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Peanut Production in Central Luzon, Philippines: An Assessment of Farmer Practices, Challenges, and Profitability

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Abstract

Peanut is a crucial leguminous crop grown by farmers in Central Luzon, acknowledged for its economic and ecological significance. Peanuts function as a versatile rotation crop, thriving in warm regions with well-drained, sandy or loamy soils, and significantly contribute to sustainable farming methods by enhancing soil fertility. Central Luzon, recognized as a key peanut-producing area in the Philippines, significantly contributes to fulfilling the demand for this crop. Nonetheless, numerous challenges remain, obstructing the growth and productivity of the industry. Farmers in the region encounter challenges including restricted access to premium seeds, dependence on conventional farming techniques, and vulnerability to pests and diseases. Due to insufficient support for training, extension services, and research funding, the identified challenges result in decreased yields and variable production quality. Mechanization, especially in the context of labor-intensive harvesting, is still not fully developed, resulting in smallholder farmers relying on inefficient and time-consuming methods.

This paper presents a thorough evaluation of peanut production in Central Luzon, including an analysis of farms and farmers, an assessment of production costs and returns, identification of constraints, proposed interventions, and a review of current research and development initiatives. Notable challenges encompass restricted access to high-quality seeds, inadequate training and extension support, and a deficiency in mechanized post-harvest equipment. The demanding processes of planting, weeding, and harvesting significantly constrain the growth of peanut production areas and overall yields. To effectively address these gaps, it is essential to foster collaboration among stakeholders. This includes the development of suitable machinery for small farm holdings, the implementation of training programs, and the enhancement of investment in peanut research and extension.

Keywords: peanut production, cost and returns, legumes, Central Luzon

1. Introduction

In the Philippines, peanuts (*Arachis hypogaea*) are one of the main food legumes that local farmers plant. They are very valuable commercially and significantly boost domestic income (Bernabe & Sugui, 2019; Billen et al., 2015; Gatan, 2015). It is frequently grown either early or late, depending on when the rotation's previous crops are harvested (Ramos, 2020). Peanuts are mostly grown in a number of provinces around the nation; the top ten producing provinces include, among others, Ilocos Sur, Pangasinan, La Union, and Aurora. The average yields of these provinces vary; Ilocos Sur leads with 1.97 mt/ha, while Cagayan has an average yield of 0.45 mt/ha (DA-BPI). Despite this, peanut output in the country is still poor, with yields usually between 800 and 1,000 kg/ha, well below the potential yield of 3–4 mt/ha a (Huelgas, 1990).

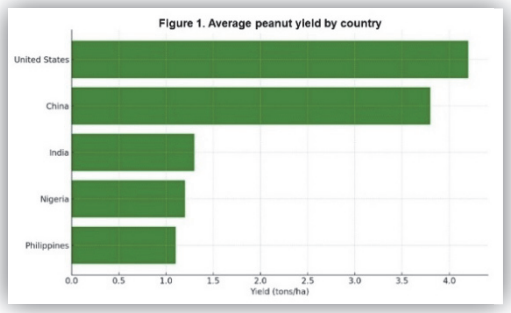
The low-yielding "native" Spanish-type cultivar is planted in around 95% of peanut regions in the Philippines (Department of Agriculture-Regional Field Unit 6, n.d.). Traditional cultivars are still the most widely used

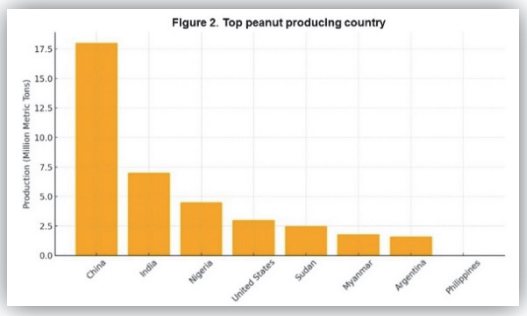
because they are easily accessible, but a number of issues, including limited access to improved cultivars, pest and disease susceptibility, and poor agronomic practices, limit their output. International breeding programs, such as those run by the USDA and ICRISAT, are responding by creating cultivars that are disease-resistant, high-yielding, and have desirable characteristics like big seeds and early maturation (University of Florida, n.d.). But even with the availability of new types, few farmers are adopting them, and many still use antiquated farming practices.

