
Profitability assessment of sweet potatoes (*Ipomea batatas*) in Claveria, Misamis Oriental

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Abstract The prevalence of male respondents (63.40%) signified male dominance in sweet potato production within the study area, and ages between 40 to 59 years constituted the largest group (46.30%) among the respondents. Most respondents (34.10%) had attained only an elementary education, with a mere 4.90% reaching college level. Regarding income sources, sweet potato production (26.82%) was prominent. Land ownership (90.20%) was prevalent, and owned 0.25 to 1 hectare of land, leading to 1-5 years of farming experience (53.70%). Moving to the yield and financial outcomes, three sweet potato varieties were assessed. Garnet achieved an average yield of 3,560.41 kg per hectare; Japanese yielded 2,720.36 kilograms per hectare, while the purple variety produced 3,800.00 kg per hectare. Gross incomes for these varieties were Php 44,620.29, Php 38,821.54, and Php 57,000.00, respectively. The study revealed that the Japanese variety exhibited the highest ROI at 98.82%, garnet (71.78%), and the purple variety (56.70%), with no significance difference at a 5% significant level, a p-value of 0.741ns. Regarding the relationships, gender exhibited a positive correlation ($r = 0.739$, $p = 0.016$), emphasizing its influence. The source of income had a positive correlation ($r = 0.014$, $p = 0.000$), underlining its relevance. Tenurial status showed a moderate positive correlation ($r = 0.250$, $p = 0.325$), indicating potential connections. These results highlighted the essential roles of gender, income source, and tenurial status. The remaining variables, age, educational attainment, total land area for sweet potatoes, and years in potato production, had minor or negligible correlations with other factors, suggesting limited associations. Challenges faced by the farmers based on rank include high cost of inputs, limited credit access, unstable prices, pest and disease issues, and inadequate market access. These findings emphasized the complexity of sweet potato production and offer valuable understanding for addressing challenges and enhancing profitability.

Keywords: Japanese variety, Garnet variety, Purple variety, Return on investment (ROI)

Introduction

The food security agenda of the government is reflected in the multi-food-energy source Food Staple Sufficiency Program (Department of Agriculture, 2012), which now includes root and tuber crops (RTCs) like sweet potato and

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cassava, as well as corn, banana, and Adlai (Job's tears). RTCs have been a staple and a source of nutrients among ethnic communities, upland/highland communities, and resource-poor smallholder farm systems. There is increasing recognition that RTCs can help make people food- and nutrition-secure and can provide sources of income from fresh roots and processing markets involving a range of food and non-food uses. Sweet potato "kamote" is also known as yam or kumera. It weighs between 0.5 and 3 kg and is elongated, although some are almost spherical. The sweet potato, scientifically known as *Ipomoea batatas*, is a perennial crop grown yearly on several continents (Kassali, 2011). The increased productivity and nutritional advantages of sweet potato, which is classified as the seventh most significant agricultural item globally with a total production of 103 million tons as of 2013 (Sugri *et al.*, 2017), make it one of the most important food sources in the world. It is regarded as the world's second most crucial food commodity due to its significant economic significance. Numerous sub-regions are home to sweet potato farms. Underdeveloped nations (Aneneokeakwa *et al.*, 2021). Based on the data from World Crops for the Northern United States, skin color can be yellow, orange, copper, red, and purple; the flesh can be white, yellow, dark orange, red, and purple. Sweet potato needs between 90 and 150 days of a frost-free period to produce harvestable roots. Sweet potatoes grow best in well-drained, loam soils, which result in more extensive and well-shaped roots. In the Philippines, sweet potatoes, or "camote" as they are locally called, are commonly referred to as the poor man's crop. Their scientific name is *Ipomoea batatas* L. It is a wholesome meal that is mainly eaten with vegetables and as a staple. Sweet potatoes were once only a small farmer's additional source of income. Still, because of the growing market demand for their products—such as flour, wine, confections, and feed—they are now an essential crop for their livelihood. According to data from the Philippine Statistics Authority (PSA), Eastern Visayas continued to be the region that produced the sweetest potatoes in 2019, with 98.95 thousand metric tons, or 18.8% of the overall output. Lirag (2019) states that sweet potato farming is a profitable enterprise in the study area when taking into account the profit realized by the farmers as indicated by the returns on investment (ROI) value of 3.88, which suggests that every NGN1 invested in sweet potato farming in the study area returns a profit per hectare of NGN3.88 kobo to the farmer despite the various challenges the farmers face. The study also shows that sweet potato production is generally successful, yielding a high 144% financial return to farmers, or Php 48,400.00 net income per hectare. According to the Philippine Root Crop Research Center, processed sweet potatoes have a higher nutritional and economic value than fresh roots in food goods. Sweet potatoes are in high demand due to their numerous culinary and industrial applications. However, this demand has not been satisfied because of

