RESEARCH PAPER

Revitalizing legumes and root crops in lahar affected areas of Zambales, Philippines: A comprehensive socio-economic, production and marketing study

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Abstract

The study aimed to revitalize legumes and root crops farming in the lahar-affected areas of Zambales, Philippines. The study conducted a comprehensive assessment of legumes and root crops farming in the lahar-affected areas of Zambales, Philippines, with a focus on peanut, cassava, mungbean, and legumes production. Data was collected from 186 farmers in selected towns, revealing that a majority of respondents were male, married, and aged 51 and above. Notably, formal education was not a strict requirement for engaging in root crop farming, and most farmers had small to medium-sized families and owned farms ranging from 0.6 to 1 hectare. Farming experience varied, with the highest representation among those aged 26 and above. Fertilizer usage ranged, but the majority of farmers used 4 to 5 bags. Weather conditions and pest/insect problems emerged as the main challenges in root crop farming. Regarding marketing, wholesale selling was the predominant approach, with traders being the main source of market and price information. Farmers primarily relied on personal capital to fund their crops. Marketing problems included low prices, delayed payments, oversupply, unstable prices, limited buyers, and price fluctuations. Statistical analysis highlighted positive correlations between socio-economic factors (age, education, family size, farm size, and farming experience) and increased production of cassava and sweet potato. To revitalize legumes and root crops farming in the lahar-affected areas of Zambales, several recommendations were proposed. Targeted training programs focusing on climate-resilient agricultural practices and pest management should be developed. Efforts to improve market access and reduce dependence on traders through collective marketing initiatives and value-added processing are essential. Investment in agricultural infrastructure, such as irrigation systems, is crucial to mitigate weather-related challenges. Policymakers should explore opportunities for providing financial support and credit facilities to farmers to boost productivity. Lastly, fostering collaboration among government agencies, research institutions, and farmer organizations will aid in formulating sustainable region-specific strategies. These findings and recommendations offer valuable insights for developing relevant policies and programs to support the agricultural sector in the lahar-affected regions of Zambales.

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Introduction

The United Nations has developed a global framework known as the Sustainable Development Goals (SDGs) to address the world's most pressing social, economic, and environmental challenges. Adopted in 2015 by all UN member states, the SDGs consist of 17 interconnected goals with 169 targets, aiming to achieve a more sustainable and equitable world by the year 2030. The SDGs encompass a broad range of issues, including poverty eradication, zero hunger, good health and well-being, quality education, gender equality, clean water and sanitation, affordable and clean energy, decent work and economic growth, industry innovation and infrastructure, reduced inequalities, sustainable cities and communities, responsible consumption and production, climate action, life below water, life on land, peace, justice, and strong institutions, and partnerships for the goals.

The drylands of the Philippines are home to nearly 20 million people, the majority of whom live in impoverished conditions. These regions are primarily located in Northern Luzon, Central Visayas, and Southern Mindanao. Agriculture in these areas faces significant risks, including recurrent droughts, pest infestations, degraded soils, and a lack of infrastructure and social services (DA-BAR, 2011). Zambales, a lahar-affected area, has a history of being impacted by devastating lahar events, resulting from volcanic eruptions, which have significantly affected the agricultural landscape in the region. As a result, many farmers in the area have faced numerous challenges in crop production, socio-economic conditions, and marketing opportunities. The legumes and root crops play a crucial role in sustainable agriculture and food security. They are known to contribute to soil fertility through nitrogen fixation and provide essential nutrients to diets, promoting better nutrition in communities. By revitalizing the cultivation of these crops in lahar-affected areas, the study seeks to explore their potential for improving agricultural resilience and enhancing food availability for the local population. Additionally, there is limited research on the socio-economic, production, and marketing aspects of legumes and root crops in lahar-affected regions like Zambales.

Legumes and Root Crops in Lahar Affected Areas of Zambales

Various root crops and legumes play significant roles in agriculture and food production in Zambales, Philippines. Mungbean *(Vigna radiata)* is a vital legume crop grown in South and Southeast Asia, including the Philippines. It is a warm season annual with trifoliate leaves and has achieved high production volumes in recent years, particularly in 2011 when it yielded 45,283 metric tons from a total production area of 32,960 hectares. Peanuts, although classified as a legume, are often considered oilseeds due to their high oil content. India stands as the second-largest producer, producing approximately 7,131,000 million metric tons annually. Peanuts are not only valuable for oil production but also yield functional compounds like proteins, fibers, polyphenols, antioxidants, vitamins, and minerals, making them versatile ingredients in processed foods, peanut butter, confections, roasted peanuts, and various other products.

