^2) produced significantly better yields than M5BD1 with only 389 g/1m^2 which obtained the lowest yield. Most of the cultivars yielded from 604 to 663 g/1m^2.

Eight cultivars had comparable performance from 509 to 558 g/plot which is 193 to 243 g/1m^2 higher than the yields of cultivars M1221B4, M2413, M9221, M2272, M11203, Binolongan, 5 AG and M1222 significantly produced the lowest yields.

Corrected Yield

When yield was converted to yield/ha, Red Borong gave significantly ($P < 0.05$) the highest corrected yield 10,910 kg/ha. GL31 ranked second at 8565 kg/ha but is comparable to M2112 at 8047 kg/ha. Cultivars M11-11-1 (7986 kg/ha), SW01VR (7873 kg/ha), M202-5 (7099 kg/ha), 10 AG (7068 kg/ha),and Elon Elon Red (6356 kg/ha) were 2924 to 4554 kg/ha lower than the corrected yield of Red Borong. Most of the cultivars gave a corrected yield ranging from 2000 to 5000 kg/ha. Eight cultivars namely, M5BD1with 1615 kg/ha, 5 AG with 1915 kg/ha, M1222 with 1956 kg/ha, M11-20-3 with 2212 kg/ha, M92-2-1 with 2233 kg/ha, M2272 with 2236 kg/ha, Binolongan with 2239 kg/ha and M130 with 2385 kg/ha gave significantly the lowest corrected yield (Table 5). The yield of Red Borong, the highest yielder, was from 8954 to 9295 kg/ha higher than the yields of M5BD1, 5 AG, M1222, which were the lowest yielders.

Table 4. Actual Plot Yield of Forty MASIPAG Rice Cultivars.

Rice Cultivars	Mean g/m^2	Rice Cultivars	Mean g/m^2
Simpocot	628^{cd}	M37 – W	745^{bc}
Elon Elon Red	781^{bc}	M115 – 2R	536^{cfg}
Binolongan	454^{gh}	M78 – 2 – 1	509^{fgh}
Azucena	713^{bc}	M92 – 2 – 1	465^{gh}
M122 – 2	422^{h}	10AG	827^{b}
M12 – 21 – B4	499^{fgh}	M97 – 1 – 2	749^{bc}
M241 – 3	494^{fgh}	M126 – 1	613^{d}
M211 – 3	542^{ef}	M160 – 1	747^{bc}
M227 – 2	464^{gh}	M192 – 4	604^{de}
M211 – 2	888^{b}	M11- 11 – 1	878^{b}
M202 – 5	827^{b}	M5BD – 1	389^{i}
BR - 210	550^{ef}	GL3 – 1	910^{ab}
M120 – 1	709^{bc}	Sampaguita	622^{d}
M219 – 3	663^{c}	M278 – 2	558^{ef}
M208 – 4	657^{cd}	M11 – 10 – 4	635^{cd}
M43 – 4 – 1	553^{ef}	M119 – 4	566^{efg}
M137 – 2	746^{bc}	Prakmalis	662^{cd}
Red Borong	1032^{a}	Dinorado	605^{de}
5AG	430^{h}	M130	483^{fgh}
M11 – 20 – 3	463^{gh}	SW – 01VR	874^{b}

[abcdefghi] Treatment means followed by the same letter superscript are not significantly different over each other at the 5% level of probability.

Cultivars M1372 and M37W were the top yielders and the only cultivars out of the 40 tested that exceeded 5 tons/ha during the 2005 wet season planting and 6 tons/ha during 2006 dry season planting (Famoso, 2005 & 2006). In this study, however, these two cultivars ranked 9th and 10th with grain yields of only 5761 kg/ha and 5721 kg/ha. It can be noted that eight of the MASIPAG rice cultivars tested have yields higher than 6 tons/ha. Arancon (1996) reported that three of the MASIPAG lines outyielded the check rice variety, PSB Rc 4. The corrected yield (kg/ha) of MASIPAG cultivars ranged from 7 to 9 tons/ha for a two year experiment (from http://www.organicriceorg/ orgriceindustry.htm).