ongoing issues with low farm productivity and other problems affecting sweet potato growers. The absence of a market and high transaction costs are two primary obstacles that farmers must overcome to achieve the goals of agricultural growth.

Lirag (2019) reported that in addition to inadequate marketing strategies, growers of sweet potatoes encounter many obstacles that substantially impact their maximum production efficiency. Inadequate storage facilities, high production costs, and an unreliable transportation infrastructure further contribute to post-harvest spoiling. Based on data from the Philippine Statistics Authority (PSA) for 2019, the provinces of Bicol and the central and eastern Visayas regions are where most of the sweet potato production is located. Notwithstanding its potential, the processing development of this variety has yet to reach the farm level, which presents difficulties for the industry. Furthermore, according to a study, income has an inverse association with years of experience and tenurial status but a positive correlation with farm size, labor input costs, other input expenses, and mode of sale. In addition, the cost of different inputs and the size of the farm are significant variables that affect the income of sweet potato farmers. Sweet potato producers face a variety of issues. One crucial challenge is the lack of market access, which is a substantial barrier to achieving agricultural development goals.

In Misamis Oriental, particularly in Claveria, most of the sweet potato grower's problems are the sweet potato weevil, low consumption, and overproduction based on the response of some sweet potato growers during the baseline survey. Thus, this study was proposed to assess the profitability of farmers growing sweet potatoes in the selected barangays of Claveria, Misamis Oriental.

Materials and methods

Setting

The study was conducted in Barangay Poblacion, Lanise, Patrocenio, Aposkahoy, Claveria, and Misamis Oriental. The study lasted from August to December 2022.

Sampling procedure

The method of purposive sampling was strategically chosen to determine the participants of the study. This approach, classified as a non-probability sampling technique, entails the deliberate selection of individuals based on

predefined criteria or specific attributes that hold significance within the context of the research investigation.

Identification of the respondents

The study's respondents were sweet potato growers in barangay Aposkahoy, Lanise, Poblacion, Patrocenio, Claveria, and Misamis Oriental.

These four barangays have the highest sweet potato production, as reported by the Department of Agriculture Municipal Agriculture Office (DA-MAO) in Claveria, Misamis Oriental. The respondents were selected randomly based on the following considerations as those having at least one-fourth hectare of land used for sweet potato production, and financial data from the last cropping season in 2021.

Instrument of the study

The research employed survey methodologies for data collection, utilizing semi-structured questionnaires as the primary survey tool among individuals engaged in sweet potato production. The survey questionnaire encompassed three essential parts. The first part captured the demographic and socio-economic characteristics of the respondents. The second part focused on conducting a thorough analysis of sweet potato production's cost and return analysis. The final part examines the influences affecting the profitability of sweet potato production.