In the Central Luzon region, peanut cultivation is crucial to local livelihoods and regional economies, especially in the provinces of Tarlac, Nueva Ecija, Zambales, and Pampanga. These provinces' rich soils and temperate climate make peanut farming possible. Farmers in these regions, however, deal with issues like erratic weather patterns, antiquated farming methods, pest issues, and restricted access to contemporary inputs and technologies. These issues are the root of declining productivity and uneven yields. Market-related issues, such as fluctuating prices and restricted access to lucrative markets, make peanut growing in the area even less sustainable. By characterizing the sociodemographic profile of peanut stakeholders, including farmers, and examining costs and returns on farm production, this study seeks to evaluate the present state of peanut production in Central Luzon. The goal of the study is to determine the variables that affect peanut productivity and investigate methods for raising yields and profits. This study aims to offer insightful suggestions for enhancing peanut output and bolstering the regional agricultural economy by investigating farming methods, obstacles, and opportunities in the area.

1.1 Global Peanut Production Status Map and Yield Analysis

The average peanut yield (in tons per hectare) for selected countries is depicted in Figure 1. Due to their sophisticated agronomic practices and high mechanization, the United States and China are the leading countries with yields exceeding 3.5 tons/ha. Conversely, developing nations such as Nigeria, India, and the Philippines have yields that are approximately or below 1.3 tons per hectare. This is primarily due to the limitations in the adoption of technology, the lack of access to high-quality inputs, and the challenges associated with climate change. This discrepancy emphasizes the necessity of targeted interventions in low-yield regions to improve sustainability and productivity. Figure 2 illustrates the top peanut-producing nations according to recent global data. China produces about 18 million metric tons annually, with India (7 MMT), Nigeria (4.5 MMT), and the United States (3 MMT) coming in that order. The Philippines is considerably behind with only around 0.03 MMT, while countries such as Sudan, Myanmar, and Argentina also contribute significantly. These discrepancies are indicative of variations in agricultural research investment, mechanization, and scope (FAO, 2023; USDA, 2023).





The production of peanuts in Central Luzon, Philippines, is indicative of numerous fundamental obstacles encountered by smallholder producers in developing economies, such as low yields, restricted mechanization, and susceptibility to market fluctuations. The comparative yield graph, Figure 1 confirms that the average peanut yield in the Philippines is between 1.0 and 1.3 tons per hectare, a considerable decrease from the yields reported in high-performing countries such as the United States (4.2 tons/ha) and China (3.8 tons/ha). This information is based on recent regional assessments. According to the global peanut production map (FAO, 2023) China, India, and Nigeria are the primary producers, together accounting for more than 50% of the global output. Conversely, the Philippines contributes a negligible annual contribution of approximately 0.03 million metric tons, which underscores the pressing necessity for strategic interventions in Central Luzon. The results of the local assessment are in line with global trends, which show that higher yields are linked to mechanization, easy access to inputs, and strong links between research and extension. Consequently, the Central Luzon instance serves as a reminder of the broader global disparities and presents an opportunity to align regional development strategies with successful international models. The region could experience a significant increase in productivity and profitability by incorporating innovations such as postharvest technologies, farmer training, and enhanced seed varieties

2. Design and Methods

This study employed a mixed-method research design that combined quantitative and qualitative approaches to assess the status of peanut production in Central Luzon. Data collection involved structured surveys with farmers and semi-structured interviews with key informants such as agricultural extension workers. Field observations were also conducted to validate survey responses. Prior to data collection, ethical clearance was obtained, and informed consent was secured from all participants. mixed-method research design that combined quantitative and qualitative approaches to assess the status of peanut production in Central Luzon. Data collection involved structured surveys with farmers and semi-structured interviews with key informants such as agricultural extension workers. Field observations were also conducted to validate the data obtained from surveys and interviews. Before data collection, ethical approval was obtained from the relevant authorities. Informed consent was secured from all participants, and they were assured of the confidentiality of their responses.