Cassava *(Manihot esculenta Crantz)* is gaining popularity in Zambales, with increasing cultivation for animal feed export and starch industry inputs. Being one of the most efficient starch producers, cassava ranks fourth in carbohydrate production after rice, sugar cane, and corn. Taro or gabi (Colocasia esculenta) is another tropical plant grown in the region, cherished for its edible corms, roots, and vegetables. Taro tubers serve as important sources of carbohydrates, energy, and staple foods in tropical and sub-tropical countries. Rich in nutrients like starch, fiber, thiamine, riboflavin, iron, phosphorus, zinc, and vitamins B6 and C, taro adds valuable nutrition to diets.

Lastly, sweet potatoes *(Ipomoea batatas)* offer a novel source of natural health-promoting compounds, including beta-carotene and anthocyanins, contributing to the functional food market. These root crops and legumes in Zambales hold immense potential for enhancing food security and improving the nutrition and livelihoods of the local communities. This study aims to bridge this knowledge gap and provide comprehensive data on the challenges and

opportunities faced by farmers in the area. Understanding the socio-economic profile of farmers, their production practices, and marketing strategies will enable the development of targeted interventions and recommendations for improving agricultural practices and increasing income-generating opportunities in the region. With changing climatic patterns and conditions posing threats to food production and food security, it is essential to identify suitable cropping systems that can adapt to the unique challenges in lahar-affected areas. The study's findings can inform the development of adaptive mechanisms and technologies that can help farmers cope with the impacts of climate change and build resilience in their agricultural practices. In like manner, gender issues should also be taken into account, recognizing the significant roles played by women in agriculture and the importance of incorporating gender-sensitive development interventions. It is noteworthy that international organizations have started measuring economic activity by gender, expanding definitions to encompass subsistence farming, food processing, and homeworking in anticipation of profit (Reeves & Baden, 2000).

This project aims to gather socio- demographic, economic, production and marketing data as regards selected legumes in the lahar affected areas of Zambales, Philippines. Hence, Limited research has been conducted to provide updated information on the socio-economic and demographic characteristics of farmers adopting specific cropping systems in special zones in Zambales, Philippines.

Objectives

The primary objective of the project is to establish benchmark information as regards the demographic-socio-economic profile, production and marketing practices of farmers who produced peanut, cassava, mungbean and legumes in Zambales, Philippines. Specifically, it aimed to: (1) establish a demographic socio-economic profile of the respondents; (2) identify relevant socio-economic variables related to increased production; (3) determine problems and recommend solutions and identify interest and

training needs to improve production; (4) determine and compare market channels.

Materials and methods
Research Design

The cross-sectional research design was chosen for this study to gather data from farmers producing peanut, cassava, mungbean, and legumes in Zambales, Philippines, at a specific point in time. This design allowed the researchers to capture a snapshot of the farmers' characteristics, production practices, and marketing methods within a defined period. By collecting data from multiple respondents simultaneously, the researchers efficiently obtained a comprehensive understanding of the current situation in the target areas. One of the major advantages of the cross-sectional design is its cost-effectiveness and time-efficiency. Conducting a cross-sectional study requires data collection at a single point in time, making it more manageable compared to longitudinal studies that require follow-up visits over an extended period. Given the nature of the research objectives, which primarily focused on establishing benchmark information and identifying current practices and challenges, the cross-sectional design provided a suitable approach to achieve these goals without incurring extensive resources and time commitments. Moreover, the cross-sectional design allowed for the exploration of relationships between variables in a snapshot format. By examining data from various respondents at the same time, the researchers could identify patterns and associations between socio-economic variables and production practices.

This analysis would help to determine relevant factors that contribute to increased production and the efficiency of the present marketing system. However, it is essential to acknowledge the limitations of the cross-sectional design. As data are collected at a single time point, it does not provide insights into changes or developments over time. To address this limitation, complementary longitudinal studies might be required to observe trends and variations in farmers' practices and socio-economic profiles over more extended periods.

Sources of Data and Information, and Survey Questionnaire

For this study, a survey-interview was conducted to gather the necessary socio-economic and demographic characteristics of legume and root crops farmers in the lahar-affected areas in Zambales. Primary data was gathered through surveys and interviews of legume/root crops farmers from the identified areas. The data focused on their production systems, crops raised, farm sizes, levels of production, production inputs, farm experience, as well as demographic characteristics such as age, sex, family size, level of education, level of awareness of their technology, problems encountered, etc. The questionnaire for the study was formulated to solicit information regarding the respondents' socio-economic and demographic profiles, production data such as input costs and volume of production, returns, etc. Additionally, data and information on marketing channels and practices, methods of sale, prices, and outlets were gathered.

