

# Cultivation of Sweet Potato and its Vines Utilization in Bataan, Philippines

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**Abstract**— *The study evaluated the cultivation of sweet potato and its vines utilization in the province of Bataan, Philippines. The data and information were gathered through field surveys of seasoned farmers using structured questionnaires. Subsequently, the collected data were analyzed using SPSS software. As a result, sweet potato planting usually falls in May to August while harvesting takes place in September to November. The most common varieties planted are Inube, Kinerots, and Super Bureau, considering high yield, color, size, and shape as the common reasons for planting a certain variety. Postproduction operations include vine removal, manual harvesting, field gathering, sorting, and grading before marketing. Most farmers considered harvesting operation as the number one that needs to be mechanized followed by planting operation. Most farmers practiced the removal of vines with large quantities of 5 to 10 tons per hectare. Sweet potato vines are mainly used as animal feed, planting materials, and composting, with no reported use for industrial applications. The study suggests exploring the mechanization of sweet potato planting and harvesting operations by providing access to modern farming equipment such as mechanical planters and harvesters that can potentially increase efficiency and reduce labor costs. The findings also suggest promoting the use of sweet potato vines for industrial applications to increase the productivity and sustainability of sweet potato farming.*

**Keywords**— *Sweet potato, cultivation, by-products, utilization, vines.*

## I. INTRODUCTION

Sweet potato (*Ipomoea batatas* L.) is one of the most important tropical root crops globally produced in more than 100 countries (Alam, 2021). The crop is high in nutrients, rich in vitamins, minerals, fiber, and antioxidants (Amagloh et al., 2021; El-Sheikha et al., 2017), with a low glycemic index, making it an excellent choice for people with diabetes (Fatima, 2022). Sweet potato has several uses, and it can be processed into various products such as starch (Bach et al., 2021), flour, chips, and puree (Mwakamu et al., 2022), alcohol (Salehign and Duraisamy, 2021), biofuels (Awogbemi et al., 2022), bioethanol (Lareo et al., 2013) and bioplastics production (Priedniece et al., 2017). Despite of its importance, the crop has been neglected in research, with most of the attention given to other staple crops such as rice, corn, and wheat.

In the Philippines, sweet potato ranked first among the vegetables in terms of volume and area of production, contributing 18.48% and 22.58%, respectively (DA-HVCC, 2022). In relation to this, Bataan is one of the major producing-provinces of sweet potato in Central Luzon. The province currently supplies sweet potato to the central markets

in Metro Manila such as Divisoria and Balintawak and serves as one of the sources of planting materials for sweet potato farmers in Tarlac Province (Flores et al., 2016). Sweet potato production in the province is characterized by smallholder farmers using traditional farming practices, with limited access to modern inputs and technology. In addition, despite the high potential of sweet potato vines, their utilization is often minimal.

Currently, there is limited information on the cultivation practices of sweet potato and its vines utilization. Thus, this study aimed to assess and provide insight into the current status of sweet potato production and postproduction practices including its vines utilization in Bataan, Philippines. The findings of this study may contribute and provide valuable information for the development of interventions aimed at improving sweet potato cultivation and addressing the specific needs of the farmers, including the sustainable utilization of sweet potato vines, which could enhance the economic, social, and environmental benefits of cultivating sweet potato.

## II. METHODOLOGY

### A. Research Method, Data Collection and Analysis

This study utilized a descriptive research design to gather data on the production and postproduction practices of sweet potato in Bataan, Philippines. Primary data were collected using structured questionnaires, administered to 30 sweet potato farmers through field survey. The participants were selected using a purposive sampling technique, which allowed for the selection of respondents who have the desired characteristics, such as sweet potato farmers who have been in the industry for at least three years and those who have at least half a hectare of land area devoted to sweet potato production.

To ensure the reliability and validity of the survey questionnaire, a pilot test was conducted among 10 sweet potato farmers who were not part of the final sample. The pilot test allowed the researchers to identify potential issues in the survey questionnaire, such as unclear questions or confusing instructions. Based on the feedback received from the pilot test, the survey questionnaire was revised and improved.

Data analysis was conducted using descriptive statistics, such as mean, frequency distribution, and percentage. The data were processed and analyzed using Statistical Package for the Social Sciences (SPSS) software. The results were presented in tables to provide a clear and concise representation of the data.