2.1 Data Collection and Analysis

The research focused on the four major peanut-producing provinces in Central Luzon—Nueva Ecija, Tarlac, Pampanga, and Zambales—based on data from the Department of Agriculture–Regional Field Office III under the High-Value Crops Development Program. The peanut farmers were selected using stratified random sampling where 77 respondents were selected which represents 10% of the total population of peanut farmers, ensuring representation from both small-scale and commercial farms. In order to collect information regarding assistance programs and production initiatives, surveys were carried out through face-to-face interviews, which took place between the months of August and September 2024. Conversations with agricultural officials who work for local government units (LGU) supplemented these interviews. Their farming techniques, productivity metrics, associated expenses, obstacles they faced, and access to markets were all included in the primary data that was acquired from farmers. Examining secondary information gathered from academic journals and government-published papers helped to establish the context.

All survey data was subjected to a meticulous process of validation, cleaning, and coding prior to the initiation of the analysis. The examination of quantitative data was carried out utilizing descriptive statistics, encompassing averages, frequencies, and percentages, to identify patterns and trends. An analysis of costs and returns was undertaken to assess the financial efficacy of peanut production. In the interim, qualitative data derived from interviews were subjected to thematic analysis to reveal significant issues and potential opportunities. The findings were analyzed in accordance with the study's objectives to yield practical insights aimed at enhancing both the productivity and sustainability of peanut farming within the region.

3. Results and Discussion

3.1 Socio-demographic Profile of Peanut Farmers

The majority of peanut farmers are male, with 80.52% males compared to 19.48% females, aligning with the national trend reported by the Philippine Statistics Authority (PSA) in 2021, where 74.01% of the agricultural workforce is male. In terms of age, the largest group of peanut farmers falls within the 46-59 years' category, comprising 44.16% of the respondents. Subsequently, 27.27% are senior folks (aged 60 and above), 24.68% belong to the middle-aged group (ages 26-45), and 3.90% are classified as young individuals (aged 25 and below). The age distribution aligns with statistics from the Department of Agriculture-Agricultural Training Institute (DA-ATI), which indicates that the average age of farmers in the Philippines is 57. The household size mostly averages 70.13%, with 4-6 individuals, consistent with national statistics documented by PSA and PhilRice (2016) for other Filipino farmers.

According to PhilRice (2016), rice farmers have a similar trend in terms of educational attainment, with 44.16% graduating from high school and 25.97% finishing primary education. Ninety-three point five one percent of respondents identify farming as their principal source of income, while the remainder derives income from non-agricultural enterprises, employment, and pensions. The majority are members of registered farmer cooperatives and organizations (FCAs), with 77.92% qualifying for Department of Agriculture interventions, which are essential for obtaining support such as agricultural inputs, irrigation, and machinery. Nonetheless, 22.08% lack affiliation with any FCA.

Regarding experience, 40.26% of peanut farmers have cultivated peanuts for 1-10 years, 22.08% for 11-20 years, 19.48% for 21-30 years, and the remaining 18.18% had over 31 years of experience. Significantly, 94.81% of respondents lack formal training in peanut production, whereas 5.19% have participated in 1-5 training sessions. 61.90% of farmers mostly get knowledge from their peers, while 28.57% obtain it from their parents, with a minority engaging in self-research or consulting farm technicians. Finally, 42% of peanut farmers distribute their

products to dealers or consolidators, followed by wholesalers at 29% and public marketplaces at 6%, illustrating the varied distribution routes within the regional peanut farming sector.