Ethical consideration

Amid the pandemic, data collection occurred physically while meticulously adhering to the stringent protocols established by the Inter-Agency Task Force (IATF). This approach was chosen to ensure all respondents' safety, well-being, and rights. Every interaction, whether conducted virtually or in person, was conducted in alignment with the health and safety guidelines stipulated by relevant authorities.

The informed consent procedures underwent adaptation to encompass a comprehensive account of the potential COVID-19-related risks. The researcher obtained explicit consent from participants, highlighting the voluntary nature of their participation in the study. Assurances were provided regarding the secure storage of all collected information, with exclusive access granted solely to authorized research personnel. This approach was integral to maintaining the privacy of the respondents. A meticulous anonymization process was undertaken

as part of data analysis and reporting, ensuring that participant data remained confidential. All identifiers were intentionally segregated from the research findings, thereby upholding the integrity of the information gathered.

Data collection quality control

The collection of data for the study was thoroughly organized and carried out. The survey instrument was pre-tested on selected farmers in Claveria before the interview to check its readability and establish the time allotment required for each respondent during the survey. Before its final reproduction, the instrument underwent additional improvement following the pre-testing. The members of the survey team and the enumerators participated in a mock interview to practice conducting the interview procedure after receiving training to gauge their comprehension of the questionnaire's content. The researchers and team leaders closely monitored the interviewers during the survey to make sure the protocol was followed, and that the interviewer could appropriately interpret the context of the inquiry.

In cases where the study team found that the respondents' responses needed to be verified, a follow-up phone call was made to them. The data-gathering method was carefully designed and carried out to guarantee the authenticity and correctness of the data acquired for the study.

Data processing and analysis

After data collection, the survey results were processed, consolidated, tabulated, and analyzed using statistical software. Several statistical techniques were used to analyze the data, including frequency, percentage, and ranking, to express the relative frequency of survey responses and other data. One-way ANOVA was used to compare the profitability of the top three varieties, and the return on investment was used to evaluate cost-effectiveness.

Results

Demographic profile

The results revealed that most respondents were male, 63.40%, while females were only 36.60%. This suggests that in the research area, sweet potato production was dominated by men. The average age of the respondents ranges from 41 to 60, with 46.30% 51 years old. Twelve (12) people aged 21–40 account for 29.30%, and those aged 61 and above account for 24.40%. The investigation

showed that the oldest in the age group is 70, and the youngest is 29. About 34.10 percent of the population was only in elementary school, and 2.90 percent completed college (Table 1).

Table 1. Demographic profile of sweet potato growers in Claveria, Misamis Oriental

Demographic Characteristics	Frequency (N=41)	Percent (%)
Gender		
Male	26	63.40
Female	15	36.60
Age		
Young (39 years old and below)	12	29.30
Middle age (40-59 years old)	19	46.30
Old (60 years old and above)	10	24.40
Educational Attainment		
Elementary level	12	29.30
Elementary graduate	14	34.10
High school level	8	19.50
High school graduate	5	12.20
College graduate	2	4.90

Socio-economic profile

Data revealed that the respondent's primary source of income came from sweet potato production (26.82%), while the laborer got seven-point thirty percent (7.30%). About 90.20% of the respondents were landowners, while two-point four percent (2.40%) were leasehold farmers (Table 2). The total land owned by most of the sweet potato growers in Claveria was 0.25 to 1 hectare, while the least entire land owned was 3.25 to 4 hectares. The number of years engaged in sweet potato production shows that 1-5 years, 53.70% of the respondents have years of farming experience, and only four-point eighty percent (4.80%) were more than 21 years of farming experience. The findings implied that most sweet potato smallholder farmers have long farming experience of 1-5 years. The study revealed that 59.10% of the respondents grew Japanese/Red skin with white flesh variety, while garnet/orange skin and flesh got 36.40%, and only 4.50% had purple/purple skin and flesh. The sweet potato growers owned the business (100%).