The findings from the field survey were then validated through focus group discussions (FGD) attended by sweet potato stakeholders, comprising mainly farmers, agricultural technicians, researchers, and traders. During the discussion, the results from the field survey were presented to the participants, and follow-up questions were asked to clarify any unclear findings. The discussion also provided an opportunity for the participants to confirm and validate the findings from the survey.

III. RESULTS AND DISCUSSION

A. Profile of sweet potato farmer-respondents

Sweet potato farmers in Bataan are mostly middle-aged, with 43.5% of males and 100% of females falling in the 40 to 60 years of age group (Table 1). This could have implications for the future of sweet potato farming in the region, as younger generations may not be interested in continuing this profession.

The majority of sweet potato farmers have only completed primary education, with 57.1% of males and 100% of females falling in this category. This suggests that there may be a need for training and education programs to help farmers improve their knowledge and skills related to sweet potato farming and postproduction practices. The vast majority of sweet potato farmers in Bataan (92% of males and 100% of females) do not have any other source of income aside from farming. This highlights the importance of ensuring that sweet potato farming is profitable and sustainable to support the livelihoods of these farmers and their families. The average household income of sweet potato farmers is PhP 23,475.00. This is a relatively low income, which may indicate that there is a need for interventions to help farmers increase their productivity and profitability. This could include providing access to credit, training on improved farming techniques, and support for postproduction practices such as marketing and value-added processing.

TABLE I. Socio-demographic profile of sweet potato farmers in Bataan

Items	Sex		Total (n=30)
	Male (n=26)	Female (n=4)	
1. Age			
<i>Below 39</i>	34.8%	0.0%	17%
<i>40 to 60</i>	43.5%	100%	72%
<i>61 and above</i>	21.7%	0.0%	11%
2. Years in Farming			
3. Educational Attainment			
<i>Primary</i>	57.1%	100%	78.57%
<i>Secondary</i>	58.1%	0.0%	19.05%
<i>Tertiary</i>	4.8%	0.0%	2.38%
4. Other Source of Income			
<i>Business</i>	8.0%	0.0%	4.00%
<i>Employment</i>	0.0%	0.0%	0.0%
<i>None</i>	92%	100%	96.0%
5. Household Income	PhP26,200	PhP20,750	PhP23,475

Most sweet potato farmers are owners of their farms, with 76% of males and 100% of females falling into this category (Table 2). This may have implications for the security of their land tenure and access to credit, as land ownership is often a prerequisite for accessing loans and other forms of financial assistance. Sweet potato farmers in the province have farm

sizes ranging from 0.5 to 5 hectares. This suggests that sweet potato farming in this region may be dominated by smallholder farmers, which could have implications for their productivity and profitability. Smallholder farmers often face challenges in terms of accessing credit, inputs, and markets, which can limit their ability to increase their yields and income.

TABLE 2. Socio-demographic profile of sweet potato farmers in Bataan

Items	Sex		Total (n=30)
	Male (n=26)	Female (n=4)	
1. Tenurial Status			
<i>Owner</i>	76%	100%	88%
<i>Rental</i>	12%	0%	6%
<i>Lessee</i>	4%	0%	2%
<i>Tenant</i>	8%	0%	4%
2. Farm Size (ha)			
<i>0.5 to 5ha</i>	100%	100%	100%
<i>Above 5 ha</i>	0.0%	0.0%	0.0%

B. Production practices of sweet potato

Table 3 shows that the most commonly planted sweet potato variety in Bataan is Inube, with 77% of male farmers and 100% of female farmers choosing this variety. This suggests that Inube may be a well-suited variety for the local growing conditions and may have desirable traits such as high yield, disease resistance, and good taste. Other varieties planted are Kinerots and Super Bureau.

TABLE 3. Production practices of farmer-respondents, percent reporting

Items	Sex		Total (n=30)
	Male (n=26)	Female (n=4)	
1. Common variety planted			
<i>Kinerots</i>	16%	0%	16%
<i>Inube</i>	77%	100%	89%
<i>Super Bureau</i>	6%	0%	6%
<i>Taiwan</i>	0%	0%	0%
2. Source of Irrigation			
<i>Rainfed</i>	100%	100%	100%
3. Planting month			
<i>May</i>	0%	25%	13%
<i>June</i>	73%	50%	62%
<i>July</i>	19%	25%	22%
<i>August</i>	8%	0%	8%
4. Harvesting month			
<i>September</i>	42%	0%	21%
<i>October</i>	50%	100%	75%
<i>November</i>	8%	0%	4%
6. Cropping pattern			
<i>Sweet potato only</i>	30%	50%	40%
<i>Sweet potato-other crop</i>	70%	50%	60%

