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Research Article

Cacao Production: Status and Prospects in Aleosan, Cotabato

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Abstract: This study aimed to determine the current status of cacao production in Aleosan, Cotabato, Philippines, including the challenges faced by farmers and their future prospects. A descriptive research design was used to survey 58 cacao farmers who are members of the Aleosan Cacao Farmers Association (ACFA). The study also revealed that most pressing challenge faced by cacao farmers is the lack of access to experts, followed by price fluctuation, disease outbreak and lack of market outlet. Despite these challenges, most farmers have potential areas for expansion of at least one hectare of land available. The study highlights the need for support services, including expert guidance, technical assistance, and access to market, to improve the productivity and livelihoods of smallholder cacao farmers in Aleosan. The farmers also suggested solutions to improve cacao production, including market linkages, price support, training and technical assistance.

Keywords: cacao farmers; cacao production; status and prospects of cacao

1. Introduction

Theobroma cacao commonly known as cacao or "food of the gods" was an economically important crop globally and a key ingredient in chocolate production. Its cultivation provided livelihood opportunities for millions of farmers around the world, including the Philippines. Cacao production had the potential to improve the livelihoods of smallholder farmers in area like Aleosan. However, many farmers still faced difficulties in production, and there was limited information about the actual conditions of cacao farming.

The focus of this study was to determine the current status of cacao production in Aleosan, including the challenges they faced and their future prospects. Although cacao had the potential of supporting many farmers in Aleosan, problem still existed, such as pests, plant diseases, changing weather, lack of tools and training, and instability of prices in the market (Cilas & Bastide, 2020). These issues were not unique to Aleosan but were the same in other places where cacao was planted, particularly when it comes to small-scale farmers with little assistance (Lirag, 2021). Studies showed that understanding the background, experience, and resources of local farmers was important to improve their productivity (Kongor et al., 2024).

The main objective of this study was to determine the status of cacao production and the prospects and challenges that Aleosan cacao farmers encountered. It specifically aimed to describe the socio-demographic profile of cacao farmers, describe the farm profile of cacao farmers, determine the status of cacao production in terms of productivity and pest and disease management, determine the prospects in terms of value-adding and area expansion, and determine the challenges in cacao farming.

The study was conducted in the Municipality of Aleosan, located in the province of North Cotabato, Philippines. The data collection took place during the 2nd semester of A.Y. 2024-2025 and ended at the 1st semester of A.Y. 2025-2026. This study assessed the current status of cacao production, identified the challenges, and explored the prospects for cacao farming in the Municipality of Aleosan, with a specific focus on active members of the Aleosan Cacao Farmers Association (ACFA).

2. Literature Review

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2.1. Profile of Cacao Farmers

Cacao is one of the important crops for the rural economy of places such as the Philippines. Ballesteros Possú et al. (2021) study focused on cacao farmers in Columbia, discovered that majority of farmers had low income, minimal access to education and were dependent on traditional agriculture. Just like the small- scale farmers in the Philippines, they also typically farmed small plots of lands and relied on family members for labor. Conditions such as these usually reduce innovation, lower productivity and make it harder to access markets.

According to Lirag (2021), in Camarines Sur, most cacao farmers were men in their middle years, with little or no formal education. Many cacao farmers in the region are more than 50 years old, this aging farmer population poses challenges for the sustainability of cacao farming, as the younger generations show less interest in agriculture.

Kouassi et al. (2021) investigated how cacao farmers in Cote d'Ivoire were adopting agroforestry practices. According to the research, while agroforestry could help soil and shade the cacao trees, still most farmers were not willing to start using it. The main things holding them back were limited education, lack of training, and lack of secure land ownership.

Another study found that supplying input credit to farmers which covers the cost of fertilizers and seed, is crucial for higher cacao yields. It was found that happy users of credit services in Cote d'Ivoire had better farming results. On the other hand, those farmers who did not rely on or understand the terms from credit institutions opted not to take on any loans (Kouadio et al., 2023).

2.2. Farm Profile of Cacao

The profile of cacao farm includes many important aspects such as farm locations, topography, size, type of production, management practices, environmental sustainability, and access to support programs.

In the Philippines, cacao farming has been promoted as a livelihood, especially in regions like Davao, because of the favorable climate and soil condition that support cacao production. According to the study of Magallon et al. (2022), it's been said that both government and private programs have helped improved the cacao industry by offering seedlings, training/seminar, and market access. Yet, for these programs to succeed, it's crucial that farms are managed carefully since the size, age and methods used can affect success. Most smallholder cacao farms in Davao del Norte depend on traditional method, which affect their productivity and sustainability.

According to Bautista (2023), introducing the students to environmental awareness in cacao production can reduce their waste and secure a sustainable future for cacao farming. As a result, farm attributes such as composting and reforestation are now being included on cacao farm profiles. The shift towards environmentally friendly practices strengthens the ecological foundation of cacao farms.

Meanwhile, Micabalo et al. (2024) also underline that cacao farmers have several challenges, mainly from climate change and getting access to financial resources. Farm profiles reveal that small-scale farmers have lack of irrigation system, proper farm planning and access to climate resilient farming methods. These difficulties reduce the capacity of farms to handle extreme weather conditions and other environmental threats. Financial constraints also limit the ability of farmers to purchase fertilizers, equipment and pest control, which are necessary for successful farms management.

2.3. Status of Cacao Production

The current situation of cacao production in the Philippines is threatened by the significant problems of productivity that stunt the industry's potential to grow. In spite of the country's conducive climate and soil requirements, the cacao industry is under great pressure to satisfy the ever-increasing need for cacao especially as the world's chocolate market keeps growing. The Department of Agriculture reported that domestic consumption of cacao is about 50,000 metric tons (MT), but only local production is able to provide between 10,000 and 15,000 (MT) (Industry Strategic Science and Technology Plans Platform, 2023).

Cacao farming in Aleosan is one of the key agricultural activities, though. It is relatively small in its scale as compared to other regions. Local farmers practice cacao farming primarily for income generation but some combining them with other crops like coconut or banana so as to diversify their earnings.

