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Characterization and production of indigenous rice (Oryza sativa L.) in the Philippines

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ABSTRACT
The twelve indigenous rice varieties were studied to describe their physical and quantitative characteristics; growth, and yield performance. These indigenous rice varieties commonly known as; the Awot, Balayan, Kabundulan, Kapawod, Katibus, Kutsiyam, Magsanaya, Malido, Manumbalay, Palawan, Sulig, and Tapul. The data collected includes the color of rice hulls and grains, length of grains, number of tillers/hill, number of grains/panicle, the weight of 1000-grains, plant height at harvest, harvested rice yield, and milling recovery. The result revealed that the colors of the hulls and grains vary from light brown, yellow and yellow-orange, and blue & red-violet pigments. The longest length of rice grains was Sulig (9.5 mm). The gathered data were significant in terms of the number of tillers/hills, the number of grains/panicle, the weight of 1000-grains, plant height at harvest, harvested rice yield, and milling recovery. The Tukeys' Honest Significant Difference (HSD) test revealed that the highest number of tillers/hill was Palawan (21 pcs), the highest number of grains/panicle was Awot (180 pcs), the heaviest 1000-grain weights were Kabundulan & Tapul (32.5 g & 32.25 g), the tallest was Palawan (144 cm), the highest harvested yield was Kutsiyam (3,486.82 kg/hectare) and the highest milling recovery were Malido and Kapawod (62.40% and 62.80%). The result implied that each of the twelve Philippine indigenous rice varieties has its own distinct physical and quantitative characteristics and yield performance although they were grown in the same area at central towns of Panay Island, Philippines.

KEYWORDS
Philippines indigenous rice; characterization; production; staple food; organic rice

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INTRODUCTION

Rice is still the staple food of more than 50% of the world (Macintosh, 2004). Its production must be increased to 760 tons (more than 40%) over current levels by the year 2025 to feed the increasing human population (Fisher, 1996).

Agriculture in the Philippines is rapidly changing, as new farming techniques and varieties come into use. The deterioration of the environment and natural resources such as deforestation, land degradation misuse of pesticides and chemicals, and the loss of genetic resources coupled with the fast-growing population in the country gave the Department of Agriculture a challenge in refocusing strategies in ensuring food security and availability. Upland rice farming is considered an important initiative in attaining the goal of rice sufficiency in the region and the country as well. This farming environment can be characterized by 18 degrees slope and not bundled attributed largely as marginal due to soil fertility, prone to soil erosion, and water unavailability. However, the upland rice environment provides an opportunity to solve the household-based food availability, income, and nutrition and in the community in general. (Anies, 2014).

Rice in the Philippines is called bigas when uncooked and kanin when cooked. Glutinous rice is referred to as malagkit (sticky). Unmilled rice is palay. Rice is the staple food in the Philippines supplying about 35% of the average Filipino's daily caloric intake. Aside from plain steamed rice, there are many Filipino rice recipes, rice snacks, and desserts.

Even the water that has been used to wash rice, called hugas bigas, is sometimes called for in Filipino recipes aside from other uses, such as an electrolyte mixture to combat diarrhea and as a fertilizer. respectively (Philfoodie, 2011).

Traditional rice varieties gave low but dependable yields under minimal input and management practice. Many were tolerant to variations in water level and competed reasonably well with weeds. Some varieties were fairly resistant to insect and disease attacks, while others possessed excellent cooking and eating qualities besides being aromatic. Among the traditional varieties mentioned, Apostol, Azucena, Binirhen, Delhlinla, Elon-Elon, Fortuna,Kasungsong, Macan I, Macaraniag, Magsanaya, Makapilay Pusa, Milagrosa, Milbuen, Milfor,Milketan, Palawan, Raminad Strain 3, Seraup Besar 15, and Wagwag were reported to have very good to excellent table qualities,(De Leon, 2005).

According to PhilRice's Ruben Miranda, national coordinator of the Upland Rice Development Program (URDP), the upland ecosystem in the Philippines, which is more than 100,000 ha, has been neglected for a long time. In the uplands, soil fertility is low, erosion is a problem, and rainfall is the main source of water for farming. Thus, crop productivity is low at only 1 to 2 t/ha once a year. The unfavorable condition in the uplands affects about 100,000 farmers and their families. IRRI sees upland farming communities as among the poorest of subsistence farmers. They are most vulnerable to food insecurity. URDP under DA's Food Staples Sufficiency Program aims to develop the upland rice areas as food-self-sufficient communities through farm diversification, rice seed assistance, and formation of organizations, (Phil Rice 2015).

