



Land-Use Potential and Agribusiness Cycles in Ayamaru Timur District, Maybrat-Southwest Papua Province

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ABSTRACT

Understanding the land-use potential in Ayamaru Timur District, Maybrat-Southwest Papua Province provides insights into optimizing agricultural activities to boost local economies and ensure sustainable development in the region. The aims of study are to explore the land-use potential and agribusiness cycles in Ayamaru Timur District by analysing physiographic characteristics, soil types, and existing land utilization patterns, the research identifies opportunities and challenges for optimizing agricultural productivity. Methods employed are field observation in on land-uses of farming land and surveys by interviewing key farmers using open structural questionnaire. Samples of soils then analysed in the Soil Laboratory of Agriculture Faculty, Papua University for further syntheses. Parameters measured are physiographic of lands, soil types and suitability, crop types and actual and potential suitability, types of crops including production and productivities, revenue, cost and added to this income generation. Major challenges are recorded for future policy development. Data presented by statistical descriptives and tabulations. The finding revealed that land suitable ranges from marginal to moderately suitable. Potential land-uses are agroforestry crops, food crops, and plantation crops. Non-agricultural land (1%), followed by agroforestry crops, food and plantation crops are actually useable by farmers. Crops grown are tubers, vegetables, non-tuber crops and legumes. Revenues earned firstly from vegetables (IDR 1,890,476), followed by tuber crops (IDR 926,506), Nuts (IDR 486,170), and non-tubers (IDR 420,000). In conclusion, vegetables, tuber and non-tuber crops, including legumes have potential for agricultural development

INTRODUCTION

In today's context of growing global population and increasing demand for food and resources (Corlett 2020; Sheppard et al. 2020; Indrawan et al. 2019), understanding how land is used effectively and efficiently is critical. Land-use potential involves assessing the productive capacity of land for agricultural, industrial, or ecological purposes, while agribusiness cycles (IFAD 2019) refer to the recurring patterns of growth, stagnation, and decline within the agricultural economy. Together, these two concepts are integral to addressing food security, economic development, and environmental sustainability. Land is a finite resource and a critical factor in agricultural production, serving as the foundation for food, fibre, and biomass generation. On the other hand, agribusiness cycles describe the periodic fluctuations in agricultural economic activities, influenced by factors such as market demand, input costs, climate variability, and technological advancements (Adnan et al. 2018; Khan et al. 2021; Rahman et al. 2021; Ugochukwu and Phillips 2018). These cycles consist of phases of expansion, peak, contraction, and trough, affecting farm incomes, investment decisions, and land management practices.

Global Land-Use Trends highlights 38% of the world's land is used for agricultural purposes, yet land degradation affects over 30% of global agricultural land (Roadmap 2022). Approximately 33% of the Earth's soils are moderately to highly degraded due to erosion, nutrient depletion, and poor management. Land-use efficiency varies widely between countries, with developed nations achieving up to 60% land productivity, while many developing countries achieve less than 40%. The land-use potential of any given area depends on a variety of factors, including soil quality, climate, water availability, and infrastructure. In the face of climate change, urbanization, and competing demands for land, unlocking land-use potential has become increasingly challenging. Land underutilization or overexploitation often leads to decreased agricultural productivity and environmental degradation (Paul et al. 2018; Clough et al. 2016; Rivai and Anugrah 2016).

Agribusiness cycles create uncertainty for farmers and agribusiness stakeholders, leading to income volatility and inconsistent land-use strategies. Climate variability and market changes further complicate the alignment of land use potential with agribusiness cycles. Understanding these interrelationships allows for better decision-making, balancing land-use optimization with the economic realities of agribusiness cycles. Agricultural production globally fluctuates in 5-10-year cycles, influenced by climate, demand, and price shocks. Price volatility of agricultural products has increased by 40% over the past two decades, primarily due to climate change, pandemics, and global supply chain disruptions. In India, for example, farm income experiences significant variability, with peak incomes during bumper harvests followed by stagnation during market downturns. The global agribusiness sector is valued at approximately \$5 trillion annually. Over 60% of rural households in developing countries rely on agriculture for their livelihoods. Land-use optimization could increase global agricultural productivity by up to 20% without expanding farmland, reducing deforestation and conserving ecosystems.