Cacao farm productivity is still a challenge because of several farming and social factors. Kongor et al. (2024), observed that the aging of trees, poor agronomic practices, and limited

access to quality inputs and extension services often prevent most cacao-growing countries, including the Philippines, from achieving higher productivity. Many farmers use old and low yielding varieties, and without proper replanting strategies or access to improved genetic materials, and yields remain stagnant. In addition, a lack of workers, inadequate training in up-to-date farming skills and poor infrastructure further contribute to low output levels.

Climate changes cause productivity issue on pod development and flowering patterns. Wanger et al. (2021) pointed out that changes in rainfall patterns and increase temperatures may disrupt normal production cycle and lower both the amount of quantity and quality of yields. As a result, the16 productivity gap between potential and actual yield in many regions remains significant.

Pests and diseases seriously threaten the ongoing growth of cacao farming. The cacao pod borer (CPB) (Conopomorpha cramerlla) is among the most damaging pests in the Philippines, which caused substantial losses over the years. Amalin et al. (2023) conducted a field evaluation of sex pheromones to monitor and control the pest in fields and discovered that setting up pheromone traps could be effective as part of integrated pest management (IPM) strategy. The study recommends further development of pheromone- based tools because these can make it easier to monitor pests and reduce reliance on chemical pesticides which often pose environmental and health risks.

In addition to pests, cacao plantations also suffer diseases such as black pod rot and vascular streak dieback. Even though it doesn't address exactly about cacao, Zhang et al. (2017), study on copper resistance in Pseudomonas syringae underscores the importance of understanding microbial resistance patterns when applying chemicals. This has implications for cacao farmers who depend on copper-based fungicides as improper use can lead to resistance of diseases and reduced efficacy over time. According to Witjaksono and Asmin (2016), addressing these problems requires the use of management approaches that are both sustainable and supported by science. More and more, people are urged to use timely pruning, following good sanitation, select resistant plants and rely on biological control methods.

When pest and disease are managed together, the surroundings are saved and healthy yields are maintained.

To address these challenges, the adoption of science-based and sustainable management practices is crucial. Integrated pest and disease management approaches improve the long-term benefits by minimizing environmental impact while enhancing yield. Strategies such as sanitation, resistant varieties, timely pruning, and biological control methods.

2.4. Prospects in Cacao Production

The prospects in cacao production in Aleosan are promising since there is a combination of various circumstances that work in its favor to make it more viable and sustainable with the initial cost of investment being low (PHP 61,148.00 for intercropping and PHP 89,628.00 for monocropping. According to Industry-Study-Cacao Philippine Cacao Industry Roadmap 2021-2025 (Department of Agriculture, 2022), the farmers could expect a high return of investment (ROI). Reports state that the net income is capable of being doubled compared to production costs on the final year of a three-year period. However, the sustainability of cacao production is an important aspect that can make a production profitable in the long-run. The growing cacao farming interests among the Filipinos are supported by good market opportunities and the rising prices on the global market (Gonzales & Janaban, 2024). Value-adding and land expansion for cacao production can significantly enhance the sustainability and viability of cacao farming offering opportunities as future prospect (Aini et al., 2020).

The shift towards value-adding aligned with rural development goals, create jobs opportunities, promoted community-based enterprises and encourages innovation. Value-adding activities can potentially diversified income sources of farmers who engage in these activities compared to those who rely solely on raw bean sales. The rise in demand for chocolate around the world is also helping the value-added cacao sector in the Philippines (Medenilla, 2022).

On the other hand, land expansion remains a viable strategy to increase cacao production and satisfy both local and international market demand. It was reported by certain researchers (Gynio, 2018; Ponpon & Murcia, 2024), that Compostela Valley and Basilan are suitable places for growing cacao due to favorable climate and soil condition. For other areas in Mindanao such as Aleosan, these results are also significant because they share comparable agro-ecological characteristics.

A study on scientific land evaluation by Sales et al. (2024), for Davao City showed that there are large areas that are moderately to high suitable for cacao production, as long as

rainfall, elevation, slope and soil type are considered. This provide a useful framework that can be used to spot places in North Cotabato where growing cacao may be feasible. The availability of such information helps guide strategic planning for expanding cacao plantation, especially in underutilized agricultural lands.

Moreover, sustainable land use standards should be part of any expansion effort. Integrating agroforestry system to cacao and shade-loving crops can reduce environmental degradation while utilizing long-term soil fertility and ecosystem condition (Villason & Olguera, 2020).

2.5. Challenges faced by Cacao Farmers

Cacao production encounters difficulties that impact farmers worldwide, including in the Philippines, they face challenges that affect farmer's productivity and its livelihoods. Climate variability is one major issue.

Research by Dhamira and Anggrasari (2024) show that regular change in rain and temperature in tropical countries such as Indonesia cause unstable cocoa yields. Similarly, unpredictable weather in Aleosan may disrupt critical stages like stop or delay of flowering, pod development and harvesting, resulting in less cacao production.

The quality of soil often presents another considerable difficulty. Doe et al. (2023) concluded that Ghana's cacao farms with low-quality soil gave much lower productivity than those with healthy, well-balanced soils. As good soil is so important for cacao trees, problems that arise due to soil damage or insufficient care could happen in Aleosan just like in Liberia. This can directly reduce cacao yields and farm sustainability

Cacao production is shaped by the way it is raised and the age of the trees. According to Kongor et al. (2024), farmers struggle with better farm management and receive few improved seedlings. Besides the other problems faced the crop modelling technology has displayed potential for forecasting cacao growth and making better decisions on farms (Romero Vergel et al., 2022). The limited chance for rural communities to gain technology and information means that farmers there are slower to accept innovations.

According the study of Umar et al. (2023) and Tokou et al. (2025) that socioeconomic factors also limit the cacao production. Most of the small-scale farmers struggle with limited access to quality planting materials, pesticides and fertilizers. Additionally, Penora and Magallon (2024), states that poor infrastructure such as inadequate farm-to-market roads delays transport and causes post- harvest losses, discouraging investment in cacao farming and reducing farmer incomes.