While modern technologies improve rice yield and farm income, the long-term effect, particularly by using inorganic pesticides and fertilizers, becomes detrimental to human health and the environment. A better alternative is by engaging in organic rice production that is sustainable and environmentally friendly. In terms of quality and nutrients, rice grown organically is comparable with that of rice grown conventionally (Quin, R. & Aganon C., 2014).

This study aims to find out the existing indigenous rice varieties in Central Towns of Panay island particularly at the municipality of Lambunao and Calinog and determine their characteristics and production performance. The following were the specific objectives:

(1) To find out the availability and existing indigenous rice varieties in the central towns of Panay Island which is currently planted by local farmers.

(2) To describe the phenotypic characteristics of indigenous rice such as the color of the hulls and grains, the presence of awns, and length of grains.

(3) To determine the quantitative characteristics and production performance of indigenous rice in terms of the number of tillers/hills, the number of grains/ panicle, the weight of 1000-grains, plant height at harvest, yield, and milling recovery.

(4) To preserve and conserve the indigenous rice varieties available in the locality for food production, food security, and better health.

It is now due time to start conserving the indigenous rice because they are fast vanishing due to the introduction of hybrid rice varieties. Traditional rice varieties gave low, but dependable yields under minimal input and management practice. Many were tolerant to variations in water level and competed reasonably well with weeds. Some varieties were fairly resistant to insect and disease attacks, while others possessed excellent cooking and eating qualities besides being aromatic. High demand for organic food nowadays due to health awareness of consumers. The consumption of indigenous and organically grown rice promotes better health among Filipinos.

MATERIALS AND METHODS

Materials

The study was conducted at WVSU-CC, Calinog, Iloilo from March 15, 2017, to September 01, 2017. The materials were as follows: Twelve indigenous (upland) rice seeds (sulig, manumbalay, kabundolan, awot, balayan, malido, katibus, tapul, magsanaya, kapawod, palawan, and kutsiyam), 288 square meters experimental area, hand tractors, knapsack sprayers, measuring stick, sickle, sacks, weighing scale, caliper, wooden mortar and pestle, record book, ball pen, and laptop computer.

Methods

It was laid out in a Randomized Complete Block Design (Gomez, 1984). The twelve treatments were randomly assigned in 48 experimental plots (2m x 3m each). The experimental layout and treatments are reflected in figure 1. The experimental plot measures 2 m x 36 meters per block and is divided into 12 subplots.

Block 1	Block 2	Block 3	Block 4
B	K	A	B
C	E	E	F
D	A	G	J
A	H	C	C
F	I	F	G
J	B	D	I
K	C	I	A
E	D	J	E
L	F	L	K
G	L	H	H
H	G	K	L
I	J	B	D

FIGURE 1: The experimental layout and treatments in the Randomized Complete Block Design (RCBD), experimental study.

Legend:

A- Awot
B- Balavan
C- Kabundulan
D- Kapawod
E- Katibus
F- Kutsiyam
G- Magsanaya
H- Malido
I- Manumbalay
J- Palawan
K- Sulig
L- Tapul

Application of Fertilizer. Application of 4 tons/hectare of organic fertilizer in the form of vermicast was done twice, that is, one week before planting and during the 45 days after planting of rice. Two bags/ha (50 kg/bag) of inorganic fertilizer (1 bag =Urea and 1 bag = T14) was applied to rice at 75 days old after planting.

Land Preparation. Two weeks before transplanting, the field was prepared. The soil was plowed and harrowed every week with a hand tractor to decompose and incorporate continuously all the weeds. Vermicast was applied as basal fertilizer during the 1st harrowing and leveling off the field at a rate of 4 tons per hectare.

Planting. Direct seeding by drilling method was done with a 25 cm x 25 cm planting distance between row and between hills with 4-5 seeds per hill. At one week after planting, thinning was done to complete the 4 plants per hill for data collection.

Pest Management. For weed control, pre-emergence herbicides were applied and hand weeding was employed. Spraying chemicals against pests and diseases were done as needed.

Harvesting Period. When 80-85% of the grains had become straw-colored on the outside, the rice was harvested and rice was thrashed immediately to avoid deterioration of grain quality and rice wastage and losses. The harvesting was done as expected on the maturity age of rice, which ranges from 135- 140 after sowing of seeds.