Inappropriate land use contributes to 25% of global greenhouse gas emissions, primarily through deforestation, soil degradation (Pareja-Sánchez et al. 2017; Limeneh et al. 2022), and unsustainable farming practices (Hutabarat 2017; Mohd Hanafiah et al. 2022). Aligning land use with agribusiness cycles can help improve resource efficiency and reduce environmental impacts. The study of "Land-Use Potential and Agribusiness Cycles" aims to explore and synthesize the dynamic relationship between land utilization and the cyclical nature of agricultural businesses. The research highlights the opportunities and challenges in maximizing land productivity while synchronizing with the fluctuations of agribusiness cycles. This study serves as a foundation for aligning land management strategies with agribusiness growth, ensuring long-term food security and economic development.

LITERATURE REVIEW

Land-Use Potential in Rural and Frontier Regions

Land-use potential is commonly understood as the capacity of land to support specific uses, especially agriculture, forestry, and settlements, based on its physical, biological, and socioeconomic characteristics. According to FAO (1976), land evaluation considers factors such as climate, soil type, topography, and existing vegetation to determine suitability for various land-use types. In rural and underdeveloped frontier areas, such as Papua and West Papua regions, land remains underutilized or mismanaged due to limited access, infrastructure, and institutional support (Boedhihartono, 2019).

In the context of Papua, particularly Southwest Papua Province, the spatial heterogeneity and rich biodiversity pose both opportunities and constraints for land-based development. Wanggai et al. (2020) noted that traditional land tenure systems and customary rights play a significant role in determining land-use patterns, often diverging from state-administered spatial planning. Thus, any assessment of land-use potential in Ayamaru Timur must integrate indigenous knowledge systems and sociocultural practices alongside agroecological assessments.

Agribusiness Systems and Cycles in Marginalized Areas

Agribusiness, broadly defined, refers to the collective business activities involved in the production, processing, and distribution of agricultural products. Agribusiness cycles typically include stages such as land preparation, planting, cultivation, harvesting, processing, marketing, and reinvestment. In marginalized and peripheral regions, such as Maybrat Regency, agribusiness development is often constrained by market access, infrastructure, capital, and policy support (Thorburn, 2018). Nevertheless, smallholder-based agribusiness models remain dominant. These cycles are highly seasonal and dependent on subsistence patterns, labor availability, and ecological conditions. Past studies, such as those by Sitorus and Purwanto (2015), have emphasized the importance of aligning agribusiness development with local ecological calendars and traditional agricultural cycles. In Ayamaru Timur, indigenous crops like sweet potato, banana, and sago may play central roles in local agribusiness systems, requiring context-specific interventions.

Integrated Land-Use and Agribusiness Planning

The integration of land-use planning with agribusiness development has been emphasized in regional development frameworks. Scholars like Lambin and Geist (2006) advocate for landscape approaches that recognize the interconnectedness of environmental, economic, and cultural dimensions of land use. For Papua and similar remote regions, this integration must be participatory and culturally sensitive. Regional autonomy laws in Indonesia (UU No. 21/2001 for Papua Special Autonomy) also underscore the importance of community participation in resource governance and planning.

Studies by Tania et al. (2021) on the role of customary institutions in natural resource management in Papua highlight the potential of combining spatial analysis (GIS, remote sensing) with community mapping to identify and realize land-use potential for agribusiness. This approach may help design inclusive agribusiness cycles that are socially acceptable and ecologically sound.

Challenges and Opportunities in Maybrat and Southwest Papua

Empirical evidence from Southwest Papua, including Maybrat Regency, remains limited but is growing. Recent assessments (Bappenas, 2022; UNDP, 2021) point to low agricultural productivity, infrastructural gaps, and weak institutional coordination as persistent challenges. However, the presence of fertile soils, abundant water resources, and untapped biodiversity represent major opportunities. The Indonesian government's development agenda for eastern Indonesia, particularly through strategic programs like PSN (Proyek Strategis Nasional), encourages agribusiness growth in Papua through infrastructure and capacity development (Kementan, 2023). In Ayamaru Timur specifically, a micro-level analysis of land-use suitability, cropping patterns, and agribusiness linkages is necessary to inform sustainable development policies. Research must also consider the interplay between customary land tenure, gender roles in agriculture, inter-village trade networks, and external market access.