Therefore, cacao farmers face a combination of challenges including the soil health issues, the climate viability, limited technological access, aging plantations, pest and diseases, and socio-economic constraints. Addressing these problems through better training, improved farming inputs and infrastructure development and sustainable practices is key to enhancing the cacao production and livelihoods of cacao farmers not just in Aleosan but all over the world.

3. Materials and Methods

This study employed a descriptive research design to examine the status and prospects of cacao production in Aleosan, Cotabato.

The respondents of this study were the cacao farmers in the Municipality of Aleosan from different barangay, because they are directly engaged in cacao production, which allows them to contribute insights into the aspects of farming, production, problems, and future prospects in cacao production.

The purpose of this study was to determine the status of cacao production in Aleosan, using complete enumeration. Hence, all the ACFA members were the participants of this study. There were a total of 58 respondents from Bagolibas, Dualing, Katalicanan, Lawili, Malapang, New Leon, Palacat, San Mateo, Sta. Cruz, Tomado, and Upper Minggading based on the data obtained from the Department of Agriculture, Aleosan.

Data collection was facilitated through a structured questionnaire that was designed to gather comprehensive information on cacao farming. The questionnaire captured key aspects, including the socio-demographic profile of cacao farmers, such as age, gender, and educational attainment. It also explored production practices, including the types of cacao varieties planted and farming techniques employed. Additionally, the questionnaire investigated the challenges faced by farmers, such as pests, diseases, market access issues, and climate-related problems. Further, it examined the prospects for growth, focusing on farmers'

perceptions and potential opportunities.

The data collection procedure for this research was systematic and structured. First, the researcher developed a structured questionnaire that contained open-ended questions to collect data on the socio-demographic profile of cacao farmers, their farm profile, the challenges they encountered, and their prospects in cacao production. Along with the questionnaire, informed consent forms were prepared to ensure adherence to ethical guidelines.

Using complete enumeration, the researcher distributed and administered the questionnaires to the members of ACFA face-to-face, with the consent of the participants and approved by the president of ACFA. The researcher was on hand to help as much as possible so that the participants understood the questions and gave accurate responses. After filling of questionnaires, all answers were saved in digital form, guaranteeing proper documentation of all data. Following data collection, the researcher safely stored the details to maintain confidentiality. Lastly, the researcher used digital programs such as Excel to determine the frequency and percentage in the data, which was helpful in knowing the status, challenges, and prospects of cacao production in Aleosan.

This comprehensive procedure guaranteed a proper collection of data for the study, ethical and reliable results.

The researcher analysed the data using descriptive statistics. Specifically, the frequency, and percentage, were used to describe the socio-demographic profile of cacao farmers, their farm profile, the status of cacao production in terms of productivity and the pests and diseases management, and the prospects and challenges in cacao production.

The researcher ensured that ethics approval was secured from the University Research Ethics Committee Office. In addition, the researcher maintained, objectivity, impartiality and other codes of conduct were observed by the researcher during the conversations with the respondents, while guaranteeing that they were informed about the objective of the study and the reasons of their involvement. Before conducting the survey, a consent form dully filled-in by the respondents was signed to signify their consent and the willingness to volunteer, anonymity and confidentiality. Moreover, potential risks and benefits of the study were also explained to the respondents.

4. Results and Discussion

A six-dimensional discussion was presented the findings of this study, namely; 1) Socio-demographic profile of Aleosan cacao farmers; 2) Farm profile of cacao farmers; 3) Status of cacao production in terms of productivity; 4) Status of cacao production in terms of pest and diseases management; 5) Prospects in terms of value-adding activity; and 6) Challenges in cacao farming.

4.1. Socio-Demographic Profile of Cacao Farmers

The profile of cacao farmers in terms of sex, civil status, age, religion, and educational attainment is presented in table 1. The socio-demographic characteristics of cacao farmers in Aleosan show that cacao production in the municipality is a male-dominated activity (72.4%) compared to females (27.6%). This trend is consistent with the findings of Lirag (2021), who reported that cacao farmers in Camarines Sur were predominantly men and typically in their middle age. Cacao farming, like many agricultural activities in the Philippines, remains labor-intensive, which may explain the higher male participation. Nonetheless, the presence of female farmers suggests that women also contribute actively to household farm operations and cacao-related activities.

Table 1. Socio-demographic profile of cacao farmers.

Variable	Frequency (n=58)	Percentage (%)
Sex		
Male	42	72.4
Female	16	27.6
Civil status		
Single	7	12.1
Married	46	79.3
Widower	5	8.6
Age		
60 and above	13	22.4

50-59 yrs old	17	29.3
40-49 yrs old	25	43.1
30-39 yrs old	3	5.17
Religion		
Roman Catholic	39	67.2
UCCP	9	15.5
Southern Baptist	9	15.5
Spirit of Truth	1	1.7
Education attainment		
No formal education	3	5.2
Elementary level	4	6.9
Elementary graduate	9	15.5
High school level	6	10.3
High school graduate	17	29.3
College level	3	5.2
College graduate	16	27.6
Main occupation		
Farming	39	67.2
Business	7	12.1
Government employee	8	13.8
Private employee	4	6.9
Number of family members		
1-3	16	27.5
4-6	39	67.2
7 and above	3	5.2
Land tenurial status		
Owner	49	84.4
Tenant	9	15.5
Average family monthly income (PHP)		
3,000-5,000	10	17.1
6,000-10,000	30	51.7
11,000-15,000	13	22.4
16,000-20,000	3	5.1
21,000 and above	1	1.7

The greater majority of respondents are married (79.3%), followed by single farmers (12.1%) and widowed individuals (8.6%). This finding indicates that cacao farming is largely a family-supported livelihood, with married individuals likely engaging in cacao production to supplement household income. The reliance on family labor aligns with Ballesteros Possú et al. (2021), who observed that small-scale cacao farmers in Colombia similar to those in the Philippines depend heavily on family members to sustain agricultural activities.