Table 5. Corrected Mean Yield of MASIPAG Rice Cultivars.

Rice Cultivars	Mean	Rice Cultivars	Mean
	kg/ha		kg/ha
Simpocot	4256[cd]	M37 – W	5721[bc]
Elon Elon Red	6356[bc]	M115 – 2R	2987[cfg]
Binolongan	2239[gh]	M78 – 2 – 1	2644[fgh]
Azucena	5236[bc]	M92 – 2 – 1	2233[gh]
M122 – 2	1956[h]	10AG	7068[b]
M12 – 21 – B4	2588[fgh]	M97 – 1 –2	5768[bc]
M241 – 3	2549[fgh]	M126 – 1	3854[d]
M211 – 3	3105[cf]	M160 – 1	5853[bc]
M227 – 2	2236[gh]	M192 – 4	3803[dc]
M211 – 2	8047[b]	M11- 11 – 1	7986[b]
M202 – 5	7099[b]	M5BD – 1	1615[i]
BR - 210	3122[cf]	GL3 – 1	8565[ab]
M120 – 1	5183[bc]	Sampaguita	3982[d]
M219 – 3	4503[c]	M278 – 2	3268[cf]
M208 – 4	4495[cd]	M11 – 10 – 4	4264[cd]
M43 – 4 – 1	3172[cf]	M119 – 4	3301[cfg]
M137 – 2	5761[bc]	Prakmalis	4511[cd]
Red Borong	10910[a]	Dinorado	3785[dc]
5AG	1915[h]	M130	2385[fgh]
M11 – 20 – 3	2212[gh]	SW – 01VR	7873[b]

[abcdcfghi] Treatment means followed by the same letter superscript are not significantly different over each other at the 5% level of probability.

Milling Potentials

The data in Table 6 show that the different cultivars had good milling and head rice recovery. Five cultivars had Grade 1 (with 65.1% to 70.0%) total milling recovery and eight cultivars fell generally under Grade 2 (60.1% to 65.0%); eleven cultivars had Grade 1 head rice recovery and fourteen cultivars under Grade 2. Most of the cultivars had Grade 3 (55.1% to 60.0%) total milled rice and head rice recoveries.

Simpocot and M1372 gave better percent milling recovery of 67.9; however, DMRT indicated that they did not markedly differ from M7821 (66%), M11203 (64.9%), M1601 (64.7%), M1221-B4 (64.3%), Dinorado (64.2%), SW01VR (63.6%), 5 AG (63.2%), M2112 (61.3%), 10 AG (60.9%), M2782 (60.8%) and M9712 (60.4%). Cultivar M9712 was closely followed by Sampaguita at 59.8 %. Thirteen cultivars had

50.7 to 58.8 % milling recovery while nine cultivars had 41.2 to 48.5%. Three cultivars, namely, M130 (39.4 %), M2084(35.7%) and Elon Elon Red (33.7%) gave the lowest milling recovery which were 28.5 to 34.2 % lower compared to those of Simpocot and M1372.

The head rice recovery of 40 Masipag rice cultivars ranges from 28.8% to 51.8%.

Table 6. Milling Potential of 40 MASIPAG Rice Cultivars.