Sampling and Ethical Consideration

The sampling method employed for this study was purposive sampling. The list of respondents was obtained from the concerned Provincial Agricultural Officers and Municipal Agricultural Officers in Zambales. Purposive sampling was chosen to ensure that the participants selected were representative of the specific lahar-affected areas in the three provinces under investigation. Due to the vast number of potential participants, complete enumeration was not practical, leading to the use of the Slovin's formula to calculate an appropriate sample size. Ultimately, a total of 186 farmer-respondents were included in the study.

Ethical considerations were given utmost importance throughout the research process. The researchers obtained informed consent from all participants before conducting the survey-interview. The respondents were fully informed about the purpose of the study, the nature of their involvement, and the potential use of the data gathered. They were assured that their participation was voluntary and that they could withdraw from the study at any point without facing any consequences. Data confidentiality and anonymity were strictly maintained. Personal identifiers of the respondents were removed from the datasets to ensure their privacy. Only aggregated data was presented in the final report, preventing the identification of individual farmers. The research team also ensured that the data collected would be used solely for the purpose of the study and would not be shared with any third party.

Data Analysis

The Basic descriptive statistics, such as the mean, percentage, and frequency counts, were utilized as the tools of analysis. The primary data on the respondents' profiles and other characteristics were presented in a qualitative manner with the aid of tables. Correlation and regression analysis were employed to establish relationships between production and independent variables identified as farm size, crops raised, input costs, etc.

Results

Socio-Demographic Profile of the Respondents

The socio-demographic profile of the respondents was described according to their age, sex, civil status, year's in residence, educational attainment, family size of children, educational attainment of children, occupation of children, and monthly income of their children.

Age

In this study, the researcher surveyed 186 farmers from different areas in Zambales such as Botolan, Cabangan, San Felipe, San Marcelino and San Narciso. The age range of the farmer respondents from below 20 to 51 above and were divided into four groups. The fig. shows that the majority or 49.46% of the farmer respondents were within the age group of 51 and above whereas 26.34% or 49 of them fell under the age of 50 years of age.

Sex

Majority of the farmer respondents interviewed were male with an average of 177 or 95.16% while 4.84% of them were female. It could be interpreted that most of the farmer respondents in the questionnaire came from male respondents. This indicates that males are more productive or widely popular in cassava and sweet potato farming.

Table 1. Age Distribution of the farmer respondents.

Age	Botolan		Cabangan		San felipe	San marcelino		San narciso		Total	Percent
	Cassava	Sweet Potato	Cassava	Sweet Potato	Cassava	Cassava	Sweet Potato	Cassava	Sweet Potato		
Below 20	0	0	0	0	0	0	0	0	0	0	0.00
21 - 40	13	8	6	2	2	4	4	4	6	49	26.34
41 - 50	11	13	7	2	1	4	3	3	1	45	24.19
51 - above	9	4	10	11	4	15	11	13	15	92	49.46
Total	33	25	23	15	7	23	18	20	22	186	100.00
Range	23-61	27-64	35-70	35-69	30-69	37-62	30-70	23-80	32-81		
Average	44	48	49	53	46	52	53	52	54		

Table 2. Sex Distribution of farmer-respondents.

Sex	Botolan		Cabangan		San felipe	San marcelino		San narciso		Total	Percent
	Cassava	Sweet Potato	Cassava	Sweet Potato	Cassava	Cassava	Sweet Potato	Cassava	Sweet Potato		
Male	31	24	23	15	7	21	16	19	21	177	95.16
Female	2	1	0	0	0	2	2	1	1	9	4.84
Total	33	25	23	15	7	23	18	20	22	186	100.00

Civil Status

Most of the respondents were married with an average of 97.85% or 182 while only four (4) or 2.15 of them were single. With that, it could be pointed out that the respondents interviewed are responsible in order for them to support their families.

Years in Residence

In terms of their years in residence, table 4 shows that majority of the farmer respondents live in residence were with the bracket of 36 and above with 169 or 90.86% while the least group of 17 or 9.14% under the range of below 35 years in residence.

Table 3. Distribution of farmer-respondents according to civil status.

Civil Status	Botolan		Cabangan		San felipe	San marcelino		San narciso		Total	Percent
	Cassava	Sweet Potato	Cassava	Sweet Potato	Cassava	Cassava	Sweet Potato	Cassava	Sweet Potato		
Single	2	0	0	0	0	0	1	1	0	4	2.15
Married	31	25	23	15	7	23	17	19	22	182	97.85
Widow/Widower	0	0	0	0	0	0	0	0	0	0	0.00
Total	33	25	23	15	7	23	18	20	22	186	100.00

Table 4. Years in residence of farmer respondents.