In terms of age, the greater number of the farmers fall within the 40-49 age group (43.1%) and 50-59 (29.3%), while 13 farmers (22.4%) are 60 years old or above. Only (5.17%) belonged to the 30-39 age bracket. These results indicate an aging farming population, consistent with Lirag (2021), who emphasized that many cacao farmers in the Philippines are more than 50 years old. This demographic pattern raises concerns regarding long-term sustainability, as younger generations show decreasing interest in agricultural work. As for religious affiliation, the greater majority of farmers (67.2%) identified as Roman Catholic, followed by UCCP (15.5%), Southern Baptist (15.5%), and Spirit of Truth (1.7%). This pattern reflects the general religious composition of rural Philippine communities, where Catholicism is predominant.

With respect to educational attainment, the greater number of farmers were high school graduates (29.3%), followed by college graduates (27.6%) and elementary graduates (15.5%). A smaller proportion had incomplete schooling, including high school level (6 or 10.3%), elementary level (4 or 6.9%), college level (3 or 5.2%), and no formal education (3 or 5.2%). The presence of farmers with limited schooling aligns with Ballesteros Possú et al. (2021), who noted that many smallholder cacao farmers have minimal education, restricting their capacity to adopt new technologies and modern farming practices. This suggests that despite having basic literacy, Aleosan cacao farmers may benefit greatly from continued training,

seminars, and technical support to improve production efficiency.

The results revealed that the greater majority is farming as the dominant occupation (67.2%) stating that farming is their primary livelihood. The remaining respondents were government employees (8 or 13.8%), business owners (7 or 12.1%), and private employees (4 or 6.9%). This indicates that agricultural work remains essential to household sustainability in Aleosan, confirming the observation of Ballesteros Possú et al. (2021) that small-scale farmers typically rely on agriculture as their main income source.

Family size results show that the greater majority of households have 4–6 members (67.2%), followed by 1-3 members (16 or 27.5%), and 3 households (5.2%) having seven or more members. Medium-sized families can serve as a source of labor for farm activities, which mirrors the findings of Ballesteros Possú et al. (2021), who noted that cacao farmers commonly utilize family labor for tasks such as weeding, harvesting, and maintenance.

All respondents (100%) were members of the ACFA. This full membership suggests a strong organizational structure within the municipality. Farmer organizations are crucial in providing access to training, planting materials, and support services. According to Kouassi et al. (2021), membership in organizations helps smallholder farmers gain access to resources, innovations, and technical support necessary for improving farming practices. In Aleosan, ACFA membership potentially empowers farmers by granting them access to free planting materials and other benefits.

Land tenure results indicate that most farmers are landowners (82.8%), while 9 (15.5%) are tenants and 1 (1.7%) is a land transfer beneficiary. Kouassi et al. (2021) highlighted that lack of land ownership and tenure insecurity discourage farmers from implementing better agroforestry or management systems. The high rate of land ownership in Aleosan may therefore contribute positively to long-term cacao productivity.

Finally, the monthly family income distribution shows that the majority earn PHP 6,000-10,000 (51.7%), followed by PHP 11,000-15,000 (22.4%), PHP 3,000-5,000 (17.1%), PHP 16,000-10,000 (5.1%), and only 1 respondent (1.7%) earning PHP 21,000 and above. This suggests that cacao farmers in Aleosan generally fall within the low-income bracket, consistent with the findings of Ballesteros Possú et al. (2021), who identified that cacao farmers often suffer from low and unstable income due to inconsistent yields and limited access to capital. Similarly, Kouadio et al. (2023) emphasized that access to credit and financial assistance has a significant impact on improving yields and incomes, yet many farmers avoid credit due to lack of understanding or trust. This may explain why Aleosan farmers experience limited financial resources for investing in their farms.

4.2. Characteristics of Cacao Farms in Aleosan

The farm profile of cacao in Aleosan, including size, number of trees planted, planting distance, and topography, is presented in table 2. The results show that cacao farming in Aleosan, the greater majority is smallholder in nature, as 42 out of 58 farmers (72.4%) cultivate only 1 hectare of land. Smaller farms measuring 0.25 ha (12.1%) and 0.5 ha (10.3%) are also common, while only 5.2% manage 2 hectares and above. These findings confirm that cacao production in the municipality is largely characterized by limited landholdings, which restrict farmers' capacity to expand production, adopt advanced technologies, and achieve higher yields. This reflects the typical farm structure of cacao-growing areas in the Philippines.

Table 2. Farm profile of cacao farming in Aleosan.

Variable	Frequency(n=58)	Percentage (%)
Size of cacao farm (ha)		
0.25	7	12.1
0.5	6	10.3
1.0	42	72.4
2.0 and above	3	5.2
Number of trees planted		
20-50	16	27.6
51-100	20	34.5
101-200	11	18.9
201-250	2	3.4
251 and above	9	15.5
Planting distance		
3X3	42	72.4

	3X4	4	6.9
	3X5	5	8.6
	4X4	7	12.1
Topography			
	Plain	10	17.2
	Rolling	38	65.5
	Hilly	10	17.25
Soil analysis frequency			
	Once a year	5	8.6
	Never	53	91.4
Varieties planted			
	UF 18	17	29.3
	BR 25	14	24.1
	Both	27	46.5
Farming system			
	Intercropping	55	94.8
	Monocropping	3	5.2
Intercropped crops			
	Coconut	48	82.8
	Banana	15	25.9
	Mango	10	17.2
	Rubber	8	13.8

This observation aligns with Magallon et al. (2022), who emphasized that Philippine cacao farms especially in Davao Region are dominated by small-scale farmers relying on traditional methods and managing only small plots of land. They noted that farm size and farm age strongly influence productivity, and that without modernized farm management, smallholders face difficulties in meeting market demand and sustaining high yields. The situation in Aleosan mirrors these national trends, suggesting a need for continuous intervention and capacity development.

Regarding the number of cacao trees planted, the greater number of farmers (34.5%) maintain 51-100 trees, followed by those with 20-50 trees (27.6%). Only a small group (15.5%) manages 251 trees and above. The small number of trees per farm is consistent with the small farm sizes and suggests that many cacao farmers in Aleosan have newly established farms, or are still in the early stages of expansion. Additionally, the trees provided by the Department of Agriculture through ACFA indicate government involvement in building farm capacities – also consistent with Magallon et al. (2022) who highlighted government support through seedling distribution and market assistance as key components of cacao development programs.