Rice Cultivars	Milled Rice		Head Rice		Rice Cultivars	Milled Rice		Head Rice	
	Grade	%	Grade	%		Grade	%	Grade	%
Simpocot	1	67.9^{a}	1	48.9^{ns}	M37-W	3	56.8^{de}	3	31.8^{ns}
Elon Elon Red	3	33.7^{q}	1	48.5	M115-2R	3	58.1^{bc}	2	39.4
Binolongan	3	53.7^{g}	2	47.4	M78-2-1	1	66.0^{a}	3	28.8
Azucena	3	41.8^{n}	3	38.6	M92-2-1	3	56.3^{f}	3	34.6
M122-2	3	56.3^{f}	1	51.2	10AG	2	60.9^{a}	2	40.1
M12-21-B4	2	64.3^{a}	2	39.2	M97-1-2	2	60.4^{a}	2	41.8
M241-3	3	47.3^{jk}	3	38.4	M126-1	3	57.7c	1	51.8
M211-3	3	41.2^{no}	1	49.7	M160-1	2	64.7^{a}	2	45.6
M227-2	3	46.7^{kl}	2	46.4	M192-4	3	$46.8j^{k}$	3	36.9
M211-2	2	61.3^{a}	1	50.9	M11-11-1	3	41.3^{n}	2	47.6
M202-5	3	42.0^{n}	1	50.9	M5BD-1	3	54.3^{fg}	1	49.8
BR-210	3	58.8^{b}	3	37.7	GL3-1	3	57.4^{cd}	1	49.6
M120-1	3	52.2^{gh}	3	35.8	Sampaguita	3	59.8^{ab}	1	48.7
M219-3	3	49.1^{ij}	2	44.5	M278-2	2	60.8^{a}	3	33.9
M208-4	3	35.7^{p}	3	32.3	M11-10-4	3	51.0^{h}	3	34.7
M43-4-1	3	43.9^{lm}	1	50.3	M119-4	3	50.7^{hi}	2	43.9
M137-2	1	67.9^{a}	3	35.9	Prakmalis	3	56.5^{e}	2	41.6
Red Borong	3	48.5^{j}	3	37.8	Dinorado	2	64.2^{a}	3	33.8
5AG	1	63.2^{a}	2	40.0	M130	3	39.4^{op}	3	30.0
M11-20-3	1	64.9^{a}	2	39.6	SW-01VR	2	63.6^{a}	2	47.1

[abcdefghijklmnopq] Treatment means followed by the same letter superscript are not significantly different over each other at the 5% level of probability.

[ns] Not significant at the 5 % level of probability.

Physical Attributes

Except for M2413 which had 10.2% chalky grains and was categorized under grade 3, all cultivars were classified under either Grade 1 or Grade 2 (Table 7).

The higher the percentage of chalky grains, the poorer the quality of rice. None of the cultivars had premium classification under percent chalky grains. However, statistical analysis on percent chalky grains failed to show significant variations among the 40 cultivars.

In terms of percent immature grains, M11111 produced the most at 13.7% which was closely followed by M1221B4 with 12.4 % and M1152R with 12.3%. The amount of immature grains produced by M2025, M1601, Dinorado and Sampaguita were about the same (11.1 to 11.7%). The rest of the cultivars had percent immature grains ranging from 3.0 to 10.9. This shows that the cultivars were classified either as Grade 2 or Grade 3 and none was classified under premium.

Seventeen out of the forty Masipag cultivars had long grains (from 7.0 to 7.5 mm) Prakmalis had the longest grains at 7.5 mm, followed by M11203 (7.3 mm), M11104, M5BD1 (7.2 mm) and M2272, M1201, 5 AG, 10 AG, M1601, M1924 and M130 all of which had mean grain length of 7.0 mm. Twenty three other cultivars had medium grain length ranging from 5.2 mm to 6.8 mm (Table 7).

Table 7. Physical Attributes of 40 MASIPAG Rice Cultivars.