Years in Residence	Botolan		Cabangan		San felipe	San marcelino		San narciso		Total	Percent
	Cassava	Sweet Potato	Cassava	Sweet Potato	Cassava	Cassava	Sweet Potato	Cassava	Sweet Potato		
1-5	0	0	0	0	0	0	0	0	0	0	0.00
6 - 10	0	0	0	0	0	0	0	0	0	0	0.00
11 - 15	0	0	0	0	0	0	0	0	0	0	0.00
16 - 20	0	0	0	0	0	0	0	0	0	0	0.00
21-35	3	2	1	1	2	0	2	3	3	17	9.14
36 and above	30	23	22	14	5	23	16	17	19	169	90.86
Total	33	25	23	15	7	23	18	20	22	186	100.00

Educational Attainment of the Farmer Respondents

With regards to the educational attainment of the farmer respondents, 32.80% or 61 of them were elementary graduate; 30.65% or 57 were high school graduate; 11.83% or 22 were college graduate; 8.06% or 15 were elementary undergraduate; 6.45% or 12 were high school undergraduate while only five (5) or 2.69% were college undergraduate. The table 5 implies that the educational attainment of the farmer respondents is not requirement in engaging root crop farming. In connection with that, as long as you have the knowledge regarding proper handling of a good plantation crop you can achieve whatever you want.

Table 5. Educational attainment of farmer-respondents.

Educational Attainment	Botolan		Cabangan		San felipe	San marcelino		San narciso		Total	Percent
	Cassava	Sweet Potato	Cassava	Sweet Potato	Cassava	Cassava	Sweet Potato	Cassava	Sweet Potato		
Elem undergrad	3	2	7	3	0	0	0	0	0	15	8.06
Elem graduate	16	6	4	7	3	6	3	9	7	61	32.80
HS undergrad	2	4	6	0	0	0	0	0	0	12	6.45
HS graduate	8	9	4	4	3	9	7	6	7	57	30.65
College undergrad	1	1	1	1	1	0	0	0	0	5	2.69
College graduate	3	0	1	0	0	4	5	4	5	22	11.83
Vocational	0	3	0	0	0	4	3	1	3	14	7.53
Total	33	25	23	15	7	23	18	20	22	186	100.00

Family Size

The family sizes of the respondents ranged from 0 to 13 and were divided into four groups. Most of the farmer respondents had one (1) to four (4) child's with an average of 93.01% or 174 whereas few of them had five (5) to eight (8) children. This shows that the respondents were aware of their financial capacity status since most of them had a medium size of family.

Farm size ownership of farmer-respondents

Table 7 indicated the farm size ownership of farmer respondents, most of the respondents got 0.6 to 1 hectare with an average of 49 or 26.34%, whereas, 39 or 20.97% of them had a farm size of 1.1 to 1.5 hectare, 33 or 17.74% had below 0.5 and 2.6 and above, 31 or 16.67% of the farmer respondents had 1.6 to 2.0 hectare, and the least ranging from 2.1 to 2.5 hectares with 1 or 0.54%.

Table 6. Family size/number of children of farmer-respondents.

Number of Children	Botolan		Cabangan		San felipe	San marcelino		San narciso		Total	Percent
	Cassava	Sweet Potato	Cassava	Sweet Potato	Cassava	Cassava	Sweet Potato	Cassava	Sweet Potato		
0	2	0	0	0	0	0	1	3	2	8	4.30
1 - 4	31	25	23	15	7	20	17	16	19	173	93.01
5 - 8	0	0	0	0	0	3	0	1	1	5	2.69
9 - 13	0	0	0	0	0	0		0	0	0	0.00
Total	33	25	23	15	7	23	18	20	22	186	100.00

Table 7. Farm size ownership of farmer-respondents.

Farm Size (has.)	Botolan		Cabangan		San felipe	San marcelino		San narciso		Total	Percent
	Cassava	Sweet Potato	Cassava	Sweet Potato	Cassava	Cassava	Sweet Potato	Cassava	Sweet Potato		
Below 0.5	0	0	0	0	3	7	7	8	8	33	17.74
0.6 - 1.0	5	4	9	4	0	6	7	7	7	49	26.34
1.1 - 1.5	6	4	6	4	2	9	2	3	3	39	20.97
1.6 - 2.0	11	6	4	4	1	1	1	1	2	31	16.67
2.1 - 2.5	0	1	0	0	0	0	0	0	0	1	0.54
2.6 and above	11	10	4	3	1	0	1	1	2	33	17.74
Total	33	25	23	15	7	23	18	20	22	186	100.00
Average	2.2	2.26	2.15	2.19	1.35	1.01	1.05	1.18	1		

Farming Experience of Farmer- Respondents

In terms of farming experience of the respondents ranged from below 5 to 26 above and were divided into six groups, 26 and above had the highest representation with 49 or 26.34% while below 5 and 6 to 10 had the same total or percentage of respondents with 45 or 24.19%, and ranging from 21 to 25 years

had the lowest response with 8 or 4.30%.