As to planting distance, the greater majority (72.4%) use the 3 m × 3 m spacing, while others use 4 × 4 m (12.1%), 3 × 5 m (8.6%), and 3 × 4 m (6.9%). The dominance of the 3m×3m spacing reflects adherence to recommended practices that enhance air flow, canopy management, and disease control. Proper spacing is an essential component of sustainable cacao farm management, which is increasingly encouraged in environmental education initiatives such as those described by Bautista (2023), who emphasized that awareness of farm practices contributes to sustainability, waste reduction, and long-term farm health.

The findings also show that rolling terrain is the greater majority common farm topography (65.5%), followed by plain (17.2%) and hilly (17.2%). This aligns with the broader literature where environmental factors such as land formation, soil conditions, and climate significantly influence cacao productivity. Bautista (2023) stressed that cacao farms increasingly integrate environmentally sensitive practices such as reforestation, contour farming, and soil preservation – practices that are highly relevant to rolling and hilly terrains such as those in Aleosan.

The results further show that almost all (91.4%) have never conducted soil analysis, while only 5 farmers (8.6%) do so once a year. This lack of soil testing suggests that many farmers are unaware of soil nutrient levels, pH balance, or potential deficiencies that may limit cacao growth. Without soil analysis, farmers cannot effectively tailor fertilizer application or soil amendments, which may lead to reduced yields or long-term soil degradation. This situation is consistent with Micabalo et al. (2024), who found that small-scale cacao farmers in the Philippines commonly face limitations in accessing farm planning tools, irrigation facilities,

and climate-resilient technologies. They noted that financial constraints often prevent them from investing in essential inputs such as soil testing, fertilizers, and pest control materials conditions that similarly affect the farmers in Aleosan.

In terms of varieties planted, 27 farmers (46.5%) cultivate both UF18 and BR25, while others grow only UF18 (29.3%) or BR25 (24.1%). Planting multiple varieties reflects an adaptive strategy to diversify farm resilience, as different varieties have unique strengths in terms of disease resistance, yield potential, or environmental adaptability. Magallon et al. (2022) highlighted that selecting the right cacao varieties is crucial for boosting productivity and ensuring long-term crop performance indicating that Aleosan farmers are making informed varietal choices.

The results also show that intercropping is widely practiced by almost all (94.8%) of the farmers, while only (5.2%) grow cacao as a monocrop. This high prevalence of intercropping indicates that farmers maximize land use, increase income sources, and reduce risks associated with crop failure. Coconut is the dominant intercrop (82.8%), followed by banana (25.9%), mango (17.2%), and rubber (13.8%). Coconut and banana, in particular, serve as shade crops and provide additional income key advantages for smallholders.

The emphasis on ecological and diversified farming practices strongly supports the arguments of Bautista (2023), who underscored the importance of environmentally friendly farm strategies such as composting, reforestation, and diversification. Intercropping enhances ecological stability, soil health, and income resilience – attributes needed for sustainable cacao farming.

Moreover, intercropping reflects farmers' response to the environmental and financial vulnerabilities described by Micabalo et al. (2024), who noted that farmers lacking irrigation systems and climate adaptation tools often rely on diversified cropping systems to stabilize income and reduce risk.

4.3. Status of Cacao Production in Terms of Productivity

The status of cacao production in Aleosan, specifically in terms of volume of harvest per month, type of product sold, selling price, and marketing system, is presented in table 3. The results show that cacao production in Aleosan remains low and underdeveloped, as the greater majority of farmers (67.2%) reported harvesting only 0-9 kg of cacao per month. Another 18.9% harvest 10-30 kg, while only a very small group produce 61-120 kg or more. This pattern clearly indicates that most cacao farms are not yet fully productive, likely because many trees are still young, newly planted, or recovering from pest and disease pressures. Some farmers reported that despite having mature trees, pest and disease infestations significantly reduced their monthly yields.

Table 3. Status of cacao production in terms of productivity.

Variable	Frequency(n=58)	Percentage (%)
Volume of harvest (dried beans)/ per month (kg)		
10-30	11	18.9
31-60	3	5.2
61-90	1	1.7
91-120	3	5.2
121 and above	1	1.7
Types of products sold		
Dried beans	14	24.1
Fermented beans	3	5.2
Dried and fermented beans	1	1.7
All	1	1.7
Selling price (dried beans/kg)		
100-199	14	24.1
200-299	3	5.2
300 and above	2	3.4
Marketing system		
None	39	67.2
Through cooperative	11	18.9
Buy & Sell	7	12.1
Online	1	1.7

These findings align with national reports showing persistent low cacao productivity in the Philippines. According to the Department of Trade and Industry (DTI), local production provides only 10,000-15,000 MT, far below the national demand of 50,000 MT, indicating a wide productivity gap. The results in Aleosan reflect this same national trend – cacao farms have potential but have not yet reached their optimal production capacity (Industry Strategic Science and Technology Plans Platform, 2023).

Similarly, Kongor et al. (2024) emphasized that low yields in cacao-growing countries can be traced to limited access to inputs, poor agronomic practices, aging trees, and a general lack of extension support – all conditions observed in Aleosan, where farmers commonly face constraints in pest management, fertilizer use, and soil analysis. Climate-related factors may also contribute. Wanger et al. (2021) noted that irregular rainfall and rising temperatures can disrupt flowering and pod development, further lowering yields. The low harvest volumes in Aleosan may, therefore, reflect not only farm-level limitations but also broader climatic challenges impacting productivity.

The greater majority of respondents (67.2%) do not sell cacao products at all. Among those who do sell, dried beans are the most common (24.1%), followed by fermented beans (5.2%). No farmers reported selling wet beans or mixed products. This lack of market participation is directly connected to low monthly harvests. Farmers simply cannot sell cacao when they produce only small quantities – or none at all. The findings reflect what the literature suggests: low yields discourage market engagement and hinder the development of local cacao value chains. This is consistent with Kongor et al. (2024), who reported that poor farm productivity limits farmers' ability to participate in markets, resulting in unstable income and reduced opportunities for growth in the cacao sector.

