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## **Agro-economic assessment: Evaluating root crop-based enterprises in Claveria, Misamis Oriental**

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**Abstract** Results showed that farming is the primary source of income. The majority of the respondents owned the land they tilled and commonly used draft animals for plowing and harrowing the field. The respondents were found to be knowledgeable on fertility management and prefer the cultural method of pest control and management. The majority of respondents sold their produce to identified regular traders to ease and hasten marketing and disposal of produce. The decreasing production was observed in cassava cultivation but it increased in average price which had reported between 2019 and 2020. There were no significant differences reported in the average yield and price of sweet potatoes but there was notable increased in the gross income, improvements in net income and returned on investment. Despite these positive trends, the changes were not statistically significant. The common problems cited by the growers were poor soil conditions and unstable prices of products, which created difficulties in marketing their produce.

**Keywords:** Farming practices, Marketing strategies, Profitability, Return on investment

### **Introduction**

Root crops are essential *economic crops* to Philippine agriculture and are grown in many regions of the country. The most cultivated root crops in the Philippines include cassava, sweet potato, taro, yam, and potato. There is increasing recognition that root and tuber crops (RTCs) can help make people food- and nutrition-secure, with the Philippine government now including sweet potato and cassava in its Food Staple Sufficiency Program (DA, 2012 as cited by Singh *et al.*, 2021). RTCs also have great potential to reduce poverty by providing income from marketing fresh roots and processed products for various food and non-food uses. In addition, RTCs can serve as reserve crops for vulnerable communities following extreme weather events and disasters. Root and tuber crops are the most important food crops after cereals. Root and tuber

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crops provide a substantial part of the world's food supply and are also an essential source of animal feed and processed products for human consumption and industrial use (Singh *et al.*, 2021).

Root and tuber crops are generally less expensive than other crops, such as grains, and are thus more accessible to small-scale farmers. These crops also have relatively stable prices, providing a dependable income for farmers. Moreover, root and tuber crops have significant export potential, particularly for processed products such as starch and flour, which are highly demanded in the global market. However, the profitability of root and tuber crops is influenced by various factors, including production costs, market prices, and weather conditions. Farmers must carefully manage these factors to enhance profitability and mitigate risks associated with fluctuating market conditions and climatic uncertainties (Singh *et al.*, 2021).

According to data from the Food and Agriculture Organization (FAO), Asia produces more than 60% of the global output of root and tuber crops, with a total production of approximately 1.2 billion tons in 2019. In Africa, root and tuber crops are critical in ensuring food security among rural populations. These crops offer numerous advantages, including adaptability to diverse soil and climatic conditions, suitability for marginal lands, high yield potential, and rich nutritional composition. They serve as valuable sources of carbohydrates, vitamins, and minerals, contributing to efforts against malnutrition and related health issues. Additionally, root and tuber crops play a vital role in the livestock industry by providing essential animal feed for producing meat, milk, and eggs (Food and Agriculture Organization, 2019).

Philippine Statistics Authority states that the total production of root crops in the Philippines in 2020 was around 8.5 million metric tons. This represented a decrease of 1.1% compared to the previous year, mainly due to the impact of the COVID-19 pandemic on agriculture. Regarding specific regions, the Philippines' top producers of root crops are generally located in Mindanao and the Visayas (Philippine Statistics Authority, 2017).

In Northern Mindanao, important root crops are cassava (*Manihot esculenta* Crantz), sweet potato (*Ipomea batatas* Linn.), aroids or gabi (*Colocasia esculenta* Linn Poir), and yam or ubi (*Dioscorea alata* Linn.) and according to Dejarme-Calalang *et.al*, 2015, Bukidnon produces the most root crops in the region (P324.492 tons), followed by Misamis Oriental (173.238 tons). Root crops are important raw materials for both food and industrial processing. These are also essential and even staple food for mountain people who need access to rice or corn. Cassava is the region's primary root crop product, followed by sweet potato. Cassava is used for food and raw materials

for starch and livestock feeds. Root crops are essential to highland marginal farmers during the dry season because they resist drought.