Income and profitability statement

The comprehensive overview of yield and financial outcomes associated with various sweet potato varieties, as shown in Table 2. The garnet variety exhibited an average yield of 3,560.41 kg per hectare. In comparison, the Japanese variety yielded an average of 2,720.36 kg per hectare, and the purple variety showcased an average yield of 3,800.00 kilograms per hectare. Buyers bought the garnet variety at an average price of Php 13.12 per kg, the Japanese variety at Php 14.04, and the purple variety at Php 15.00, resulting in gross incomes of Php 44,620.29, Php 38,821.54, and Php 57,000.00, respectively.

Table 2. Socio-economic profile of sweet potato growers in Claveria, Misamis Oriental

Socio-Economic Profile	Frequency (N=41)	Percent (%)
Main Source of Income		
Sweet potato production	11	26.82
Vegetable production	9	21.95
Corn production	7	17.10
Livestock production	6	14.63
Sari-sari store	5	12.20
Labourer	3	7.30
Land Tenurial Status		
Farm owner	37	90.20
Tenant	3	7.30
Leasehold farmer	1	2.40
Total Land Area/Hectare		
0.25 - 1	20	48.80
1.25 - 2	9	21.90
2.25 - 3	5	12.20
3.25 - 4	3	7.30
4.25 - 5	6	14.70
Years Engaged in Sweet Potato Production		
1-5	22	53.70
6-10	6	14.60
11-15	5	12.20
16-20	6	14.60
21 above	2	4.80
Variety Used		
Garnet/orange skin and flesh	16	36.40
Japanese/red skin with white flesh	26	59.10
Purple/purple skin and flesh	2	4.50
Type of Farming Business		
Single owner	41	100.00
Partnership	0	0.00

Regarding production costs, garnet growers incurred an average of Php 16,120.00, while Japanese growers reported Php 11,546.00, and those cultivating the purple variety faced an average production cost of Php 15,057.00. Calculating the net financial outcome, garnet secured a net income of Php 18,643.24, Japanese recorded Php 19,295.87, and the purple variety yielded an income of Php 20,625.00 (Table 3).

Interestingly, the study revealed that the Japanese variety attained the highest return on investment (ROI) of 98.82%, followed by the garnet variety with an ROI of 71.78%. In comparison, the purple variety achieved an ROI of 56.70%. Overall, the study showed no significant difference observed in the ROI across the three varieties.

Table 3. Income and profitability statement of three (3) varieties of sweet potato production in Claveria, Misamis Oriental

Income statement	Sweet potato varieties			Significance
	Garnet (Php)	Japanese (Php)	Purple (Php)	
Average Yield	3,560.41	2,720.36	3,800.00	
Selling Price	13.12	14.04	15.00	
Gross Income	44,620.29	38,821.54	57,000.00	
Cost of Production	16,120.00	11,546.00	15,075.00	
Harvesting Expenses	6,483.53	4,805.14	11,100.00	
Post-harvest Expenses	679.41	1,050.63	3,600.00	
Marketing Expenses	2,017.65	1,878.61	4,200.00	
Other Expenses	1,916.67	987.50	2,400.00	
Total Expenses	25,977.06	19,525.67	36,375.00	
Net Income	18,643.24	19,295.87	20,625.00	
Return On Investment	71.78%	98.82%	56.70%	0.741 ^{ns}

ns.= not significant

Correlation analysis

The correlation analysis of the socio-demographic characteristics of the respondents has yielded intriguing insights. The age of respondents showed a negligible negative correlation with the other variables, suggesting no substantial association ($r = -0.004$, $p = 0.731$). The gender of respondents, on the other hand, exhibited a noteworthy positive correlation ($r = 0.739$, $p = 0.016$), indicating that gender might be influential in certain aspects. Educational attainment discovered

a minor negative correlation ($r = -0.132$, $p = 0.331$), suggesting a limited link. The main source of income revealed a positive correlation ($r = 0.014$, $p = 0.000$), implying potential relevance in understanding income sources. Tenurial status showed a moderate positive correlation ($r = 0.250$, $p = 0.325$), suggesting a possible connection. The total land area planted with sweet potatoes displayed a weak positive correlation ($r = 0.100$, $p = 0.420$), indicating a slight association. Lastly, years engaged in potato production exhibited negligible positive correlation ($r = 0.026$, $p = 0.569$), suggesting limited linkage (Table 4).