The greater majority of farmers (67.2%) sell their cacao at 0-99 pesos, followed by 24.1% selling at 100-199 pesos. Only a few earn prices 200 pesos and above. This pricing structure further highlights the farmers' limited bargaining power and low output levels. When production is insufficient and inconsistent, farmers are often forced to accept lower prices. This situation reflects the broader national struggle where smallholder farmers lack the market leverage and volume needed to command higher prices. Productivity constraints described by Kongor et al. (2024) and Wanger et al. (2021) inevitably translate to economic constraints for farmers in Aleosan.

The greater majority of respondents (67.2%) have no marketing system, and this is primarily due to zero or insufficient cacao production. Among those engaged in marketing are (18.9%) sell through cooperatives (ACFA), (12.1%) through buy-and-sell arrangements and only 1 farmer (1.7%) markets products online. The minimal involvement in marketing highlights that cacao farming in Aleosan is still in its developmental stage. Without reliable production, farmers cannot actively participate in market channels. This mirrors the findings of DTI and several studies indicating that poor infrastructure, lack of technical support, and low yields restrict the growth of local cacao value chains. As a result, potential income opportunities remain untapped.

4.4. Status of Cacao Production in terms of Pest and Diseases Management

The status of cacao production in Aleosan, in terms of pest and disease management, is critical for understanding the challenges faced by farmers. The findings related to the degree of insect pest infestation, common insect pests observed, pest control methods used, common diseases, disease control methods, pesticide application frequency, weeding practices, and fertilizer application frequency are summarized in table 4. The degree of Insect Pest Infestation in Aleosan is that the greater number of the farmers (49.0%) experience high pest infestation, while 47.4% experience low infestation. One farmer reported a very high infestation level. This indicates that pest pressure is a major constraint in Aleosan cacao production.

Table 4. Status of cacao production in terms of pest and disease management.

Variable	Frequency (n=58)	Percentage (%)
Degree of insect infestation		
Very low	1	1.8
Low	27	47.4
High	29	49.0
Very high	1	1.8
Common insect pest observed*		

Pod borer	56	86.2
Stem borer	40	58.6
Bugs	13	12.1
Termites	10	6.9
Thrips	18	20.7
Common diseases*		
Pod rot	55	94.8
Vascular streak dieback	14	24.1
Stem canker	11	18.9
Pest control used		
Physical Barrier	13	22.4
Disease control method		
Cultural	52	89.7
Chemical	6	10.3
Frequency of Pesticide Application		
None	3	5.2
Every 14 days	1	1.7
As needed	54	93.1
Weeding method		
Manual	38	65.5
Chemical	18	31.1
Mechanical	1	1.7
Frequence of weeding		
Monthly	20	34.5
Quarterly	10	17.2
Twice a year	25	43.1
Once a year	3	5.2
Fertilizer Application frequency		
None	9	15.5
Monthly	3	5.2
Twice a year	3	5.2
Three times a year	4	6.9
Once a year	37	63.8
Quarterly	2	3.4
Volume of fertilizer per hectare		
0-10	19	32.7
11-50	34	58.6
51-100	4	6.9

* multiple responses

The most prevalent pest is the CPB, reported by 86.2% of farmers. This finding strongly supports existing literature, particularly Amalin et al. (2023), who described CPB as one of the most destructive pests in the Philippines, causing severe yield losses. Their research suggests that pheromone traps and IPM strategies are essential to controlling CPB – highlighting a clear gap in current practices in Aleosan. Stem borers (58.6%), thrips (20.7%), bugs (12.1%), and termites (6.9%) were also noted, showing a diverse range of pests affecting the farms.

A greater majority of the farmers (77.6%) do not use any pest control measures, while 22.4% rely on physical barriers. The lack of pest control is alarming, especially given the high prevalence of CPB and other pests. This aligns with Kongor et al. (2024) and Micabalo et al. (2024), who emphasized that without adequate knowledge or inputs, farmers resort to passive approaches, resulting in worsening infestations and declining yields.

The most common disease is pod rot (94.8%), followed by vascular streak dieback (24.1%) and stem canker (18.9%). The majority rely on cultural control methods (89.7%), such as pruning and sanitation, while only 10.3% use chemical treatments. This preference for traditional methods is consistent with Witjaksono and Asmin (2016), who noted that effective cacao disease management requires a combination of cultural practices, sanitation, and resistant varieties. However, improper use of fungicides can lead to resistance, as highlighted by Zhang et al. (2017) in their study on copper resistance. This suggests that while

chemical controls are underutilized in Aleosan, caution must be taken to this problem.

Almost all of farmers (93.1%) apply pesticides only as needed, indicating reactive rather than preventive management. Manual weeding (65.5%) remains the dominant practice, reflecting traditional farm labor systems. Fertilizer application is also low and infrequent, with 63.8% applying fertilizers only once a year and 15.5% not applying any at all. The majority apply only 11–50 kg per hectare, a quantity insufficient for optimal cacao production. This reflects the challenges identified by Micabalo et al. (2024), who found that lack of financial resources, climate impacts, and limited access to modern farm technologies prevent smallholders from adopting proper nutrient management strategies. Without adequate fertilizer application and soil management, cacao yields remain stunted.

4.5. Prospects in terms of Value-Adding and Area Expansion

The prospects for cacao production in Aleosan, particularly in terms of value-adding and area expansion, is shown in table 5. The findings show that the greater number (75.9%) of the cacao farmers in Aleosan have at least one hectare of land available for cacao expansion, while only 14 or 24.1% have no additional area for planting. This suggests that most farmers in the municipality still possess untapped agricultural land that can be developed for cacao production.

Table 5. The prospects in terms of value-adding and area expansion.