Rice Cultivars	Chalky Grains		Immature Grains		Grain Length		Grain Width	
	Grade	%	Grade	%	Class	mm	Class	mm
Simpocot	2	9.0^{ns}	3	10.5^{c}	M	5.8^{c}	I	2.3^{b}
Elon Elon Red	1	3.8	2	9.1^{fg}	M	6.0^{de}	I	2.0^{c}
Binolongan	2	9.9	1	4.0^{m}	M	6.3^{cd}	I	2.0^{c}
Azucena	1	5.0	2	8.1^{h}	M	5.8^{c}	I	2.0^{c}
M122–2	2	8.2	2	6.7^{h}	M	6.3^{cd}	I	2.2^{bc}
M12–21–B4	1	4.6	3	12.4^{ab}	M	6.3^{cd}	I	2.0^{c}
M241–3	3	10.2	2	6.6^{jk}	M	6.0^{de}	I	2.5^{a}
M211–3	2	7.3	1	4.9^{l}	M	6.0^{de}	I	2.3^{b}
M227–2	2	5.8	2	7.0^{j}	L	7.0^{a}	I	2.0^{c}
M211–2	2	6.0	2	9.6^{ef}	M	6.0^{de}	I	2.0^{c}
M202–5	1	8.0	3	11.5^{b}	M	6.2^{d}	I	2.5^{a}
BR-210	1	4.4	2	10.0^{de}	M	6.2^{d}	I	2.0^{c}
M120–1	2	5.4	2	8.8^{gh}	L	7.0^{a}	I	2.0^{c}
M219–3	1	4.8	1	4.0^{m}	L	6.8^{b}	I	2.0^{c}
M208–4	2	5.9	1	3.6^{mn}	L	6.7^{b}	I	2.5^{a}
M43–4–1	2	6.9	1	4.8^{l}	M	5.7^{ef}	I	2.5^{a}
M137–2	2	6.8	1	4.5^{lm}	L	6.7^{b}	I	2.0^{c}
Red Borong	2	6.4	3	10.4^{cd}	M	5.5^{f}	I	2.5^{a}
5AG	2	7.8	1	3.9^{m}	L	7.0^{a}	I	2.5^{a}
M11-20-3	2	5.6	1	4.7^{l}	L	7.3^{a}	I	2.0^{c}
M37-W	2	9.9	2	7.9^{ij}	M	6.2^{d}	I	2.3^{b}

Table 7 Continued

Rice Cultivars	Chalky Grains		Immature Grains		Grain Length		Grain Width	
	Grade	%	Grade	%	Class	mm	Class	mm
M115-2R	1	3.7	3	12.3^{ab}	M	5.7^{ef}	I	2.5^{a}
M78-2-1	2	6.3	1	3.9^{m}	M	5.7^{ef}	I	2.0^{c}
M92-2-1	2	8.4	1	3.8^{m}	M	6.2^{d}	I	2.0^{c}
10AG	2	5.6	1	4.1^{m}	L	7.0^{a}	I	2.0^{c}
M97-1-2	1	4.5	3	10.9^{bc}	L	6.7^{b}	I	2.0^{c}
M126-1	2	7.7	1	3.8^{m}	L	6.7^{b}	I	2.0^{c}
M160-1	1	4.2	3	11.1^{b}	L	7.0^{a}	I	2.0^{c}
M192-4	1	4.2	1	4.2^{m}	L	7.0^{a}	I	2.0^{c}
M11-11-1	2	8.6	3	13.7^{a}	M	6.2^{cd}	I	2.3^{b}
M5BD-1	1	4.5	2	5.1^{k}	L	7.2^{a}	I	2.5^{a}
GL3-1	2	6.2	2	5.7^{kl}	M	6.0^{de}	I	2.0^{c}
Sampaguita	1	4.7	3	11.5^{b}	M	6.0^{de}	I	2.3^{b}
M278-2	2	5.9	1	3.0^{o}	M	6.3^{cd}	I	2.0^{c}
M11-10-4	2	9.5	2	9.8^{c}	L	5.9^{g}	I	2.0^{a}
Prakmalis	2	5.4	2	6.7^{j}	L	7.5^{a}	I	2.0^{c}
Dinorado	2	6.8	3	11.7^{b}	L	6.7^{b}	I	2.3^{b}
M130	2	4.7	1	3.8^{mn}	L	7.0^{g}	I	2.2^{bc}
SW-01VR	1	4.9	1	4.0^{m}	M	6.5^{c}	I	2.0^{c}

abcdefghijklmno Treatment means followed by the same letter superscript are not significantly different over each other at the 5% level of probability.

M Medium (5.5 to 6.5 mm)
L Long (6.6 to 7.4 mm)
I Intermediate (2.0 to 3.0 mm)

All cultivars had intermediate (I) grain width which ranges from 2.0 to 2.5 mm. The widest (2.5 mm) were obtained from nine cultivars namely; M2413, M2025, M2084, M4341, Red Borong, 5 AG, M1152R, M5BD1 and M1194.