Farmers in Claveria, particularly those with limited resources, mainly grow root and tuber crops for subsistence, particularly during food shortages or when other crops fail. Any surplus production is sold for cash. However, root crop growers often need more time to improve their production methods despite the potential for increased profitability. This is because they need access to markets, have limited contact with traders, and more information on the opportunities for tradable root and tuber crop products and markets (FAO, 2018). Additionally, these farmers often need access to advanced technologies or business service providers to help them increase their productivity and profitability (FAO, 2020). As a result, many farmers need help to achieve economic stability and growth in their root and tuber crop-based enterprises (World Bank, 2019).

Assessing the profitability of root crop-based enterprises is beneficial for farmers in Claveria, given the municipality's extensive land area. However, like any other business venture, root crop growers are exposed to risks inherent in their undertaking. Thus, the study evaluated the profitability and identified the factors affecting the area's production and profitability of root crop-based enterprises.

## **Materials and methods**

### ***Setting***

The study was conducted in barangay Gumaod, Cabacungan, Kalawitan, Tamboboan, Panampawan, Rizal, Madaguig, Lanise, Aposkahoy, and Parmbugas, Claveria, Misamis Oriental focusing on the different root crop growers in the said locality.

### ***Sampling procedure***

The purposive sampling technique was employed in selecting the respondents because purposive sampling is a non-probability sampling technique that involves selecting participants who meet specific criteria or possess certain characteristics relevant to the research study.

### ***Identification of the respondents***

83 root crop growers were selected as respondents for the study from the 10 barangays of Claveria, Misamis Oriental. The respondents were identified

from the list of root crop growers obtained from the data of the Municipal Agriculture Office (MAO) in the areas covered by the study. These growers had cultivated at least 1/4 hectare for at least two years from 2019 to 2020.

### ***Instrument of the study***

The study used survey instruments in data gathering. It utilized the semi-structured questionnaire to conduct the survey, administered to the root crop growers. The questionnaire contained the following sections: socio-demographic characteristics, agricultural production and services, cost and return analysis, and problems met during production and marketing.

### ***Ethical consideration***

Following the ethical consideration of informed consent, the researcher secured the respondent's consent with emphasis on voluntary participation in the study and assured the confidentiality of the data gathered.

### ***Data collection quality control***

The data gathering process for the study was carefully planned and executed. Before the interview, the instrument was pre-tested on some farmers in Claveria to validate its ease of understanding and determine the time allotment needed per respondent during the survey. After the pre-testing, further instrument refinement was done before its final reproduction. The survey team and enumerators were trained to assess their understanding of the questionnaire's content, and a mock interview was conducted among the team members and enumerators to practice the delivery of the interview process.

During the survey, the researchers and team leaders carefully observed the enumerators throughout the interview to ensure that the procedure was implemented, and that the enumerator could interpret the context of the questionnaire as expected.

A follow-up phone call was initiated to the respondents for items in the questionnaire with responses requiring verification, as checked by the study team. Overall, the data-gathering process was meticulously planned and executed to ensure the accuracy and validity of the data obtained for the study.

### ***Data processing and analysis***

After the 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 distribution, and weighted mean. The weighted mean was used to determine the average value of the responses to each item in the questionnaire.

The independent sample t-test was employed to assess whether there were significant differences between the crop production of root and tuber crops in 2019 and 2020.

## Results

### *Demographic profile*

The data showed that out of 83 respondents, 47 are male (56.6%), and 36 are female (43.4%) as seen in Table 1. This implies that males were more prevalent than females. In terms of age distribution, most of the respondents (59.0%) were middle-aged, with 21.7% being young (below 40 years old) and 19.3% being old (60 and above). It indicated that the root-crop growers in Claveria, Misamis Oriental, are generally experienced in farming and may have gained valuable knowledge and skills over the years. However, many younger growers may bring new perspectives and ideas to the sector.