Variable	Frequency (n=58)	Percentage (%)
Potential expansion area for cacao (ha)		
1	44	75.9
Currently engage in value-adding	4	6.9
Value- adding activities		
Tablea	3	5.17
Chocolate making	2	3.4
Value-adding can increase income	4	6.9
Interested to engage in value-adding	44	75.9
Interested value-adding activities*		
None	14	24.1
Tablea	40	68.9
Roasting	3	5.17
Chocolate making	5	8.6
Benefits of value-adding activities to your business*		
Increased Profitability	42	72.4
Improve Market Access	2	3.4
Enhanced Product Quality	2	3.4
Support service received*		
Organization\co-op	58	100
Road improvement	58	100
Planting materials	55	94.8
Credit	9	15.5
Seminar	9	15.5
Market linkages	9	15.5
Post-harvest facility	3	5.2
Price support	3	5.2
Technical assistance	2	3.5
Suggested solutions to improve cacao production*		
Road improvement	46	79.3
Market linkages	42	72.4
Price support	16	27.6
More training	13	22.4
Post-management training	11	19.0
Post-harvest support	11	19.0
Free-planting materials	9	15.5
Technical help	7	12.1

* multiple responses

These results align with the literature indicating that land expansion is an important opportunity for enhancing cacao production, especially in areas with favorable climate and soil conditions. Ponpon and Murcia (2024) reported that regions in Mindanao such as Compostela Valley and Basilan are highly suitable for cacao production due to their agro-ecological characteristics. Since Aleosan shares similar climatic conditions, it likewise holds strong potential for cacao expansion. Additionally, Sales et al. (2024) emphasized that many areas in Mindanao possess moderate to high suitability for cacao, provided that factors like rainfall, slope, elevation, and soil type are considered. This scientific land evaluation supports the idea that Aleosan can expand production strategically by developing underutilized lands. Furthermore, Villason and Olguera (2020) stressed the importance of integrating sustainable land-use practices such as agroforestry to maintain soil fertility and ecosystem conditions. Thus, the availability of expansion areas in Aleosan presents not only an economic opportunity but also a chance to promote sustainable farming systems.

The study shows that only (6.9%) of the respondents are currently engaged in value-adding activities such as producing tablea, chocolate, or other processed cacao products. Almost all (93.1%) still rely solely on selling raw beans. Although current involvement is low, the literature suggests that value-adding is a highly promising component of cacao production. According to Aini et al. (2020), value-adding activities increase profitability, create rural jobs, and promote community-based enterprises. Medenilla (2022) also noted that rising global demand for chocolate strengthens the prospects for value-added cacao products in the Philippines. The fact that the small group of value-adding practitioners in Aleosan believe that it increases income indicates a recognition of its economic benefits. However, the limited number of value-adding adopters shows that many farmers may face financial, technical, or knowledge-based constraints.

The greater majority (75.9%) of the farmers expressed interest in engaging in value-added processing in the future. Among these, tablea-making is the top choice (65%), followed by chocolate making and roasting. This finding aligns with literature indicating that value-adding can double farmers' income compared to selling raw beans alone (Department of Agriculture, 2022). The shift toward value-adding reflects what Aini et al. (2020) described as a pathway toward diversified income streams and improved profitability, making cacao farming more sustainable and market-responsive.

All farmers (100%) reported receiving road improvement and market linkage support, showing the strong focus of government agencies on improving farm-to-market access. These interventions directly help farmers transport products, reduce post-harvest losses, and find buyers essential elements identified in the Industry-Study-Cacao Philippine Cacao Industry Roadmap 2021-2025 (Department of Agriculture, 2022) as drivers of improved profitability. Almost all of cacao farmers (94.8%) also received planting materials, which aligns with government efforts to expand cacao plantations nationwide. However, the distribution of other forms of assistance was limited just like the credit and seminars (15.5%), price support and cooperative membership (5.2%), post-harvest facility support (3.5%), and technical assistance (1.7%). These findings highlight a gap in financial services, skills development, and technical support, which are crucial for sustaining productivity and enabling farmers to adopt value-adding practices. Literature emphasizes that sustainability in cacao production requires not only land availability but also continuous support in training, pest management, and post-harvest improvement (Villason & Olguera, 2020).

In regards to the suggested solutions to improve cacao production in Aleosan farmers identified several priority interventions just like road improvement (79.3%), market linkages (72.4%), price support (27.6%). These suggestions reflect the high importance of market access and stable prices, which are consistent with findings from the Industry-Study-Cacao Philippine Cacao Industry Roadmap 2021-2025 (Department of Agriculture, 2022), stating that profitability is strongly influenced by infrastructure and marketing systems.

Additional support needed specifically the more training (22.4%), pest management and post-harvest support (19%), free planting materials (15.5%) and technical help (12.1%). These concerns match literature identifying that technical capacity, pest and disease control, and post-harvest quality improvements are vital to achieving higher yields, better bean quality, and increased income (Gonzales & Janaban, 2024; Villason & Olguera, 2020).

4.6. Challenges in Cacao Farming

The data in table 6 presents the various challenges encountered by cacao farmers in Aleosan, as reported by 58 respondents. The most critical challenge identified by all

respondents is the lack of access to cacao experts who can provide technical guidance on cultivation, pest and disease management, and post-harvest practices. This lack of expert support limits the farmers' capacity to apply improved technologies, manage their plantations efficiently, or respond effectively to production risks.

Table 6. Challenges faced by the cacao farmers in Aleosan.

Challenges*	Frequency (n=58)	Percentage (%)
1. No access to cacao experts	58	100
2. Price fluctuation	29	50
3. Lack of information dissemination	22	37.9
4. Disease outbreak	19	32.8
5. Lack of market outlet	15	25.9
6. Poor planting materials	14	24.1
7. High maintenance cost	13	22.4
8. Peace and order	12	20.7
9. Lack of technical knowledge	9	15.5
10. Labor shortage	8	13.8
11. Expensive inputs	8	13.8
12. Low yield	7	12.1
13. Stray animals	6	10.3
14. Pod stealing	3	5.2
15. Poor road	3	5.2
16. Farm distance to market	2	3.4
17. Lack pf post-harvest facilities	2	3.4
18. High transport cost	1	1.7

* multiple responses

This result is strongly supported by Kongor et al. (2024), who emphasized that farmers in many cacao-growing regions struggle due to poor farm management knowledge and limited access to improved seedlings. Without expert guidance, plantations age without proper rehabilitation, resulting in lower yields. Similarly, Romero Vergel et al. (2022) highlighted that rural communities often have limited access to training and technology, slowing their adoption of innovative farming practices. Therefore, Aleosan's lack of expert support mirrors global trends and underscores the urgent need for technical, research, and extension interventions.