Sensory Description

The sensory descriptions of 40 Masipag rice cultivars are presented in Table 8. All cultivars were perceived to be aromatic when cooked because during milling and cooking, these already emitted aroma. However, when the cooked rice cooled, only BR210, 10 AG, Sampaguita and M130 maintained their aroma. Eleven cultivars were slightly aromatic, twelve were moderately aromatic and thirteen had no aroma.

Almost of the cultivars have an old-like and no-off odor. Three cultivars, namely, Dinorado, M2272 and M2112 had sack-like odor while M2413 smelled like cockroach.

As to their color, twelve cultivars were grayish white, ten were creamiest white, five were reddish and maroon, and the rest were light brown, pinkish and brown. Mixture in color rating was observed because of the continuous milling of the 40 cultivars. The milling machine could not be totally cleaned before milling another cultivar.

Only M5BD1 had a slightly glossy appearance while the rest of the cultivars were either moderately glossy or had dull appearance. The dull appearance could be mainly due to the milling process where the grains were unproperly dehulled resulting in non-sticky, hard to tough rice. Only M37W, M2782, and M130 were tender when cooked. The panelists observed that upon conducting the sensory evaluation they experienced itchy throat which was mainly due to the pericarp. The presence of the pericarp is attributed to the inability of the milling machine to properly dehull the rough rice since only a very small amount of the rough rice was used for milling.

As to texture, only three cultivars M227-2, M115-2R and M130 were rated as smooth, sixteen cultivars were slightly smooth and the rest were rated as rough.

Three out of the 40 MASIPAG cultivars Elon Elon Red, M2193, and M2782 were rated as tasty. The rest were rated either as bland or slightly perceptible (Table 8).

Table 8. Sensory Description of Cooked MASIPAG Rice Cultivars.

Rice Cultivars	Aroma	Off-odor	Color	Gloss
Simpocot	MA	old-like	reddish	mod. glossy
Elon Elon Red	MA	none	light brown	dull
Binolongan	SA	none	grayish white	dull
Azucena	SA	old-like	maroon	dull
M122–2	NA	none	maroon	dull
M12–21–B4	SA	none	creamiest white	dull
M241–3	NA	cockroach-like	grayish white	dull
M211–3	MA	old-like	creamiest white	dull
M227–2	NA	sack-like	grayish white	dull

Table 8 Continued

Rice Cultivars	Aroma	Off-odor	Color	Gloss
M211–2	MA	sack-like	grayish white	dull
M202–5	NA	old-like	grayish white	dull
BR-210	A	old-like	reddish	dull
M120–1	NA	none	grayish white	dull
M219–3	MA	none	brown	mod. glossy
M208–4	MA	none	pinkish	dull
M43–4–1	NA	none	pinkish	mod. glossy
M137–2	SA	none	grayish white	mod. glossy
Red Borong	MA	old-like	reddish	dull
5AG	SA	none	maroon	dull
M11-20-3	SA	old-like	creamiest white	dull
M37-W	MA	none	grayish white	mod. glossy
M115-2R	SA	old-like	maroon	mod. glossy
M78-2-1	NA	none	creamiest white	dull
M92-2-1	MA	old-like	grayish white	mod. glossy
10AG	NA	none	creamiest white	dull
M126-1	NA	moldy	grayish white	dull
M160-1	NA	none	creamiest white	dull
M192-4	NA	none	creamiest white	mod. glossy
M11-11-1	SA	none	light maroon	slightly glossy
M5BD-1	NA	old-like	grayish white	mod. glossy
GL3-1	MA	none	reddish	dull
Sampaguita	A	moldy	brown	dull
M278-2	NA	none	creamiest white	mod. glossy
M11-10-4	MA	old-like	creamiest white	dull
M119-4	SA	old-like	redish	dull
Prakmalis	SA	old-like	brown	mod. glossy
Dinorado	MA	sack-like	grayish white	dull
M130	A	none	creamiest white	mod. glossy
SW-01VR	SA	none	light brown	dull

A - Aromatic
MA - Moderately Aromatic
SA - Slightly Aromatic
NA - No Aroma

Table 8. Sensory Description of Cooked MASIPAG Rice Cultivars.