Source of Income from farming of farmer respondents (Monthly Income)

Table 9 signified the source of income from farming of farmer respondents, ranging from 5,001 to 10,000 had the highest representation with 60 or 32.26%,

followed by 50 or 26.88% of the respondents had a ranging of 10,001 to 15,000 and the least was ranging of 30,001 to 35,000 with the percentage of 1.08%.

Other Trainings and Topics Preferred by the Farmers-Respondents
Table 10 shows the result of other trainings and topics preferred by the farmers-respondents. Majority of the farmer respondents they need to know about new and modern technology with the total or percentage of 141or 75.81%, followed by Cultural management with 33 or 17.74% and the least is fertilizer management with 12 or 6.45%.

Variety of Cassava and Sweet Potato of Farmer-Respondents
This table shows the variety of cassava and sweet potato used by the farmer respondents in Zambales. In sweet potato, majority of the respondents used super Taiwan variety with total of 53 or 66.25% followed by bureau with total of 27 or 33.75%. Whilst, in terms of cassava, 80 or

75.47% of the respondents used Lakan 2 variety, while 19 or 17.92% of them used Pinusuan, however, only seven (7) or 6.60% of the farmer respondents used Matabia.

Fertilizer Used
Table 12 shows the number of bags of fertilizer used by farmers. Most of the farmers with the total of percentage used 4 and 5 bags of fertilizer with a total response of 63 or 22.99% followed by below 3 bags with a total response of 57 or 20.80%. Using 9 bags had the least response with 1 or 12.77%.

Problems Encountered by the Farmer Respondents
In terms of the problem encountered of the farmer respondents of Botolan, Cabangan, San Felipe, San Marcelino and San Narciso as presented in table 26, the main problem in root crops farming was the weather condition with the highest representation of 176 or 34.38%, followed by pest/insects with 133 or 25.98% while the Unproductive seeds had the least representation with 26 or 5.08%.

Table 8. Farming experience of farmer-respondents.

| Range (years) | Botolan | | Cabangan | | San felipe | San marcelino | | San narciso | | Total | Percent |
	Cassava	Sweet Potato	Cassava	Sweet Potato	Cassava	Cassava	Sweet Potato	Cassava	Sweet Potato		
Below 5	1	4	3	2	2	7	8	8	10	45	24.19
6 - 10	5	9	4	2	3	6	4	6	6	45	24.19
11 - 15	5	1	6	2	0	4	1	0	0	19	10.22
16 - 20	5	4	2	4	0	2	1	1	1	20	10.75
21 - 25	3	1	0	0	0	2	2	0	0	8	4.30
26 above	14	6	8	5	2	2	2	5	5	49	26.34
Total	33	25	23	15	7	23	18	20	22	186	100.00

Table 9. Source of Income from farming of farmer-respondents (Monthly income).

| Range (Monthly Income) | Botolan | | Cabangan | | San felipe | San marcelino | | San narciso | | Total | Percent |
	Cassava	Sweet Potato	Cassava	Sweet Potato	Cassava	Cassava	Sweet Potato	Cassava	Sweet Potato		
below 5000	5	4	4	1	2	4	3	2	3	28	15.05
5001-10000	12	6	4	5	3	11	6	8	5	60	32.26
10001-15000	8	4	12	2	1	6	3	5	9	50	26.88
15001-20000	2	5	2	3	1	1	1	2	2	19	10.22
20001-25000	3	2	1	2	0	1	3	1	1	14	7.53
25001-30000	2	2	0	1	0	0	1	2	2	10	5.38
30001-35000	1	1	0	0	0	0	0	0	0	2	1.08
35001 above	0	1	0	1	0	0	1	0	0	3	1.61
Total	33	25	23	15	7	23	18	20	22	186	100.00

Table 10. Other trainings and topics preferred by the farmers-respondents.

