

## Consumer acceptability test on boiled tubers of ‘Baligonhon’ yam (*Dioscorea alata* L.) phenotypes

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### Article history:

Received: 20 November 2024

Revised: 12 February 2025

Accepted: 19 February 2025

Published: 9 February 2026

### Keywords:

Anthocyanin,  
Northern Mindanao,  
Carbohydrate,  
Staple food

### DOI:

[https://doi.org/10.26656/fr.2017.10\(1\).281](https://doi.org/10.26656/fr.2017.10(1).281)

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### Abstract

Direct utilization of crop genetic resources that are available in the locality is vital in achieving food security and in fighting poverty. ‘Baligonhon’ yam produces variable tuber flesh color [purple, rainbow (diluted rainbow) and white] at harvest, thereby reducing tuber quality. Rainbow is sold at a lower price, whereas white is considered non-marketable. Exploring the preference of the farmer among the three flesh colors is an initial step in exploring the usefulness of phenotypes with faded tuber color, such as white phenotype. This study involved 50 untrained panelists who are 20-59 years old, residents of Bantuanon, Lantapan, Bukidnon, and have previously tasted yams. Based on the 9-point hedonic rating scale, purple is the most preferred, followed by rainbow and white flesh colored tuber. Acceptability of tubers decreases along with their color. However, data revealed that the white phenotype is still acceptable even with simple preparation (boiling), suggesting higher potential for utilization as an alternative source of carbohydrate. White phenotype can contribute more to addressing global challenges of food insecurity amidst climate change when given value than just being discarded and left rotten in the farmer’s field.

## 1. Introduction

Roots and tubers are packed with calories and are nutrient-dense, a cheaper and excellent alternative staple among the people in the tropics and subtropics who largely consume cereals (Nuani, 2022). Purple/greater yam (*Dioscorea alata* L.) is one of the most popular root/tuber crops in the country with nutritional, medicinal and traditional importance (Aquino and Morales, 2021). It is locally known as ube. In the Philippines, there are only two varieties recommended by the National Seed Industry Council, namely, PSB VU-2 or Zambal and PRA-35, popularly known as ‘kinampay’ (<https://agriculture.com.ph/2019/08/08/ubi-production-guide>). ‘Kinampay’ is the dominant variety grown and produced in the province of Bohol. Nonetheless, there are other cultivated varieties that exist across the country. In the province of Bukidnon, ‘Baligonhon’ is the most common type of ube produced by the farmers. It has a purple flesh color that can be harvested as early as 6 months from planting.

‘Baligonhon’ yam is well adapted to the prevailing climatic conditions in the province. However, it is very

susceptible to anthracnose infection and other pests and diseases. Recently, local yam production in Bantuanon, Lantapan, Bukidnon, is confronted with another challenge relative to the quality and marketability of tubers. There are cropping seasons wherein farmers produce a high percentage of rainbow and white colored flesh even after careful selection of seed setts at planting. Rainbow-colored flesh is characterized by the occurrence of diluted purple color, giving off a mixture of white and purple color in the flesh. The white flesh tuber only has a small streak of purple, and white color dominates the flesh. The deterioration of purple color in tuber flesh affects tuber marketability (Wu *et al.*, 2015). Rainbow flesh tuber is marketable at a reduced price, while the white phenotype has no market at all. This forces the farmers to discard the white colored flesh tubers in the field.

Yam with purple colored flesh is widely used for flavoring and coloring, thus they are most preferred in the market (Depositario *et al.*, 2011). Its importance and utilization are well-established. In contrast, tubers with white colored flesh are very edible but not aesthetically

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attractive. Nevertheless, white flesh-colored tubers still contain anthocyanins with antioxidant properties (Lubag *et al.*, 2008). The study of Lubag *et al.* (2008) revealed high antioxidant activities of anthocyanin extracted from purple and white yam varieties compared to butylated hydroxyanisole and  $\alpha$ -tocopherol. Further, white phenotype may contain unique and useful gene/s for yam improvement against biotic and abiotic stresses, which are at risk of erosion when it remains neglected and underutilized. Conservation of this genetic material is essential in coping with the current challenge of global food security and poverty.

In plant genetic conservation, direct utilization is one potent approach in preserving genetic material (Salgotra and Chauhan, 2023). Several landraces of various crops cease to exist because farmers stopped planting them in lieu of modern genetically uniform varieties with higher-yielding potential (Villa *et al.*, 2005). White flesh 'Baligonhon' phenotype is a promising multi-purpose crop that can be used as food, feed, and even for medicinal purposes (Obidiegwu *et al.*, 2020). However, the popularity of the purple phenotype may hide and hinder its utilization potential. To maximize the income of the farmers and prevent the complete extinction of white 'Baligonhon' phenotypes, it is vital to explore their other useful value. Assessment of the preference of the residents who have direct access is an initial step in exploring the utilization of this phenotype. Hence, this study was conducted to determine the acceptability of 'Baligonhon' yam phenotypes planted during dry season cropping, involving residents of Bantuanon, Lantapan, Bukidnon.