METHODOLOGY

This research was conducted in Maybrat Regency, encompassing district of Ayamaru Timur. Sample villages were selected based on the diversity of biophysical and socio-structural conditions in the field. Ayamaru District (referred to here as the parent district) is located at the coordinates 01°16'38.7" South Latitude and 132°11'156.9" East Longitude, with an area of 254.91 km² (BPS-Maybrat 2022; Dinas Pertanahan Kabupaten Maybrat 2022). It encompasses one urban village (kelurahan) and 24 rural villages (kampung). The research employed a descriptive method using survey techniques (Rao 2018). Surveys involved visits to sample locations and farmers targeted for this study. During these visits, several important aspects were collected and analysed, including soil types and their distribution, descriptions of agricultural land conditions, farming profiles, as well as strategic issues regarding agricultural development constraints. Communities within each district and village were considered subjects due to their status as customary landowners and their direct involvement in land-use activities. The research objects included various aspects related to soil, agriculture, plantations, livestock, fisheries, and forestry (BPS-Maybrat 2022; Kabupaten-Maybrat 2023).

Descriptive statistical data analysis is used to describe or summarize the characteristics of data without making broader conclusions. Quantitative data includes variables such as production, income, and land area. Qualitative data includes categories such as crop types and agroecological zones. Data visualization for qualitative data done by using a frequency table which is used to display the distribution of categories (Snedecor and Cochran 1989; Sagrim et al. 2015; Rangel and Diniz-Filho 2013).

RESULTS AND DISCUSSION

Physical Land Conditions

The physiographic condition of East Ayamaru District is categorized as a highland and hilly area, with slopes ranging between 41–60%, classified as very steep. The district has a physiographic character with elevations between 259–397 meters above sea level. A summary of the district's physiographic features, including flat, undulating, rolling, hilly, or mountainous terrain, is presented in table. East Ayamaru District is predominantly characterized by gently sloping hills, covering an area of 282.41 km² or 66% of the district's total area. This is followed by hilly/mountainous terrain, which spans 86.34 km², accounting for approximately 20% of the total district area. Flat areas constitute 12.31 km², representing approximately 2.88% of the district's total area.

Table 1. Physiography, Area, and Percentage Distribution in East Ayamaru District

No	Physiography	Area (km ²)	% of District	% of Regency
1	Gently Sloping Hills	282.41	66.06	0.05
2	Undulating-Wavy Terrain	35.69	8.35	0.01
3	Lake	10.78	2.52	0.00
4	Flat Terrain	12.31	2.88	0.00
5	Hills/Mountains	86.34	20.20	0.02
Total	-	427.52	100	-

Source: The Data is Derived from DEM (Digital Elevation Model) with 90-Meter Resolution and Landsat Imagery, 2010

Describes the type of landforms or terrain within the district. Categories include gently sloping hills, undulating to rolling terrain, lake areas, flat areas, and hilly/mountainous regions. The percentage of each physiographic type relative to the total area of East Ayamaru District (427.52 km²). The percentage of each physiographic type relative to the total area of the regency where the district is located. This percentage indicates how significant the physiographic type is on a broader administrative scale. Covers 282.41 km², which is the dominant physiographic feature in the district, accounting for 66.06% of the district's total area. This feature contributes to only 0.05% of the total regency area, indicating that gently sloping hills are more concentrated within this district. Covers 35.69 km², making up 8.35% of the district's area. This terrain contributes 0.01% of the total regency area, reflecting its limited extent. Lake areas occupy 10.78 km²,

representing 2.52% of the district's area. The lake area contributes 0.00% of the regency's total area, showing it is not a significant feature on the broader scale.