Training/Topics	Botolan Cassava	Sweet Potato	Cabangan Cassava	Sweet Potato	San felipe Cassava	San marcelino Cassava	Sweet Potato	San narciso Cassava	Sweet Potato	Total	Percent
New and Modern Technology	23	18	23	11	4	14	16	17	15	141	75.81
Fertilizer Management	0	3	0	3	0	0	2	0	4	12	6.45
Cultural Management	10	4	0	1	3	9	0	3	3	33	17.74
None	0	0	0	0	0	0	0	0	0	0	0.00
Total	33	25	23	15	7	23	18	20	22	186	100.00

Table 11. Variety of Cassava and sweet potato of farmer-respondents.

Variety	Botolan Cassava	Sweet Potato	Cabangan Cassava	Sweet Potato	San felipe Cassava	San marcelino Cassava	Sweet Potato	San narciso Cassava	Sweet Potato	Total	Percent
Bureau	0	5	0	7	0	0	7	0	8	27	33.75
Super Taiwan	0	20	0	8	0	0	11	0	14	53	66.25
Total	0	25	0	15	0	0	18	0	22	80	100.00
Pinusuan	3	0	5	0	0	7	0	4	0	19	17.92
Matabia	7	0	0	0	0	0	0	0	0	7	6.60
Lakan 2	23	0	18	0	7	16	0	16	0	80	75.47
Total	33	0	23	0	7	23	0	20	0	106	100.00

Table 12. Fertilizer used.

Number of Bags USed	Botolan Cassava	Sweet Potato	Cabangan Cassava	Sweet Potato	San felipe Cassava	San marcelino Cassava	Sweet Potato	San narciso Cassava	Sweet Potato	Total	Percent
Below 3	10	7	2	3	3	8	9	3	12	57	20.80
4	8	2	10	3	4	7	13	7	9	63	22.99
5	13	1	11	2	2	10	6	11	7	63	22.99
6	9	1	3	3	1	5	3	3	4	32	11.68
7	4	1	1	1	0	2	1	1	3	14	5.11
8	6	0	2	1	0	0	0	0	0	9	3.28
9	0	0	0	1	0	0	0	0	0	1	0.36
10-up	2	0	14	19	0	0	0	0	0	35	12.77
Total	52	12	43	33	10	32	32	25	35	274	100.00

Table 13. Problems encountered.

Problems Encountered	Botolan Cassava	Sweet Potato	Cabangan Cassava	Sweet Potato	San felipe Cassava	San marcelino Cassava	Sweet Potato	San narciso Cassava	Sweet Potato	Total	Percent
Weather Condition	33	20	22	15	7	23	18	20	18	176	34.38
Pest/Insect	23	5	20	10	7	20	15	16	17	133	25.98
Financial	2	2	5	8	5	10	2	6	10	50	9.77
Stealing of products	5	8	4	4	0	8	5	3	1	38	7.42
High Cost of Production	6	7	11	1	3	5	6	7	9	55	10.74
Growing of weeds	7	4	7	5	5	0	0	5	1	34	6.64
Unproductive seeds	0	3	0	5	0	0	12	0	6	26	5.08
Total	76	49	69	48	27	66	58	57	62	512	100

Socio-economic Factors affecting Increased Production

In terms of statistical analysis, the predictors of cassava had positive correlation with its production.

Therefore, with age, production increases by 1.65% since aged farmers are presumed to have more knowledge and skills in raising the crop.

By means of education, production also increases by 19.81% because more educated farmers had more skills and talents in raising the crop, With the increasing number of children, it is also presumed that more help is provided to the farmer, hence production of the crop also increases by 12.43%.

It also shows that as farm size increases, production of cassava increases by 8.28% so with farming experience, by 1.42%. The same holds true to sweet potato. All predictors had positive correlation with the production of the crops, hence as farmers age, production increases, along with education, number of children, farm size and farming experience.

Table 14. Socio-economic factors affecting increased production.

Predictors	Cassava ($R^2 = 40\%$) Coefficients (%)	Sweet potato ($R^2 = 56\%$) Coefficients (%)
Age	1.65	1.22
Education	19.81	16.11
Children	12.43	7.59
Farm size	8.28	5.69
Farming experience	1.42	1.23

Form of Production

In terms of the form of products produced by the farmer-respondents as shown in table 21, majority of the farmer-respondents sold their products fresh with a representation of 186 or 100%.

Table 15. Form of products.