3.2 Farm Profile of Peanut Farmers

The farmers' farm size relative to peanut production: 53.25% had an area of 0.50 hectares or less, and 33.77% had an area of 0.51–1.00 hectares (ha). On the other hand, the latter has an area of 1.01-1.50 ha, 1.51-2.00 ha, and 2.51-3.00 ha, with 7.79%, 2.60%, and 2.60%, respectively. Based on the data presented by PhilRice (2016), the average farm size of the rice farmers is 1.54 hectares. Proximity of the farm to the nearest market is one of the factors to be considered in choosing an agricultural production site to minimize transportation costs in marketing the produce. Respondents obtained yields using the Arayat Red/ Pula and Puti varieties above 1,000 kg (45.45%); the average yield is computed around 1,200 kg. It shows that 61.04% of the farmers' farms were located 5.00 or less kilometers from the closest market. Conversely, 12.99% of respondents' fields were 20.01 km or more from the market, whereas 25.97% of farmers' areas were situated at 5.01–10.00 km from the market.

According to the findings, 53.75% of the respondents owned their land; 27.50% of the farmers were tenants, and 10.00% of them had farms that were owned by their parents or relatives; the remaining 8.75% of the farmers rented the area. The farmer's overhead cost is reduced if they own the land. Based on the respondents, they pay ranging from PhP 10,000.00 to PhP 15,000.00 per year for the rental fee. The types of seeds used by the peanut farmers are 96.10% of the respondents were using good seeds, whereas the rest of the farmers, 3.90% utilized breeder seeds. Interestingly, the majority of the farmers in Pampanga utilized Arayat Red. While, Tarlac province used their local varieties called Namnama Red and 160 (white). On the other hand, San Antonio, Zambales peanut farmers planted the locally called variety "Sinamalagi" and Arayat Red. Furthermore, Nueva Ecija peanut farmers used the Arayat Red variety. According to the respondents, they produced their own seeds because high cost and the source of good-quality seeds are their main concerns. According to Moreno, et al. (2023) seed is one of the most expensive costs in peanut production, and the use of high-quality seed is important to provide the greatest yield potential.

Peanut farmers' sources of seeds were 36.84% of the farmers produced their own seeds, whereas 27.37% were bought it to other farmers. The remaining of the seeds utilized were from the government centers, public markets, dealers, and agriculture supply stores with 20.00%,10.53%, 4.21%, and 1.05%, correspondingly. Farmers said that they are opt to produce their owned seeds to lack of source of good quality seeds and high cost of seeds. As per declaration of the farmers the good seeds price ranges from PhP 2,000.00 to PhP 2,500.00. The sources of irrigation in peanut production of the respondents commonly were Shallow Tube Well (STW) with 63.75%, this means that they incurred additional expenses for fuel, while the latter were relying on rainwater (rainfed), rivers, National Irrigation System (NIS), and Solar Power Irrigation System (SPIS) with 31.25%, 2.50%,1.25%, and1.25%, consequently.

Table 1. Farm Profile of Peanut Farmers in Central Luzon

Variable	Frequency	Percentage (%)	Variable	Frequency	Percentage (%)
Area (hectare)			***Peanut Varieties Used***		
Below 0.50	41	53.25%	Arayat Red	38	40.86%
0.51-1.0	26	33.77%	Pula	28	30.11%
1.01-1.50	6	7.79%	Asha	15	16.13%
1.51-2.0	2	2.60%	Puti	12	12.90%
2.01-3.0	2	2.60%	***Types of Seeds Used***		
Average yield per hectare (kg)			Good Seeds	74	96.10%
Below 500	14	18.18%	Certified Seeds	3	3.90%
500 – 1,000	28	36.36%	***Seed Source***		
Above 1000	35	45.45%	LGU	19	24.68%
Distance to Market (km)			Own	35	45.45%
Below 5.0	47	61.04%	Market	23	29.87%

5.01-10.00	10	12.99%	***Irrigation Facilities/ Sources***		
10.01 and more	20	25.97%	National Irrigation System (NIS)	1	1.25%
Land Ownership			Shallow Tube Well (STW)	51	63.75%
Self-Owned	43	55.84%	Others: Rainfed	25	31.25%
Owned by Parents, Relatives	8	10.39%	Others: River	2	2.50%
Rented/ Tenanted	7	9.09%	Others: Solar Powered Irrigation System (SPIS)	1	1.25%
Tenanted	22	28.57%			