Data Gathered:
The data collected were the color of hulls and grains, presence of Awn, length of rice seeds (mm), number of tillers/hill, plant height at harvest (cm), number of grains/panicle, the weight of 1000- grains (g), rice yield (kg/ha) and milling recovery after harvesting at 140 days after planting. The data were gathered from the ten sample plants per plot.

The color of the rice hull and grains. The colors were determined using the Color Chart/Wheel by matching the color of the rice grains with the chart. The color of grains and hulls was determined by 3 persons as panel members.

The number of tillers/hill. At harvest, the plants were pulled out from the soil and the number of tillers was counted including the productive and unproductive tillers.

The number of grains/panicle. At harvest, the rice plants were collected to count the number of grains per panicle. The ten sample plants were gathered, and the grains were counted per panicle. Only 3 panicles were considered per plant/hill.

The 1000-grains weight. There were 1000 filled grains collected and the weight was determined using a digital weighing scale. The average weight (g) was obtained from 10 samples of filled 1000-grains.

Height at harvest. Before the harvest on the 140 days, the height of the plants was measured in centimeters with 10 sample plants. It was measured from the base until the tallest leaf/leaves of the plant. The average height was determined by dividing the total height gathered divided by the number of plants.

The yield of rice. The yield was determined by weighing the dried grains (estimated with 14% moisture). There was ten sample plants/plot gathered as representative plants in computing the average yield per hectare. The planting distance of 25 cm x 25 cm apart, the plant population was estimated to be 160,000 plants in the one-hectare land area.

Milling recovery (%). Milling recovery was determined by getting the ten- one kg samples each variety and milling was done using a wooden mortar and pestle. Broken rice above 20% (length of grain broken during manual milling) was considered in the milling recovery.
Data Analysis

Analysis of Variance (ANOVA) was used in evaluating and analyzing the data for all the treatments with the use of Statistical Tool in Agriculture Research (STAR) software, (IRRI, 2013).

RESULT AND DISCUSSION
The summary of the results of the data collected is presented in Tables 1 and 2. In table 1, the majority color of the hulls was yellow-orange while the majority color of the milled grains was light orange without the removal of the "bran layer/seed coat". The longest length of grains was 9.5 mm (Sulig) while the shortest was 5.75 mm (Manumbalay). The rice grains with the presence of "awn/apex" were the Palawan and Kutsiyam rice varieties.

Table 2, shows the summary of statistical analysis from the data gathered in the 12 indigenous rice varieties. Analysis of variance showed significant differences in terms of the number of tillers/hill, the number of grains/panicle, the weight of 1000-grains, height at harvest, yield/ha, and milling recovery. Tukey's Honest Significant Difference (HSD0) Test revealed the following significant higher value: the highest number of tillers/hill was 21.25 pcs/hill (Palawan), the highest number of grains/panicle was 180 pcs/hill (Awot), and the heaviest weight of 1000-grains was 32.25 grams (Kabundalan and Tapul), the tallest among the 12 native rice varieties was 144 cm (Palawan), the highest yield/hectare was 3,486.82 kilograms (Kutsiyam), and the highest milling recovery was 62.40% (Malido) and Kapawod (62.80%).

TABLE 1: Physical Characteristics of 12 Philippines Indigenous Rice Varieties

Indigenous Rice	Color of the Hull	Color of the milled rice	Average Length of Palay Grains (mm)	Presence of AWN
(A) Awot	yellow-orange	yellow-orange	8.0	none
(B) Balayan	light orange	light- yellow	6.5	none
(C) Kabundulan	yellow-orange	light-yellow	9.0	none
(D) Kapawod	red-orange	red-yellow	8.0	none
(E) Katibus	light yellow	light-yellow	7.5	none
(F) Kutsiyam	yellow-orange	light-yellow	7.5	yes
(G) Magsanaya	yellow-orange	light-yellow orange	6.5	none
(H) Malido	yellow-orange	light-yellow	8.0	none
(I) Manumbalay	light brown	light-brown	5.8	none
(J) Palawan	yellow-orange	yellow-orange	8.5	yes
(K) Sulig	Light orange	orange	9.5	none
(L) Tapul	Light blue-violet	red-violet	8.5	none

TABLE 2: Summary of Result of the 12 Indigenous Rice Varieties and their Quantitative Characteristics.