Form of Products	Botolan Cassava	Botolan Sweet Potato	Cabangan Cassava	Cabangan Sweet Potato	San felipe Cassava	San marcelino Cassava	San marcelino Sweet Potato	San narciso Cassava	San narciso Sweet Potato	Total	Percent
FRESH	33	25	23	15	7	23	18	20	22	186	100
PROCESS	0	0	0	0	0	0	0	0	0	0	0.00
Total	33	25	23	15	7	23	18	20	22	186	100

Pre-Marketing Arrangement

In terms of the pre-marketing arrangement in Zambales, as indicated in Table 22 all the farmer-respondents sold their products on a whole sale basis with the total of186 or 100%. This implies that there were buyers or middle who purchase their products.

Source of Market and Price Information

As regards their sources of information, majority of the farmer's respondents get information and other data from the traders with 186 or 100%.

Source of Loan of Farmer Respondents

In terms of the source of loan of farmer-respondents, as presented in Table 25, majority of the farmer-respondents answered that their financial support on the crops they plant was their own capital with a representation of 186 or 100%.

Marketing Problems

Marketing problems are also experienced by the farmers. They reported some difficulties in the way they produce their crops. They reported low prices for the produce with 144 or 67.29%, delay payments with 24 or 11.21%, sometimes oversupply that would lead to lower prices with 13 or 6.07%, and some others experience Unstable Prices and limited buyer from buyers the same representation 5 or 2.34%, demand for the products with 15 or 7.01%, and even price fluctuations with 8 or 3.74%. These problems, if not solved, can be difficulties for the farmers that could lead to slacks in the production of their crops.

Table 16. Pre-marketing arrangement.

Pre-Marketing Arrangement	Botolan Cassava	Botolan Sweet Potato	Cabangan Cassava	Cabangan Sweet Potato	San felipe Cassava	San marcelino Cassava	San marcelino Sweet Potato	San narciso Cassava	San narciso Sweet Potato	Total	Percent
Per Kilo	0	0	0	0	0	0	0	0	0	0	0.00
Whole Sale	33	25	23	15	7	23	18	20	22	186	100
Total	33	25	23	15	7	23	18	20	22	186	100

Table 17. Source of market and price information.

Sources of Market	Botolan		Cabangan		San felipe	San marcelino		San narciso		Total	Percent
	Cassava	Sweet Potato	Cassava	Sweet Potato	Cassava	Cassava	Sweet Potato	Cassava	Sweet Potato		
Trader	33	25	23	15	7	23	18	20	22	186	100
Co-Farmer	0	0	0	0	0	0	0	0	0	0	0.00
Other	0	0	0	0	0	0	0	0	0	0	0.00
Total	33	25	23	15	7	23	18	20	22	186	100

Table 18. Source of loan of farmer-respondents.

Source of Loan	Botolan		Cabangan		San felipe	San marcelino		San narciso		Total	Percent
	Cassava	Sweet Potato	Cassava	Sweet Potato	Cassava	Cassava	Sweet Potato	Cassava	Sweet Potato		
Own Capital	33	25	23	15	7	23	18	20	22	186	100.00
Relatives	0	0	0	0	0	0	0	0	0	0	0.00
Bank	0	0	0	0	0	0	0	0	0	0	0.00
5'6	0	0	0	0	0	0	0	0	0	0	0.00
Total	33	25	23	15	7	23	18	20	22	186	100.00

Table 19. Marketing problems.

Problems Encountered	Botolan		Cabangan		San felipe	San marcelino		San narciso		Total	Percent
	Cassava	Sweet Potato	Cassava	Sweet Potato	Cassava	Cassava	Sweet Potato	Cassava	Sweet Potato		
Low Price	33	25	15	9	7	15	12	12	16	144	67.29
Delay Payment	5	10	0	3	0	0	0	5	1	24	11.21
Over Supply	0	0	2	1	0	4	2	2	2	13	6.07
Unstable Price	0	2	0	0	0	2	0	0	1	5	2.34
Limited Buyer	0	0	0	0	0	0	2	1	2	5	2.34
Demand	10	3	0	2	0	0	0	0	0	15	7.01
Price Fluctuation	0	1	3	0	0	2	2	0	0	8	3.74
Total	48	41	20	15	7	23	18	20	22	214	100.00

Discussion

The study sheds light on the challenges and opportunities in revitalizing legumes and root crops farming in the lahar-affected areas of Zambales. The findings underscore the importance of considering socio-economic, production, and marketing factors in formulating policies and programs aimed at enhancing agricultural productivity and livelihoods in the region. The findings of this study provide valuable insights into the socio-economic, production, and marketing aspects of legume and root crop farming in the lahar-affected areas of Zambales. Several key points from the study align with existing literature, while others offer new perspectives and opportunities for further exploration. On the Socio-demographic Profile and Education, the majority of farmers being male, married, and aged 51 and above is consistent with previous studies on agricultural demographics in developing countries (e.g., Dar *et al.*, 2016).