3.3 Problems Encountered in Peanut Farming

Figure 3 highlights the challenges that the respondents faced in producing peanuts. As revealed, 25.20% of them had problems with the occurrence of pests and diseases majority were larval insects, and white grubs. Some diseases they experienced were "bulutong" and leaf spot locally called as *apaya* (yellowing of peanut leaves), in Pura, Tarlac which are recognized locally in Pura, Tarlac. Gordon (2022) reported that pests account for 20-40% of yield losses worldwide and crop protection crop protection constitutes about 5-8% of a farmer's total production costs. On the other hand, 24.40% of the peanut farmers encountered weed outbreaks. The identified weeds were broadleaves and *Cyperus rotundus L. with* local name: mutha, sudsud, and barsanga. According to Donayre, DK., et.al., 2019 *C. rotundus* considered as the world's worst weed due to its prolific behavior in the soil, persistence in harsh environments, and competitive ability. They added that weeds cause higher rice yield loss (5-90%). Weed Science Society of America (2019) found out that 50% to 70% would be lost if weeds were left uncontrolled.

In addition, the source of quality seeds and high cost of seeds were also issues of the respondents with 15.60% and 12.80%, respectively. Whitty E.B. (2002) mentioned in his study that, seeds normally constitute a major cost of producing peanuts. Labor intensive during harvesting, low production during the wet season, irrigation, farm-to-market bridge/road, and high cost of fertilizer were also mentioned problems of the peanut farmers with 9.20%, 8.00%, 3.60%,0.40%, and 0.40%, respectively. Low yields of peanut are mainly attributed to lack of high-yielding adaptive cultivars, damaged by diseases and pests, poor agronomic practices, unreliable rainfall patterns with frequent droughts, and limited use of inputs (Saese et. al, 2006)

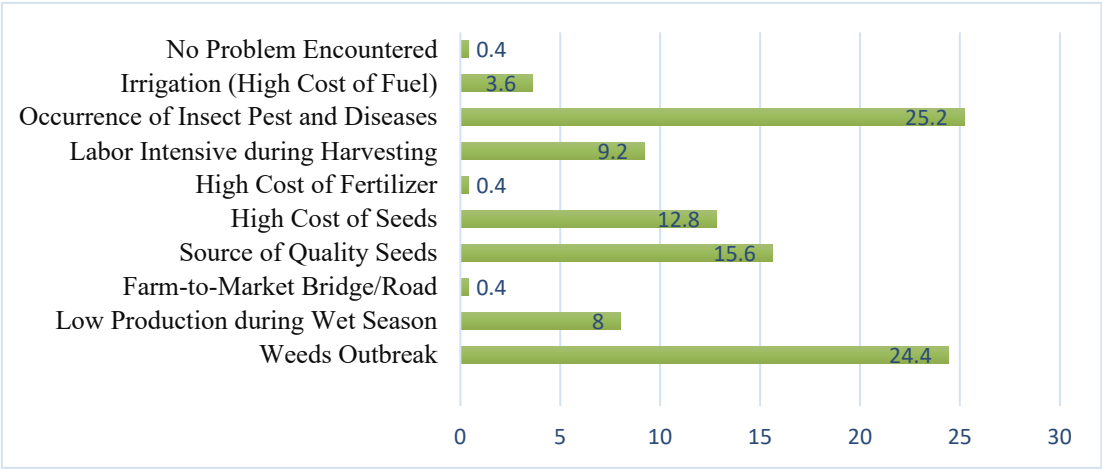


Figure 3. Problems encountered in peanut farming (%)

Note: Respondents can provide multiple answers.