Sweet potato farmers in Bataan rely solely on rainfed irrigation, with 100% of both male and female farmers indicating this as their source of irrigation. This could make farmers vulnerable to droughts and other weather-related risks, which could have negative impacts on their yields and income. Sweet potato farmers mostly plant their crop in June, with 73% of male farmers and 50% of female farmers choosing this month. The harvest months are September and October, with 42% of male farmers and 100% of female farmers choosing these months respectively. This suggests that there is a window of opportunity for farmers to plant and harvest their sweet potato crop in a coordinated manner to ensure good yields and timely delivery to markets.

Sweet potato farmers in Bataan practice intercropping, with 70% of male farmers and 50% of female farmers indicating that they plant sweet potato with other crops. This suggests that farmers are diversifying their income streams and may be able to achieve better yields and profits by planting complementary crops.

The reasons for planting a certain sweet potato variety among farmers in Bataan are summarized in Table 4. As indicated, the most common reason for planting a certain variety among farmers is "high yield" with 96% of respondents selecting this as a reason. The second most common reason is "color" with 75% of respondents choosing this reason, followed by "shape" and "size" which both have a 68% response rate and ranked third. The "high price" of sweet potato was chosen by 61% of respondents, ranking fourth, while "disease tolerant" was the least common reason chosen by 48% of respondents and ranked fifth. Finally, "low planting material cost" was the least chosen reason, with 32% of respondents selecting it and ranked sixth.

TABLE 4. Reason for planting a certain variety among sweet potato farmers

Reason for planting	Yes*	Ranking
Shape	68%	3
Size	68%	3
High yield	96%	1
Color	75%	2
Disease tolerant	48%	5
Low planting material cost	32%	6
High buying price	61%	4

\*Multiple responses

Table 5 presents the planting practices of sweet potato farmers in Bataan. Sweet potato farmers primarily use vines as planting material, with 100% of respondents applying basal fertilizer. The average cost of planting materials per bundle is PhP 136.67, and 97% of farmers produce their planting materials. Pre-treatment of planting material is practiced by 8% of respondents. On average, the width and length of the farm are 104.0 m and 100.7 m, respectively. There are 14 rows per bed. The distance of planting materials per row is 15 centimeters, while the distance per hill is 4.5 centimeters. The depth of planting materials is 4.2 centimeters.

TABLE 5. Planting practices of sweet potato farmers

Practices	Item/%reporting
Planting material used	Vines
Cost of planting material per bundle	PhP137
Farmers producing planting material	97%
Farmers practice pre-treatment of planting material	8%
Farmers practice basal fertilizer application	100%
Average width of farm	104 m
Average length of the farm	101 m
No. of rows per bed	14.0
Average distance per row	15.0 cm
Average distance per hill	4.5 cm
Average depth of planting	4.2 cm

The common farm chemical inputs used by sweet potato farmers, including fertilizers, herbicides, and insecticides are presented in Table 6. All farmers reported using complete fertilizer, with an average of 4 bags per hectare. 36.67% of farmers reported using Urea, with 3 to 6 bags per hectare. Only 13% of farmers reported using herbicide, with an

application rate of 1.375 liters per hectare. The majority (87%) did not use any herbicides. 6.67% of farmers reported using Brodan insecticide, with an application rate of 1 liter per hectare. Other insecticides used by a small percentage of farmers included Express, Selecron, and Trebon, with application rates ranging from 0.5 to 3 kg or liters per hectare. The majority (83%) did not use any insecticides.