The finding that formal education is not a strict requirement for engaging in root crop farming supports the notion that traditional knowledge and skills are often passed down through generations in agricultural communities (Ellis *et al.*, 2017). However, it is essential to recognize the potential benefits of providing educational and training opportunities to farmers, as studies have shown that education can lead to improved agricultural practices and increased productivity (Asfaw *et al.*, 2012).

As to the Challenges in Root Crop Farming, the identified challenges in root crop farming, such as weather conditions and pest/insect problems, resonate with existing literature (e.g., Gbegbelegbe *et al.*, 2012). Lahar-affected areas may present unique challenges due to soil degradation and erosion caused by volcanic ash deposits, which can impact crop productivity (Nakano *et al.*, 2006).

Addressing these challenges may require region-specific strategies, including soil conservation measures and pest management techniques. Looking at the marketing and access to Markets, the predominance of wholesale marketing and reliance on traders as the main source of market and price information aligns with findings from other studies in developing countries (Dorosh *et al.*, 2009).

Lack of direct access to markets and limited bargaining power may lead to price fluctuations and delayed payments, as observed in this study. Improving market access and empowering farmers to engage in value-added activities, such as processing and marketing cooperatives, could enhance their bargaining position and income (Reardon *et al.*, 2019). Socio-economic Factors and Production, the positive correlations between socio-economic factors (age, education, family size, farm size, and farming experience) and increased production of cassava and sweet potato reaffirm the significance of human capital and resources in agricultural productivity (Kilic *et al.*, 2017, Magulod *et al*, 2022).

Providing support and training programs targeted at improving farmers' skills and resources could potentially boost production and overall livelihoods (Ulimwengu *et al.*, 2013, Madarang, 2021). As to Policy Recommendations and Programs implications, the study's comprehensive analysis of the challenges faced by farmers in the lahar-affected areas of Zambales provides a basis for formulating targeted policy recommendations and programs. Strategies to address weather-related risks could include the introduction of climate-resilient crop varieties and promoting sustainable land management practices (Lobell *et al.*, 2014, Magulod *et al*, 2022).

Additionally, initiatives to enhance market access and strengthen farmer organizations could help overcome the marketing problems identified in this study (Swinnen *et al.*, 2019). Moreover, investing in education and training opportunities for farmers could lead to increased productivity and overall agricultural development (Barrett *et al.*, 2012, Guzman *et al*, 2021).

Conclusion

The study aimed to revitalize legumes and root crops farming in the lahar-affected areas of Zambales, Philippines. It surveyed 186 farmers in selected towns, focusing on peanut, cassava, mungbean, and legumes production. The socio-demographic profile of the respondents revealed that a majority were male, married, and aged 51 and above. Formal education was not a strict requirement for engaging in root crop farming, and most farmers had small to medium-sized families and owned farms ranging from 0.6 to 1 hectare. Farming experience varied, with the highest representation in the 26 and above years category. The study identified super Taiwan and Lakan 2 as the main varieties of sweet potato and cassava used by the respondents. Fertilizer usage ranged, but most farmers used 4 to 5 bags. Weather conditions and pest/insect problems were the primary challenges in root crop farming. In terms of marketing, farmers primarily sold their products on a wholesale basis, with traders being their main source of market and price information.

Personal capital was the primary source of funding for the farmers' crops. Marketing problems included low prices, delayed payments, oversupply, unstable prices, limited buyers, and fluctuations in prices. Statistical analysis revealed positive correlations between socio-economic factors like age, education, family size, farm size, and farming experience with increased production of cassava and sweet potato. The study's insights into the socio-demographic profile, production practices, and marketing challenges of farmers can aid in developing relevant policy recommendations and programs to support the agricultural sector in the lahar-affected regions of Zambales.

Recommendations

Based on the findings of the study, several recommendations can be made to revitalize legumes and root crops farming in the lahar-affected areas of Zambales. Firstly, targeted training programs should be developed to enhance farmers' knowledge and skills, especially in climate-resilient agricultural practices and pest management. Secondly, efforts should be made to improve market access and reduce

the dependence on traders by promoting collective marketing initiatives and value-added processing. Thirdly, there is a need for increased investment in agricultural infrastructure, such as irrigation systems, to mitigate the impact of weather-related challenges. Fourthly, policymakers should explore opportunities for providing financial support and credit facilities to farmers to address funding constraints and encourage investment in agricultural productivity. Lastly, collaboration between government agencies, research institutions, and farmer organizations is essential to develop sustainable and region-specific strategies for the revitalization of legumes and root crops farming in the lahar-affected regions

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