## 2. Materials and methods

### 2.1 Limitations of the study

Panelists in this study were limited to ages 20 to 59 years old. Preferences for senior citizens and children may not be represented in the results obtained.

### 2.2 Time and place of the study

This study was conducted from August to September 2023 at Bantuanon, Lantapan, Bukidnon, with the local yam consumers as the panelists.

### 2.3 Sample preparation

Newly harvested tubers from 'Baligonhon' yam phenotypes were used in this study. The tubers were cleaned and washed using potable water and allowed to dry for 1 h. Tubers were then unpeeled using a knife, then washed in potable water and sliced into samples weighing at least 200 g.

Samples from each phenotype (5 kg) were separately

placed inside a pot with 1 L of potable water. The samples were cooked simultaneously, under the same cooking conditions for 45 min. The cooked tubers were sliced into smaller sizes, weighing around 50 g each. The slices from each phenotype were placed in individual aluminum food trays (Figure 1).



Figure 1. Boiled tubers of purple, rainbow, and white 'Baligonhon' yam phenotypes.

### 2.4 Consumer acceptability of the three phenotypes

A formal letter was sent to the Barangay Captain seeking permission to recruit possible panelists during the monthly barangay meeting. The principal Investigator was granted time during the August barangay assembly meeting. Prior to the consumer acceptability test, a focus group discussion was conducted to request the consent of each panelist according to the recommendation of the University of the Philippines Los Baños (UPLB) Research Ethics Board. After the orientation, panelist were provided with ballpens and score cards to record their assessment.

Boiled tubers were served to the panelists while still hot for acceptability evaluation following the methodology of Jahan *et al.* (2020). The study used the 9-point Hedonic rating scale (Table 1) to assess the acceptability of the yam phenotypes for consumption. Suggestions and recommendations are important sources of information; thus, they were also collected during the assessment. The panelists assessed the acceptability of each phenotype by tasting the boiled tuber and giving scores according to the 9-point Hedonic rating scale. The

Table 1. Hedonic rating scale used during the consumer acceptability test of yam phenotypes.

Hedonic rating	Description
1	Dislike extremely
2	Dislike very much
3	Dislike moderately
4	Dislike slightly
5	Neither like nor dislike
6	Like slightly
7	Like moderately
8	Like very much
9	Like extremely

assessment was done in less than 20 min. Panelists were provided with water for rinsing to refresh their palate after tasting each sample phenotype.

### 2.5 Statistical analysis

Data were collated and summarized after the consumer acceptability test. The simple regression model was also used to analyze the results. The phenotype based on color (purple, rainbow, and white) served as the independent variable, and consumer acceptability as the dependent variable.

## 3. Results and discussion

Hot boiled tubers of different ‘Baligonhon’ were tested by a group of fifty untrained panelists who previously consumed ‘Baligonhon’ yam either boiled yam or as an ingredient of other delicacies. Results obtained were presented and discussed based on the context of exploring the utilization of the variants of ‘Baligonhon’ yam, particularly the white phenotype that is often discarded and considered as non-marketable.

### 3.1 Acceptability of the three phenotypes

The 9-point hedonic rating scale revealed that the purple phenotype had a narrow distribution of ratings, i.e. most confined to the moderately- extremely liked range. The overall acceptability of the purple phenotype was very high (95%), as shown in Table 2 and Figure 2. More than half (58%) of the panelists extremely liked the boiled purple tuber, while 36% liked it very much. Only 6% liked it moderately, while nobody among them had given a neutral score or in the scale of disliked range (Table 2; Figure 2). This confirms the established popularity and wide acceptability of purple yams in the area.

Table 2. Overall consumers’ acceptability of the ‘Baligonhon’ yam phenotypes.

‘Baligonhon’ phenotype	Overall acceptability (%)	Standard deviation
Purple	94.67	±0.61
Rainbow	85.11	±1.21
White	78.22	±1.69
Acceptable value*	>70	----

Values presented are based on the mean hedonic rating scale, N=50.

\*Ramos *et al.* (2019)

Rainbow phenotype has 84% of the panelists like this phenotype, specifically extremely liked by 32%, very much liked by 24%, and moderately liked by 28% of the panelists. Only 10% of the panelists just barely liked it, while the remaining 6% were undecided whether they liked it or disliked it (Table 2; Figure 2).