TREATMENT MEANS OF GATHERED DATA

Treatment	No. of tiller/ hill	No. of grains/ panicle	Wt of 1000 grains (g)	Plant height at harvest (cm)	The yield of rice (kg/ha)	Milling recovery (%)
(A) Awot	13.50	180.00	23.25	123.75	3106.80	59.60
(B) Balayan	8.50	104.25	29.25	122.50	1750.83	59.00
(C) Kabundulan	9.75	113.00	32.50	135.25	2057.40	59.20
(D)Kapawod	8.00	148.50	26.50	122.25	1827.9	62.80
(E) Katibus	13.00	161.25	20.75	133.00	2491.98	60.40
(F) Kutsiyam	18.00	114.50	29.25	135.00	3486.82	62.20
(G) Magsanaya	9.75	148.50	24.25	126.50	1810.8	59.80
(H) Malido	15.00	104.25	30.00	118.50	2699.21	62.40
(I) Manumbalay	8.25	157.75	18.75	117.25	1415.81	59.20
(J) Palawan	21.25	102.50	26.75	144.00	33.51.37	59.20
(K) Sulig	12.00	111.50	28.00	131.00	2152.23	59.60
(L) Tapul	9.25	110.50	32.25	122.50	19.05.18	61.20
ANOVA RESULTS	significant	significant	significant	significant	significant	significant
C.V. (%)	12.05	9.76	5.11	4.28	12.57	1.68

CONCLUSIONS

There were 12 indigenous rice varieties planted by local farmers in central towns of Panay island particularly in the municipality of Lambunao and Calinog, Philippines These varieties were the Awot, Balayan, Kabundulan, Kapawod, Katibus, Kutsiyam, Magsanaya, Malido, Manumbalay, Palawan, Sulig and Tapul. Rice hull colors were yellow-orange, while the color of the grains was light yellow in most indigenous rice varieties. Kutsiyam and Palawan have the presence of awn while Sulig got the longest grain among the native rice.

The quantitative and production performance of indigenous rice indicates that the highest number of tillers/hills was Palawan (21 pcs), the highest number of grains/panicle was Awot (180 pcs), the heaviest 1000-grain weight was Kabundulan & Tapul (32.5 g & 32.25 g), the tallest was Palawan (144 cm), the highest harvested yield was Kutsiyam (3,486.82 kg/hectare) and the highest milling recovery were Malido and Kapawod (62.40% and 62.80%).

The preservation and conservation of indigenous rice varieties were still ongoing done by local farmers in the locality evident by the availability of more indigenous rice varieties found in the upland area of Lambunao and Calinog, Iloilo, Philippines.

RECOMMENDATIONS

The researcher recommends the planting of Palawan and Kutsiyan indigenous rice varieties in the central towns of Panay island for food sufficiency. Production of indigenous rice varieties are encouraged to upland farmers for production and conservation purposes. The participation of the National and Local governments in the preservation and conservation of indigenous rice is strongly encouraged for food supply and security. Furthermore, it recommends that more studies will be conducted in indigenous or upland rice varieties to compare the present findings.

REFERENCES

[1] Macintosh, D (2004). *Rice harvest is more affected than the first thought by global warming.* Media Resources, IRRI Online. Retrieved from http://www.irri.org.

[2] Fisher, KS (1996). Research approaches for variable rainfed system-thinking globally, acting locally. In-Pla*nt Adaptation and Crop Improvement.* Copper M & Hammer GL (ed). *CAB International*, Wallingford, UK, pp 25

[3] Anies, AJP (2014). *Traditional Upland Rice Varieties Mindanao (Philippines).* Retrieved from HTTP:// agris,fao,org/agris-search

[4] Philfoodie (2011). *Philippine Rice Varieties* – Philippine Food blog spot.com/2011/05/Philippine rice varieties. Retrieved: 3/23/17

[5] De Leon, JC (2014). n, (2014). *Rice that Filipinos Grow and Eat*. Retrieved from http://dirp3.pids.gov.ph.

[6] Philrice (2015), Magazine, Volume 28, No. 3. www.Philrice.gov.ph. Retrieved: 3/24/17

[7] Quin, R. and Aganon C. (2014). *Organic rice production*. Organic Agriculture in the Philippines: A Training Manual. PCAARRD Training Module No. 4/2014

[8] Gomez, A.A. (1984) *Statistical Procedures for Agricultural Research*, 2nd edition, John Wiley & Sons Inc., New York.

[9] IRRI, (2014), *Statistical Tool for Agricultural Research* (STAR) Software, Version 2.0.1, Biometrics and Breeding Informatics (bbi.irri.org) IRRI, Philippines