Flat areas span 12.31 km², which is 2.88% of the district's area. Similar to lakes, flat terrain accounts for only 0.00% of the regency's total area, highlighting its localized distribution. This terrain covers 86.34 km², or 20.20% of the district's area. It contributes 0.02% of the total regency area, indicating moderate significance within the broader landscape. The district spans a total area of 427.52 km², with 100% of its physiography accounted for across these categories. Gently sloping hills dominate the district, covering the majority of the land area, making it suitable for moderate land-use activities such as agriculture, grazing, or settlements. While lakes and flat areas are less prominent, they may hold significance for specific ecological or economic purposes, such as fisheries or water resource management. These regions, covering 20.20% of the district, likely present challenges for accessibility and development but may also serve as important conservation zones or sources of biodiversity. This land type is moderately represented and could indicate transitional zones between flat and hilly areas. The data emphasizes the need for tailored land-use planning to align with the unique physiographic characteristics of East Ayamaru District, ensuring sustainable development and optimal utilization of its diverse terrain.

Soil Types and Land Suitability

The dominant soil types in East Ayamaru District are an association of Inceptisol (Eutrudept) and Ultisol (Hapludult). The area predominantly covered by Oxisol soil type spans 316.20 km², followed by Inceptisol, which covers 88.24 km². Inceptisol soils are characterized by a medium texture (loam) to fine texture (clay). The soil reaction ranges from slightly acidic to neutral, with a pH of 5.9–6.9. These soils exhibit moderate to high base saturation (42–100%), but their Cation Exchange Capacity (CEC) is low (12–14 cmol(+)/kg). The soil fertility is classified as relatively low, primarily due to the low CEC (Table 2).

Table 2. Soil Types, Area, and Percentage Distribution in East Ayamaru District

No	Soil Type	Area (km ²)	% of District	% of Regency
1	Entisol	23.09	4.88	0.00
2	Inceptisol	88.24	20.64	0.02
3	Oxisol	316.20	73.96	0.06
Total	-	427.52	100.00	0.07

Source: Field Survey, RePPPRoT 1986, and Landsat Imagery, 2010

Ultisol soils have a fine texture (clay), an acidic reaction (pH 4.8–5.0), low base saturation (less than 35%), and a low Cation Exchange Capacity (CEC) (6–11 cmol(+)/kg). Consequently, the fertility of these soils is classified as low. The results of the land suitability evaluation for specific crop commodities are presented in Table 2. The land suitability in East Ayamaru District falls within the range of moderately suitable (S2) to marginally suitable (S3). Some of the limiting factors related to land suitability in East Ayamaru District include water availability, soil physical conditions, and temperature. Detailed results of the

land suitability evaluation for specific crop commodities are provided in subsequent sections (Table 3).

Table 3. Types of Crops and Land Suitability Classes

No	Crop Type	Actual Suitability Class	Potential Suitability Class
1	Corn	S3wa	S3wa
2	Sweet Potato	S3nr	S2wa
3	Taro	S2rc	S2rc
4	Peanut	S3wa	S3wa
5	Mustard Greens	S3wa	S3wa
6	Tomato	S3wat	S3wat
7	Rambutan	S3nr	S2t
8	Durian	S3nr	S2t
9	Cocoa	S3nr	S2t
10	Teak	S3wa	S3wa

Source: Author Processed

Notes: S3: Marginally Suitable, S2: Moderately Suitable, wa: Water Availability, rc: Rooting Media (Texture), nr: Nutrient Retention (CEC, Base Saturation, pH), t: Temperature, oa: Drainage.

The total potential land area in East Ayamaru District is approximately 426.16 km². Of this, around 281.80 km², or approximately 66.13% of the district's total area, is potential land that can be developed for agroforestry crops. Meanwhile, 35.07 km² can be developed for plantation crops. The data on the potential land area in East Ayamaru District is presented in Table 4.

Table 4. Potential Land, Area, and Percentage Distribution in East Ayamaru District

No	Potential Land Use	Area (km ²)	% of District	% of Regency Area
1	Conservation	87.26	20.48	0.016
2	Agroforestry Crops	281.80	66.13	0.050
3	Food Crops	12.25	2.87	0.002
4	Plantation Crops	44.85	10.52	0.008
Total	-	426.16	100	0.076

Source: Author Processed

The actual land area in East Ayamaru District is approximately 426.16 km². In general, there is no significant difference between the potential and actual land areas in the district. The actual land area that can be developed for agriculture is 91.42 km². The types of crop groups that can be developed include plantation crops, food crops, and crops that can be integrated with forest plants (agroforestry systems) (Table 5).