3.4 Interventions Recommended

The solutions that the peanut producers suggested to address the issues they had faced while growing peanuts are displayed in Figure 4. Regarding the weed outbreak, 15.42% conducted manual weeding, while 30 respondents 11.86% used herbicides. Furthermore, 35 13.83% farmers advised using chemical control, whereas 0.79% farmers

used biological control agents (BCAs) to combat pests and illnesses. Regarding the issues of high seed costs and source quality seeds, 24.51% respondents stated that they grow their seeds, while 18.58% respondents said they were hoping for a government subsidy on peanut seeds to help them with those issues.

In addition, 28.58% respondents recommended harvesting and post-harvest machinery to alleviate the high manpower required during harvesting. 3.56% farmers, suggested that the government should provide fuel subsidies to alleviate irrigation issues. The remaining 1.58% respondents said they would change the planting schedule to prevent low output during the rainy season, while the government fertilizer subsidy and farm-to-market bridge/road development both received 0.40% response each.

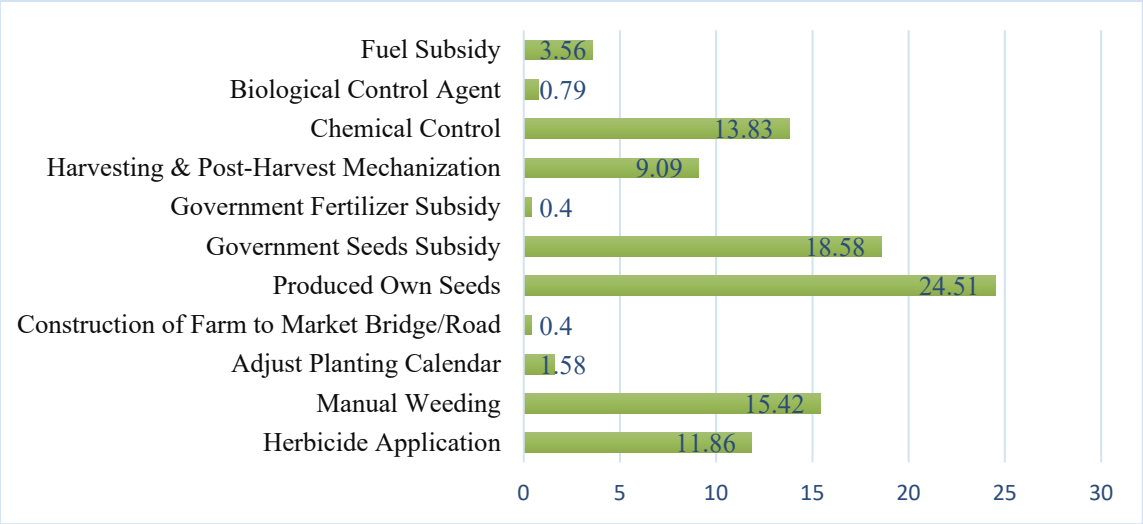


Figure 4. Intervention Recommended (%)

3.5 Cost and returns on Peanut Production

The average yield of peanut farmers was 1,975.76kgs or 65.86 cavans (30kilos/cavan) of peanut, which they sold at Php. 70.00 per kilogram. Given these, a farmer may earn a gross income of Php. 138,303.20 after selling all his peanut produce. Among the operating expenses, the labor costs were recorded at Php. 45,815.00, which included payments to hired labor who performed farm work like planting, spraying, weeding and harvesting. As a result, human labor is a major component of the cost of peanut production.

In addition, the material expenses amounted to Php. 25,683.50 for seeds, pesticides, herbicides, insecticides and others. After deducting the operating expense from the gross income, a farmer earned average of Php. 66,804.70 for almost four months of cultivating peanut. This amount is of great help to farmers in feeding their families, sending their children to school, and buying necessities. The return on investment is documented at 93.00%, indicating that producers may completely recoup the costs associated with peanut production. The data analysis reveals that peanut cultivation offers both financial gain and job prospects. Nonetheless, this is not a certain result, as farmers' income is significantly dependent on their crop yield and market pricing. Success frequently depends on advantageous weather conditions, the lack of pests, and consistent peanut prices during the harvest period.