**Table 1.** Demographic profile of the respondents in Claveria, Misamis Oriental

DEMOGRAPHIC CHARACTERISTICS	FREQUENCY	%
Sex		
Male	47	56.60
Female	36	43.40
Age (average age, 48 years old)		
Young (below 40 years old)	18	21.70
Middle Age (40 – 59 years old)	49	59.00
Old (60 years old and above)	16	19.30
Educational Attainment		
Elementary level	17	20.50
Elementary graduate	23	27.70
High school level	16	19.30
High school graduate	18	21.70
Vocational course	2	2.40
College level	5	6.00
College graduate	2	2.40

Regarding educational attainment, the most common level of education was elementary graduates (27.7%). This implies that there are limited opportunities for higher education in the area or that many growers prioritize gaining practical skills and experience over formal education. However, it is worth noting that a significant percentage of respondents also had a high school education or higher, suggesting there were also opportunities for further education and training.

***Socio economic profile***

Regarding occupation, 97.6% identified as farmers, highlighting the importance of agriculture as a primary source of income (Table 2). The small percentage of respondents identified as a farmer, and barangay health workers /farmers / barangay kagawad may indicate that some growers also hold other roles and responsibilities within their communities.

**Table 2.** Socio-economic profile of the respondents in Claveria, Misamis Oriental

SOCIO-ECONOMIC CHARACTERISTICS	FREQUENCY	%
Occupation		
Farmer	81	97.60
Farmer and barangay health worker	1	1.20
Farmer/barangay kagawad	1	1.20
Source Of Income		
Farming	82	80.39
Employment	17	16.67
Business	3	2.94
Years in Farming (17)		
Below average	44	53.00
Above average	39	47.00

The primary source of income for the respondents was farming, with 80.39% reporting it as their sources of income. However, a small percentage of growers reported employment or business as their source of income, suggesting that there may be opportunities to diversify income sources in the area. The data showed that the respondents' average years in farming were 17.82. It signified that the root-crop growers had significantly experienced in agriculture, which may contribute to the overall productivity and success of the sector in the area.

***Production/Technical practices***

Most land preparation activities, specifically plowing, were accomplished using draft animals (65.90%), followed by manual cultivation (20.45%) and mechanized methods (9%), with a small percentage (4.54%) using a combination of these methods (Table 3). The frequency of plowing also varied, with 47.62% of growers plowing their fields once, 34.52% plowing twice, and 4.76% plowing more than three times. harrowing, most root-crop growers (80.85%) performed this activity using draft animals, while a smaller percentage (8.51%) used a combination of these methods. The frequency of harrowing varied, with 42% of respondents choosing to leave their fields unharrowed, 38.10% harrowing once, and the remaining farmers performing the activity more than once.

**Table 3.** Production and technical practices by the respondents in Claveria, Misamis Oriental

<b>PRODUCTION/TECHNICAL PRACTICES</b>	<b>FREQUENCY</b>	<b>%</b>
Frequency of plowing the field prior to planting		
Once	40	47.62
Twice	29	34.52
Thrice	1	1.19
More than thrice	4	4.76
Unplowed/unharrowed	10	11.90
Method of Plowing		
Draft animal	58	65.90
Mechanized	8	9.00
Combination	4	4.54
Manual/human	18	20.45
Frequency of harrowing the field prior to planting		
Once	32	38.10
Twice	13	15.48
Thrice	1	1.19
More than thrice	2	2.38
Unplowed/unharrowed	36	42.86
Method of Harrowing		
Draft animal	38	80.85
Mechanized	5	10.64
Manual/human	4	8.51

### *Fertilizer application*

As fertilizer application, 65.1% of the respondents applied fertilizers to their production, while the remaining 34.9% did not use fertilizers (Table 4). Among those who applied fertilizers, the majority (36.4%) did so once throughout the cropping season. Regarding the types of fertilizer used, 42.3% of the respondents used organic fertilizers, while inorganic and combination fertilizers used 23.9%.