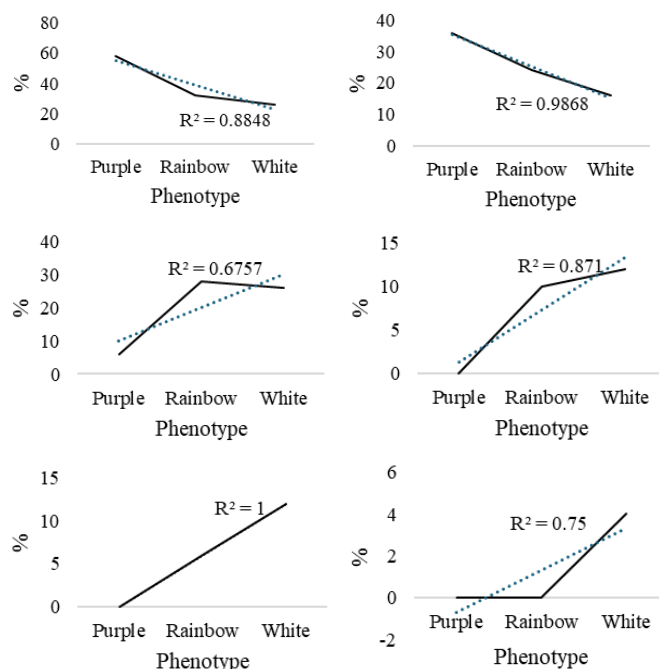


Figure 2. Simple linear regression analysis of each descriptive rating in the hedonic rating scale on the consumer’s acceptability of ‘Baligonhon’ yam phenotypes. (a) like extremely, (b) like very much, (c) like moderately, (d) like slightly, (e) neither like nor dislike and (f) dislike slightly and dislike moderately.

A wider window of distribution was obtained for the consumer’s acceptability of the white tubers (Table 2). White tubers were extremely liked by 26%, very much liked by 16%, and moderately liked by 26%, a total of 68%. The remaining 12% of the panelists slightly liked the white tuber, while 12% were undecided, and 8% disliked it (Table 2; Figure 2).

In terms of overall consumers’ acceptability rating, 95% of the panelists liked the purple phenotype (Table 3; Figure 3). For the rainbow phenotype, there were 85% who liked the taste of the boiled tuber of said phenotype. On the other hand, the overall acceptability of the white phenotype was at 78%, surpassing the 70% acceptability value established by Ramos *et al.* (2019) for overall consumers’ acceptability. Thus, indicating higher utilization potential of the white phenotype. The fact that the non-marketable white phenotype was accepted by

Utilization of white phenotype is suggested by the panelist	Frequency
Yam ball delight	1
Binignit ingredient	3
Best paired with coffee	1
White ube jam	1
White yam flour	1
White ube pastillas	1
Yam Suman	1
Total	9

local residents, even by just the simplest way of preparing it, suggests a higher potential for its utilization as an alternative source of carbohydrate. This can be taken advantage of with the increasing price per kilogram (PhP/kg) of rice and corn, which are the major staples in the country.

Acceptability of tubers declined along with their fading purple color (Figures 2 and 3). Nonetheless, the three phenotypes are still acceptable according to the established cut-off (70%), according to Ramos *et al.* (2019). Thus, there is a need to preserve these phenotypes. The white phenotype may not have a market in the locality at present, but the fact that 78% of the panelists liked its taste suggests great potential for the utilization of this phenotype in the future.

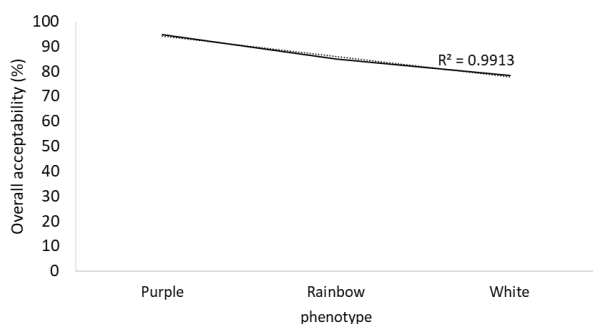


Figure 3. Simple linear regression analysis on the overall consumer's acceptability of 'Baligonhon' yam phenotypes.

### 3.2 Suggested utilization of white phenotype

Given the overall acceptability of the white phenotype, it is foreseen that acceptability and utilization of this phenotype will increase with further processing and value adding. Some of the panelists suggested that white tuber phenotype can be paired with coffee during snack time, and can be processed into sweetened Filipino 'kakanin' like delight, among others. Another panelist suggested that white phenotype can be a good ingredient of 'binignit', a traditional food served especially during the Lenten Season, just like other root crops with white colored flesh (Table 3). Further, during the preparation of the tubers for the consumer acceptability test, it was observed that white tubers turned purple when cooked together with purple tubers. Hence, enhancing its color is not difficult to make it more aesthetically attractive, like the purple phenotype. With these suggestions, observation and the starchy nature of white phenotype, many things can be done to maximize its potential and improve its utilization. As a whole, all 'Baligonhon' phenotypes are essential in overcoming the challenge of food security in terms of both quantity and quality.

## 4. Conclusion

Based on the results of this study, the consumers

preferred the tastes of the boiled three 'Baligonhon' yam phenotypes (purple, rainbow, and white) of purple yam. Thus, it is recommended that white colored tubers be processed into different kinds of food delicacies and be subjected to further sensory evaluations involving trained panelists. Likewise, comparison of the nutritional components of the three 'Baligonhon' yam phenotypes is also considered essential when it comes to enhancing their utilization.

### Conflict of interest

The authors declare no conflict of interest.

### Acknowledgements

This study was funded by the DOST-ASTHRDP. The Central Mindanao University administration is also acknowledged for the administrative support provided to the corresponding author.

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