Table 2. Cost and returns on peanut production in Central Luzon, 2024, 1.0 ha.

Item / Activity	Unit	Quantity	Amount/unit (P)	Total Amount (P)
GROSS INCOME				
Yield per hectare	kg	1,975.76	70.00	138,303.20
A. Farm Inputs				
Peanut Seeds	kg	100	120.00	12,000.00
Fertilizer	bags	4	1,500.00	6,000.00
Insecticide	liter	2	850.00	1,700.00
Fungicide	liter	2	950.00	1,900.00
Fuel	liter	50	57.67	2,883.50
Sacks	pcs	100	12.00	1,200.00
Sub-total				25,683.50
B. Labor Cost				-
Land Preparation, 2 times	MD	Tractor rental	3,500.00	7,000.00
Planting	MD	8	550.00	4,400.00
Fertilizer/Pesticides/Herbicides application	MD	5	550.00	2,750.00
Weeding, 2 times	MD	10	550.00	5,500.00
Irrigation,2 times	MD	5	550.00	2,750.00
Drying	MD	10	550.00	5,500.00
Harvesting	MD	25	550.00	13,750.00
Contingency, 10% of labor cost				4,165.00
Sub-total				45,815.00
TOTAL EXPENSES				71,498.50
NET INCOME				66,804.70
RETURN ON INVESTMENT				93%

4. Summary

The analysis indicated that a significant majority of respondents were male (80.52%), with a considerable portion (44.16%) in the age bracket of 46-59 years. A significant number of farmers indicated that their household size varied between 4 to 6 members and that they had attained a high school education level. A notable percentage (68.83%) indicated that peanut production is their main source of income, whereas farm business emerges as the top income generator (93.51%).

Nonetheless, many farmers encountered a lack of alternative income sources, highlighting their economic vulnerability. A significant 94.81% of respondents indicated that they had not engaged in any training related to peanut production, underscoring a considerable knowledge gap that could affect productivity.

Farmers have identified a range of challenges, notably pest and disease management at 25.20%, weed outbreaks at 24.40%, and elevated seed costs at 15.60%. To tackle these challenges, the study suggests the implementation of thorough training programs, the establishment of financial support systems, the promotion of cooperative formations among farmers, investment in research and development, and enhancements to rural infrastructure. The study indicates that by focusing on these areas, there is potential for substantial enhancement in peanut production in Central Luzon, which could result in improved livelihoods for farmers and contribute to a more sustainable agricultural sector as a whole.

5. Conclusions

Comprehensive training in modern farming techniques and sustainable practices will empower farmers, improve their productivity, and promote better pest management. Financial support initiatives, including subsidies for premium seeds and fertilizers, are crucial for mitigating the economic challenges encountered by farmers, thereby promoting investment in superior agricultural inputs. The establishment of farmer cooperatives can optimize resource allocation, augment price negotiation leverage, and improve access to governmental assistance, promoting a community-oriented agricultural model. Ongoing investment in research to create pest-resistant peanut cultivars and customized agricultural practices is essential for enhancing resilience against pests and responding to local environmental conditions, hence resulting in increased yields.

Improving rural infrastructure, including roads and irrigation systems, will markedly enhance market access, lower production costs, and facilitate the efficient distribution of agricultural products. Stressing the use of certified seeds and proper fertilizer management based on soil analysis can increase crop yields and ensure economic viability by making better use of nutrients. A synthesis of cultural, biological, and selective pesticide strategies would enhance sustainable pest management, minimizing environmental repercussions and agricultural expenses.

Upgrading to efficient agricultural machinery can reduce labor expenses and enhance operational efficiency, so rendering peanut growing more economically viable. Effective methods in drying, storage, and transportation are essential for preserving peanut quality and minimizing loss, which can directly affect marketability and profitability. Integrating peanuts into various crop rotations improves soil health, mitigates agricultural hazards, and increases overall farm yield. Adopting these proposals may result in significant enhancements in peanut output in Central Luzon, directly helping farmers' livelihoods and fostering a more sustainable agricultural sector.

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