Rice Cultivars	Cohesiveness	Tenderness	Texture	Taste
Simpocot	separated	hard	rough	slightly perceptible
Elon Elon Red	distinct grains stick together	hard	rough	tasty
Binolongan	distinct grains stick together	hard	rough	bland
Azucena	separated	hard	rough	slightly perceptible
M122-2	separated	hard	rough	bland
M12-21-B4	separated	hard	rough	bland
M241-3	distinct grains stick together	hard	rough	slightly perceptible
M211-3	distinct grains stick together	hard	rough	bland
M227-2	distinct grains stick together	hard	rough	bland
M211-2	separated	hard	rough	slightly perceptible
M202-5	distinct grains stick together	hard	smooth	bland
BR-210	distinct grains stick together	tough	slightly smooth	raw taste
M120-1	distinct grains stick together	tough	rough	slightly perceptible
M219-3	distinct grains stick together	hard	rough	tasty
M208-4	distinct grains stick together	tender	slightly smooth	slightly perceptible
M43-4-1	separated	hard	rough	slightly perceptible
M137-2	separated	hard	slightly smooth	slightly perceptible
Red Borong	distinct grains stick together	tough	slightly smooth	bland
5AG	distinct grains stick together	tough	slightly smooth	slightly perceptible
M11-20-3	distinct grains stick together	hard	rough	slightly perceptible
M37-W	separated	tender	slightly smooth	slightly perceptible

Table 8 continued

Rice Cultivars	Cohesiveness	Tenderness	Texture	Taste
M115-2R	distinct grains stick together	hard	smooth	slightly perceptible
M78-2-1	separated	tough	slightly smooth	slightly perceptible
M92-2-1	distinct grains stick together	tough	rough	bland
10AG	distinct grains stick together	tough	rough	bland
M97-1-2	separated	hard	slightly smooth	slightly perceptible
M126-1	separated	tough	slightly smooth	slightly perceptible
M160-1	distinct grains stick together	tough	slightly smooth	slightly perceptible
M192-4	distinct grains stick together	tough	rough	bland
M11-11-1	separated	hard	rough	bland
M5BD-1	separated	hard	rough	bland
GL3-1	separated	tough	slightly smooth	bland
Sampaguita	distinct grains stick together	tough	slightly smooth	slightly perceptible
M278-2	distinct grains stick together	tender	slightly smooth	tasty
M11-10-4	separated	hard	rough	bland
M119-4	distinct grains stick together	tough	slightly smooth	slightly perceptible
Prakmalis	distinct grains stick together	tough	rough	slightly perceptible
Dinorado	separated	rough	slightly smooth	slightly perceptible
M130	distinct grains stick together	tender	smooth	slightly perceptible
SW-01VR	separated	hard	rough	slightly perceptible

DISCUSSION

The findings of this study show that there are MASIPAG rice selections which are high yielding, early maturing, resistant to pests and weeds; have good eating quality, low seed requirement and good stand; need no chemicals and fertilizers; and can adapt to the local climate. These results are supported by the findings of two previous studies by the author (Famoso, 2005; Famoso, 2006) where some of the MASIPAG rice selections have the above-mentioned favorable characteristics and that the yields of two selections exceeded the 5 t/ha national average yield of rice. The results from this study also confirm the preference of farmers for MASIPAG rice selection with high yield and good eating quality (Dusaran & Pabulayan, 2002).

It is a fact that consumer preference for rice is largely based on eating quality which includes the aroma. All the 40 selections were adjudged as aromatic. However, only BR 210, 10 AG, Sampaguita and M130 maintained their aroma when the cooked rice has cooled. This result on Sampaguita is supported by the findings of Arancon (1996 in PhilDHRRA, 2004).