**Table 4.** Fertilizer application practice by the respondents in Claveria, Misamis Oriental

FERTILIZER APPLICATION	FREQUENCY	%
Applied Fertilizer for the production		
Yes	54	65.10
No	29	34.90
Frequency Fertilizer applied		
Once	28	36.40
Twice	23	29.90
Thrice	1	1.30
None	25	32.50
Types of Fertilizer used		
Organic	30	42.30
Inorganic	17	23.90
Combination	17	23.90
No application	7	9.90

### *Marketing practices*

Among the respondents, 57.75% reported personally disposing of their root crops, which could suggest that they consume the crops themselves or give them to family and friends (Table 5). Additionally, 41.55% of respondents sold their root crops, indicating a market demand for these crops. Regarding home consumption, only 0.70% of respondents reported using root crops as planting material. This may indicate that most crops produced are intended for something other than future planting but for immediate consumption or sale. Regarding market outlets, 82.0% of respondents reported selling their root crops to traders/suki, while only 18.0% directly sold their crops to the local market. This may suggest that most respondents rely on intermediaries to sell their root crops.



**Table 5.** Marketing practices of the respondents Claveria, Misamis Oriental

MARKETING PRACTICES	FREQUENCY	%
Breakdown of root-crop disposal		
Personal	82	57.75
Sold	59	41.55
Home consumption		
Planting material	1	0.70
Market Outlet		
Traders/suki	73	82.00
Direct selling to a local market	16	18.00

**Cassava**

The data revealed a non-significant decreased in cassava yield from 9,148.69 kg in 2019 to 7,883.63 kg in 2020, with t-values of 0.777 and 0.754, respectively ( $p > 0.05$ ) as seen in Table 6. The average price of cassava increased slightly from 9.60 to 11.14, but the t-values of -1.633 and -1.407 indicated that this change was not statistically significant. Similarly, gross income, production cost, net income, and returned on investment that showed minor changes, but their corresponding t-values of 0.570, 0.557, 0.534, 0.523, 0.612, and 0.629 were not statistically significant.

**Table 6.** Cost and return analysis of cassava production in Claveria, Misamis Oriental

Cassava	Mean		t- value		Significance
	2019	2020	2019	2020	
Average yield (kg)	9,148.69	7,883.63	0.777	0.754	0.439ns
Average price	9.60	11.14	-1.633	-1.407	0.106ns
Gross income	88,414.92	79,206.33	0.570	0.557	0.570ns
Production cost	13,207.10	12,096.88	0.537	0.548	0.579ns
Net income	75,207.82	72,217.16	0.534	0.523	0.585ns
ROI	7.60	6.31	0.612	0.629	0.542ns

\* Significant at a level of 5% of probability ( $p < .05$ ), ns = Not-significant ( $p \geq .05$ )

### *Sweet potato*

The average yield of sweet potato increased from 3,897.69 kg in 2019 to 5,192.00 kg in 2020, with t-values of -0.586 and -0.559, respectively ( $p > 0.05$ ), indicating no significant difference (Table 7). The average price also saw a slight increase from 15.31 to 16.40, but the t-values of -0.529 and -0.541 were not statistically significant. Gross income showed a significant increase from 50,134.62 to 75,100.00, with t-values of -0.769 and -0.729. The production cost remained relatively stable, and net income and exhibited ROI increased. However, none of these changes were statistically significant, as indicated by the non-significant t-values.

**Table 7.** Cost and return analysis of sweet potato production in Claveria, Misamis Oriental

Sweet potato	Mean		t- value		Significance
	2019	2020	2019	2020	
Average yield (kg)	3,897.69	5,192.00	-0.586	-0.559	0.564ns
Average price	15.31	16.40	-0.529	-0.541	0.602ns
Gross income	50,134.62	75,100.00	-0.769	-0.729	0.450ns
Production cost	12,261.54	12,200.00	0.010	0.010	0.992ns
Net income	37,873.08	62,900.00	-0.792	-0.749	0.437ns
ROI	4.17	6.08	-0.695	-0.665	0.494ns

ns = Not-significant ( $p \geq .05$ )

### *Gabi/Taro*

The average yield of gabi/taro increased from 525.33 in 2019 to 591.43 in 2020, with t-values of -0.209 and -0.219, respectively ( $p > 0.05$ ), indicating no significant difference (Table 8). The average price also experienced a slight increase from 17.00 to 21.43, but the t-values of -1.239 and -1.247 were not statistically significant ( $p > 0.05$ ). Similarly, gross income showed a notable increase from 8,788.78 to 13,300.00, with t-values of -0.845 and -0.829 ( $p > 0.05$ ). The production cost remained relatively stable, and net income and ROI increased. However, none of these changes were statistically significant, as indicated by the non-significant t-values.