Table 4. Relationship between the socio-demographic characteristics of the farmers and their return on investment (ROI)

Socio-Demographic Characteristics	Correlation Coefficient	P value
Age of Respondents	-.004	.731 ^{ns}
Gender of Respondents	.739	.016*
Educational Attainment	-.132	.331 ^{ns}
Main Source of Income	.014	.000**
Tenurial Status	.250	.325 ^{ns}
Total Land Area Planted with Sweet Potato	.100	.420 ^{ns}
Years engaged in Potato Production	.026	.569 ^{ns}

a. Dependent Variable: Return on Investment

*Significant at $p \leq 0.05$

** Significant at $p \leq 0.01$

Problems met in sweet potato production

Study findings showed that the farmers in the study area faced high input costs, difficult loan availability, low prices, pest and disease incidence, and poor market access. Farmers said the biggest production problem in sweet potato growing was the high fertilizer cost. They said that fertilizer prices continuously increased while their products experienced unstable prices. The second was low production; due to the high fertilizer cost, farmers tend to lessen fertilizer use, resulting in low production. The third was the poor variety used. Sweet potato growers stated that farmers lose their profit because their products cannot be sold due to the poor variety they choose for planting. At the same time, the lowest was the weather condition because, according to the farmers, sweet potatoes have a high tolerance to weather conditions (Table 5).

Table 5. Production-related problems met by sweet potato growers in Claveria, Misamis Oriental

Production related problems	Rank
High Cost of Fertilizer	1
Low Production	2
Poor Variety Used	3
High Cost of Planting Materials	4
Poor Soil Condition	5
Pest and Diseases	6
Weather Condition	7

Discussion

According to the study conducted by Tor *et al.* (2017), root and tuber crop production was dominated by males, resulting in 77.30% of the total population within the study area, and this could be attributed to the fact that males are likely to have access to capital which will enable them to invest in improved storage methods than the females. Okeke *et al.* (2015) found that root producers, primarily men, have more excellent options for investment capital than women since women often spend most of their time and earnings on their children. Also, Tor *et al.* (2017) stated that 40-year-olds are active in farming and have more experience adapting improved storage techniques. Additionally, farmers had farming experience of 16-20 years. Natson *et al.* (2016) reported that males dominated land preparation and planting.

According to Ndou *et al.* (2020), sweet potato vine nurseries and growers can earn substantial income from sweet potato enterprises. Sambitan *et al.* (2018) stated that the profitability of sweet potato production varied depending on the location and size of the farm. Larger farms tended to be more profitable than smaller ones, and farms located in areas with better access to markets and transportation infrastructure tended to have higher net incomes.

Zul *et al.* (2020) found that sweet potato farming in Gunung Talang, West Sumatra, Indonesia, was financially lucrative. Farmers earned IDR 39,506,345 per hectare per season, resulting in a net income of IDR 27,229,436. With a ratio of 2.08, the profitability was evident. The B/C ratios, on a total and cash cost basis, were 1.11 and 2.20, respectively. This suggests that sweet potato farming was a significant income source for Gunung Talang farmers. Another study by Sambitan *et al.* (2018) stated that sweet potato production was profitable for farmers in the Philippines, with an average gross income of Php 91,800 per

hectare and a net income of Php 46,230 per hectare. Salvador and Banoc (2020) revealed that sweet potato production is affected by different problems related to the incidence of insect pests and diseases and erratic climatic conditions, which hamper production by 41.33 to 42.22 percent.

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