CONCLUSIONS

Based on the above observations, it is concluded that rice cultivar Red Borong is highly adaptable to the CPU farm conditions and could be grown there. Red Borong can be grown for its high grain yield. BR210, 10 AG, Sampaguita and M130 can also be grown for their aroma; and M37-W, M278-2 and M130 for their tenderness; and Elon Elon Red, M219-3 and M278-2 for their taste.

RECOMMENDATIONS

It is recommended that another trial for dry season planting be conducted to further assess and compare the agronomic and yield characteristics, milling recovery, and eating quality of these cultivars.

ACKNOWLEDGMENT

The researcher expresses her profound gratitude to the University Research Center for financial assistance in conducting the 2006 wet season planting for without all the study would have not been materialized.

Special thanks is extended to MASIPAG Visayas for providing the planting materials to the Central Philippine University, College of Agriculture.

Above all, the researcher acknowledges the Almighty God for the enlightenment and wisdom which made this study successful.

REFERENCES

Bangwaek C., B.S. Vergara, & R.P. Robles (1994, December). Effect of temperature regime on grain chalkiness in rice. *International rice research notes, 19*(4), 8.

Duy, Pam Quang, Hirano, Satoro Sagawa, & Eiki Kuroda (2004). *Plant production science, 7*(1), 3 -10.

Famoso, E. B. (2006, March). *Adaptability of different MASIPAG rice selection under Central Philippine University experimental farm conditions under wet season planting.* Unpublished research report, University Research Center, Central Philippine University, Jaro, Iloilo City.

Famoso, E. B. (2006, August). *Adaptability of different MASIPAG rice selection under Central Philippine University experimental farm conditions during dry season planting.* Unpublished research report, University Research Center, Central Philippine University, Jaro, Iloilo City.

Laza, M. R. C. Peng ShaoBing; Akita, S. & Saka H. (2004). *Plant production science. 7*(3),271 -276.

Medina, C.P. 2001. *Organic/sustainable*: Case studies on upland farm systems in.Kabankalan, Negros Occidental, Philippines. PCARRD-UPLB-IFOAM Cooperative Project (1998-2000). Retrieved December 20, 2006 from http://www.organicriceorg/orgriceindustry.htm

Mendoza, T. C. (2001). *Organic/sustainable agriculture*: Case studies on lowland farm systems in Infanta, Quezon, Philippinews. PCARRD-UPLB Project (1999-2000).

Mendoza, T. C. (2002). *Impact analysis of organic farming in rice agroecosystems in the Philippines.* Paper presented during the 1st RDA/ARNOA International Conference on Asian Organic Agriculture held at Suwon and Cheanon/Korea.

Oryza organic rice market report. Retrieved January 5, 2007 from Http://oryza.com/global/organicrice/index.shtml

Peng S. & Hardy B., (Eds.). (2001). *Rice research for food security and poverty alleviation.* Proceedings of the International Rice Research Conference, March 31 April 3, 2000. Los Baños, Philippines. International Rice Research Institute p692.

PhilDHRRA (2004). *Philippine organic rice: Industry orientation paper.* Retrieved August 29, 2006 from http://hrdc.pcarrd.dost.gov.ph/phil_organicmarket%20files/organic%20rice%industry.pdf

Qiao-quan L., Z. Wang, X. Chen, X. Cai, M. Hong & M. Gu. Agrobacterium-mediated Transformation of Elite Chinese Rice Cultivars with Antisense Waxy Gene to Reduce Amylose Content in the Endosperm and Improve Rice Quality. *Rice research for food security and poverty alleviation.* Proceedings of the International Rice Research Conference, March 31- April 3, 2000. Los Baños, Philippines. International Rice Research Institute p129.

Rice quality. Retrieved December 2006 from Http://www/org/ppfm/riceQuality/webhelp/OLY07.htm

The Philippine Development Assistance Program, Inc. (PDAP, 2003). *Organic rice industry profile.* Unpublished initial results.

The rice journal. Retrieved December 2006 from Http://www.ricejournal.com/backissues/march 2002/story2.asp