**Table 8.** Cost and return analysis of cassava production in Claveria, Misamis Oriental

Gabi/Taro	Mean		t- value		Significance
	2019	2020	2019	2020	
Average yield	525.33	591.43	-0.209	-0.219	0.838ns
Average price	17.00	21.43	-1.239	-1.247	0.236ns
Gross Income	8,788.78	13,300.00	-0.845	-0.829	0.412ns
Production cost	2,533.33	2,542.86	-0.007	-0.008	0.994ns
Net Income	6,255.44	10,757.14	-1.000	-0.953	0.334ns
ROI	3.50	4.03	-0.218	-0.219	0.831ns

\* Significant at a level of 5% of probability ( $p < .05$ ), ns = Not-significant ( $p \geq .05$ )

**Table 9.** Problems met/factors affecting the profitability of the respondents in Claveria, Misamis Oriental

PROBLEMS MET/FACTORS AFFECTING	FREQUENCY	%
Production related problems		
High cost of Fertilizer	49	28.80
Poor variety used	11	6.50
Low production	38	22.40
High cost of stem cuttings/planting materials	1	0.60
Poor soil conditions	58	34.10
Pest and diseases	10	5.90
Weather conditions	2	1.20
Lack of water supply	1	0.60
Marketing related problems		
Transportation	44	30.14
No stable buyers	44	30.14
Unstable prices of a product	58	39.73

### ***Problems met***

The common problems in root crop farming were poor soil conditions (34.1%), followed by high cost of fertilizer (28.8%), and low production (22.4%) as shown in Table 9. Other issues such as poor variety selection, pests and diseases, weather conditions, high cost of planting materials, and lack of water supply were less frequently reported. In terms of Marketing, unstable prices of products were identified, representing 39.73% of the total occurrences.

### **Discussion**

According to the study conducted by Tor *et al.* (2017) stated that the root and tuber crop production were dominated by males resulting in 77.3% of the total population within the study area, and this could be attributed to the fact that males were likely to access to capital which enabled them to invest in improved storage methods more than the females. This is also supported by the study of Okeke *et al.* (2015), who posited that root and tuber producers, who were mostly males, had more opportunities for investment capital than females, who tended to devote most of their earnings and time to their families. The farming experience of the farmers revealed that a higher proportion (48.45%) of the farmers had a farming experience of 16-20 years, with the mean farming experience of the farmers being 13.91 years, suggesting that the farmers had gathered reasonable experiences that would aid them in making useful decisions regarding the private extension service delivery in the study area (Onyemekihian *et al.*, 2022). Based on the study conducted farmers in Claveria still use traditional methods in production and marketing practices. A similar study conducted by Joy B. Araza (2023) states that 95% of farmers in Samar are still used traditional methods. It also stated that most farmers were not applying fertilizers, which also led to lower production. It was due to the root crops responded very well to fertilization in addition to its ability to produce a reasonable yield on low-fertility soils. However, the findings of this research are contradicted the findings of Joy (2023) with regards to the management of the fertilizer that the farmers in Claveria are applied fertilizer in their crops whether organic or inorganic but because of deteriorating soil structure and fertility associated with shortening fallow periods are continued to produce low roots and tubers. This declines in output thus discourages the producers from investing in their enterprise and subsequently, utilizing the improved local storage method (Tor *et al.*, 2017). To address this problem, the study suggested that the Municipal Agriculture Office should prioritize the capacity enhancement on

sustainable soil management by providing training and resources on sustainable soil management practices to the root crop growers within the vicinity.

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