TABLE 6. Common farm chemical inputs used by sweet potato farmers

Type of Inputs	% Reporting	Quantity used
1. Inorganic Fertilizer		
Complete	100.00	4 bags/ha
Urea	36.67	3-6 bags/ha
2. Herbicide		
Onecide	13.00	1.375 li/ha
Do not use herbicide	87.00	-
3. Insecticide		
Brodan	6.67	1 li/ha
Express	3.00	3 kg/ha
Selecron	3.00	1 li/ha
Trebon	3.00	0.5 li/ha
Do not use insecticide	83.00	-

### C. Postproduction practices of sweet potato

Table 7 provides information on the harvesting practices of sweet potato farmers in Bataan. Sweet potato farmers in Bataan harvest their crops manually 120 days after planting, starting at 8:00 AM. All respondents reported practicing vine removal, with large quantities of 5 to 10 tons of vines removed before harvesting. The mode of disposal for these vines is for animal feed, planting materials, and composting as organic fertilizer. The average yield of sweet potato per hectare is 63.89 bags, with a range of weight per bag at 100 kg. With this, the average yield per hectare is 6,388.89 kg.

TABLE 7. Harvesting practices of sweet potato farmers

Practices	Item
Method of harvesting	Manual harvesting
Maturity Indicator	120 days after planting
Common time start of harvest	8:00 AM
Vine removal	100% practice vine removal
Volume of vines removed	5 to 10 tons
Mode of disposal	Animal feed, planting material, composting
Volume of harvest (yield)	6,388.89 kg/ha
Average weight per bag	100 kg/bag

TABLE 8. Degree of mechanization of sweet potato farming operation

Item	Manual	Mechanical	Rank for mechanization
Land preparation	0%	100%	-
Planting	100%	0%	2
Harvesting	100%	0%	1
Vine removal	100%	0%	3
Field gathering	100%	0%	4
Sorting/grading	100%	0%	5

Table 8 presents the degree of mechanization of farm operations among sweet potato farmers in Bataan. All respondents reported that land preparation is done mechanically, while all other operations, including planting, harvesting, vine removal, field gathering, and sorting/grading are done manually. The findings suggest limited use of mechanization in the sweet potato farming system in Bataan. Among the various sweet potato farming operations, farmers

identified harvesting as the top priority for mechanization, followed by planting operation.

D. Sweet potato vines utilization practices

Table 9 shows the waste utilization practices of sweet potato by-products among farmers in Bataan. All respondents reported practicing vine removal, which typically takes 1.75 days of operation per hectare, with a volume of 5 to 10 tons. The preferred mode of disposal was for animal feeds (ranked first), followed by planting materials (ranked second) and composting (ranked third). The schedule for vine removal was usually one day before harvesting. These findings suggest that farmers in Bataan prioritize the use of sweet potato by-products as animal feed. It is worth noting that none of the farmers in the study reported using sweet potato vines for industrial applications, such as the production of biofuels or any other value-added products. The focus of their utilization was mainly on animal feeds, followed by planting materials and composting.

TABLE 9. Sweet potato vines utilization

Practices	Item
Vine removal	100% of farmers
Schedule of vine removal	1 day before harvest
Duration of vine removal	1.75 days per hectare
Volume of vines removed	5 to 10 tons per hectare
Mode of disposal	Rank
Animal feed	1
Planting material	2
Composting	3

IV. CONCLUSION AND RECOMMENDATION

In this study, the cultivation of sweet potato and its vines utilization in Bataan, Philippines were assessed. Primary data were gathered through field surveys among sweet potato farmers using structured questionnaires. Gathered data were consolidated and analyzed using the SPSS software. As a result, sweet potato planting in Bataan typically takes place from June to August while the harvesting schedule falls from September to November. The common varieties planted are Inube, Kinerots, and Super Bureau. Farmers predominantly prioritize high yield, followed by considerations for color, size, and shape when selecting a variety for planting.

The most common postproduction practices of sweet potato include vine removal, manual harvesting, field gathering, sorting, and grading before marketing. Sweet potato farming in Bataan is a prevalent agricultural practice with manual planting and harvesting are still the primary methods. Among the various sweet potato farming operations, harvesting was identified as the top priority for mechanization, followed by planting operation. Before harvesting, most farmers practiced the removal of vines with large quantities of 5 to 10 tons per hectare. The study also revealed that sweet potato vines are mainly utilized as feed for farm animals, while a small portion is used for planting materials and composting. None of the respondents reported using sweet potato vines for industrial applications.

The study highlights the need to explore the mechanization of sweet potato planting and harvesting operations, providing

access to modern farming equipment such as mechanical planters and harvesters that can potentially increase efficiency and reduce labor costs. Furthermore, the need for industrial applications of sweet potato vines to further increase the economic value of this crop. Research and development initiatives should be encouraged to explore potential industrial applications of sweet potato by-products, particularly, the large quantities of vines.

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