Majority of the respondents (50%) identified price instability as a major concern. Fluctuating cacao prices cause financial uncertainty, making it difficult for farmers to invest in inputs, labor, or farm expansion. This issue aligns with socioeconomic literature. Umar et al. (2023) and Tokou et al. (2025) reported that small-scale cacao farmers often experience unstable incomes due to volatile market prices, limiting their ability to sustain or improve production. Price fluctuation not only affects profitability but also discourages long-term commitment to cacao farming, especially among resource-poor rural households.

A considerable number of farmers reported a lack of timely information on market trends, technological innovations, and government support programs. This lack of information flow contributes to poor decision-making and slower adoption of better farming practices. Romero Vergel et al. (2022) emphasized that technological innovations such as crop modeling and improved farming systems hold great potential for cacao production. However, limited access to information in rural areas prevents farmers from benefiting from these advancements. This condition is evident in Aleosan, where information gaps hinder both productivity and adaptive capacity.

Many respondents reported challenges directly affecting production performance like the disease outbreaks (32.8%). Cacao is highly vulnerable to climate-related diseases. Dhamira and Anggrasari (2024) found that changing rainfall patterns and temperature fluctuations negatively affect cacao flowering and pod development, often leading to higher disease incidence. Similar climate variability in Aleosan may contribute to the disease outbreaks reported by farmers.

Poor planting materials (24.1%), the lack of quality seedlings contributes to low yield and poor plantation performance. Doe et al. (2023) showed that soil and planting material quality significantly influence productivity, as seen in cacao-producing areas like Ghana. Kongor et al. (2024) further emphasized that many farms use aging or inferior cacao trees,

leading to reduced outputs over time.

High maintenance costs (22.4%), the need for fertilizers, pesticides, and regular farm maintenance adds financial burden. The findings of Umar et al. (2023) noted that many small-scale farmers struggle with limited access to inputs, which reduces both yield and farm sustainability. High input costs often discourage farmers from maintaining their plantations properly.

Marketing challenges continue to constrain the income potential of cacao farmers like the lack of market outlet (25.9%) limits farmers' ability to sell their produce at competitive prices. The poor roads (15.5%) hinder transport of cacao beans, contributing to post-harvest losses and higher transport fees. The high transport cost (1.7%), although reported by few, still reflects logistical difficulty. These findings align with the study of Penora and Magallon (2024), who reported that poor infrastructure, especially inadequate farm-to-market roads, contributes to delays, product spoilage, and lower farm incomes. Similar conditions appear evident in Aleosan, where road quality and market access continue to pose constraints.

The greater number of condition issues like labor shortage (13.8%), expensive inputs (13.8%), low yield (12.1%), pod stealing (10.3%), stray animals (5.2%) are also observed as challenged in Aleosan. These constraints further illustrate the complexity of challenges faced by cacao farmers. Labor shortage and expensive inputs reflect the broader socioeconomic limitations discussed by Tokou et al. (2025), where farmers often lack sufficient labor and capital. Low yield reflects poor soil conditions and aging trees issues supported by Doe et al. (2023) and Kongor et al. (2024). Pod stealing and stray animals demonstrate security and environmental disturbances that threaten production stability. These combined problems reduce farm efficiency, limit income, and potentially discourage expansion or long-term investment.

Least cited challenges of Aleosan cacao farmers are the lack of technical knowledge (3.4%), lack of post-harvest facilities (3.4%). Even though only a small number reported these challenges, they represent critical gaps. Lack of post-harvest facilities can degrade bean quality, reducing selling price. Limited technical knowledge further results from the broader issue of inadequate expert support once again echoing Kongor et al. (2024) and Romero Vergel et al. (2022).

Therefore, this study provides a clear picture of the current situation of cacao production in Aleosan, Cotabato, Philippines, among members of the ACFA. While cacao farmers face significant challenges – particularly limited access to experts, price fluctuations, disease outbreaks, and inadequate market outlets – they still demonstrate strong potential for growth, with many having at least one hectare of land available for expansion.

5. Conclusions

This study concludes that cacao production in Aleosan, Cotabato is presently in a developmental stage marked by low productivity but significant long-term potential. The majority of cacao farmers are married men, high school graduates, landowners, and active members of ACFA. Their membership reflects a collaborative structure that allows access to training, planting materials, and shared knowledge. Most farmers practice intercropping, particularly with coconut, which provides appropriate shade for young cacao trees while offering an additional and more immediate source of income.

However, current harvest levels remain minimal, with most farmers producing only 0-9 kilograms per month. This low yield is largely due to the immaturity of cacao trees, many of which are still in the juvenile phase and not yet fully productive. Consequently, most farmers are not actively engaged in regular cacao marketing. Those who sell typically offer dried beans at low and unstable prices, limiting profitability. The most pressing concern identified by all respondents is the lack of access to cacao experts. Farmers expressed a strong need for professional guidance in proper cultivation practices, pest and disease management, and post-harvest processing. Additional constraints include fluctuating prices, plant diseases, insufficient market information, and high farm maintenance costs, all of which hinder income growth.

Despite these challenges, the future of cacao production in Aleosan remains promising. Many farmers have at least one hectare of available land suitable for expansion, indicating readiness to scale up operations. Moreover, there is strong interest in value-adding activities such as processing beans into tablea and other cacao-based products to increase farm-gate prices and reduce vulnerability to market volatility.

Therefore, this study recommends a three-pronged strategy focused on strengthening

technical extension services, improving access to quality inputs and affordable credit, and promoting value chain integration. Establishing continuous training programs and a centralized processing facility through ACFA can enhance productivity, stabilize income, and transform cacao production in Aleosan into a sustainable and competitive local industry.

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