Table 5. Actual Land Use, Area, and Percentage Distribution in East Ayamaru District

No	Actual Land Use	Area (km ²)	% of District	% of Regency Area
1	Lake	9.78	2.29	0.04
2	Conservation	87.26	20.48	0.37
3	Non-Agricultural Land	237.60	55.76	1.00
4	Agroforestry Crops	65.00	15.25	0.27
5	Food Crops	12.25	2.87	0.05
6	Plantation Crops	14.27	3.35	0.06
Total -		426.16	100	1.79

Source: Author Processed

Farming Conditions

The types of agricultural commodities, along with their production and productivity, are categorized based on the agricultural sectors cultivated by the community in East Ayamaru District (Table 6).

Table 6. Types of Agricultural Fields, Planting Area, Production, and Productivity

No	Type of Agriculture	Planting Area (m ²)	Production (kg)	Productivity (kg/ha)
1	Tuber Crops	610.93	922.86	15,105.82
2	Vegetables	226.50	356.25	15,728.48
3	Legumes	1,329.69	56.75	427.76
4	Non-Tuber Carbohydrate Crops	620	600	9,677.42

Source: Author Processed

Among all agricultural sectors, legumes (especially peanuts and mung beans) are the crops with the largest cultivated area but the lowest productivity. In contrast, vegetables are horticultural crops with the smallest cultivated area but the highest productivity. In terms of farming types, tubers widely cultivated by the community include taro (bete), sweet potato, cassava, and taro johar. Commonly grown vegetables include bok choy, cabbage, long beans, spinach, gedi leaves, sugarcane shoots, and corn. Legumes analysed in this study consist of peanuts and mung beans, while the non-tuber carbohydrate crop cultivated in significant quantities is banana. Previous study reported by Rumere (2024) that Maybrat and several regencies in Papua Barat province are suitable for agricultural crops development. For outsiders observing the agricultural land along the roads in East Ayamaru District, from the easternmost village of Viane to the area around Kambuaya Airport, the impression is of barren land with very low productivity. However, this perception is inaccurate.

When managed using local technology, specifically the No-Tillage Technology (NOT) combined with burning and direct planting, crops such as legumes, tubers, and vegetables (notably long beans, spinach, mustard greens,

cabbage, beans, and collards) yield high production and significantly contribute to farmers' income in the district (Munasinghe et al. 2019; Fatmasari et al. 2018).

Revenue, Production Costs, and Income

The average values of non-cash revenue, cash revenue, total revenue; variable costs, fixed costs, and total costs; as well as non-cash income, cash income, and total income from agriculture among the community in East Ayamaru District (Table 7).

Table 7. Types of Agricultural Enterprises, Unit Price, Consumption, Sales, and Total Revenue

No	Type of Agriculture Enterprise	Unit Price (IDR/kg)	Amount Consumed (kg)	Amount Sold (kg)	Non-Cash Revenue (IDR)	Cash Revenue (IDR)	Total Revenue (IDR)
1	Tuber Crops	3,330	90.80	187.43	302,364	624,142	926,506
2	Vegetables	2,500	126.67	242.38	205,714	1,684,762	1,890,476
3	Nuts	10,000	16.46	46.04	25,853	460,317	486,170
4	Non-Tuber Carbohydrates	2,500	51.00	33.00	255,000	165,000	420,000

Source: Author Processed

The table provides an overview of the types of agricultural activities, their outputs, and associated revenues in East Ayamaru District. It details the quantities consumed and sold, along with the revenues generated from non-cash and cash sources for each type of crop farming. This categorizes the farming activities into tubers, vegetables, legumes, and non-tuber carbohydrates. These represent the main agricultural sectors in the district. The selling price per kilogram for each category. Prices vary based on the type of crop tubers IDR 3,330/kg, Vegetables IDR 2,500/kg, Legumes IDR 10,000/kg (highest price due to higher market demand or limited supply), non-tuber carbohydrates IDR 2,500/kg. The amount of production consumed by households for their needs. For example, vegetables have the highest consumption (126.67 kg), reflecting their importance in daily diets. Legumes have the lowest consumption (16.46 kg), likely due to their higher market value and price. The quantity of each crop sold to generate cash income. Vegetables have the highest sales (242.38 kg), while legumes have the lowest (46.04 kg). The value of the crops consumed by the household, calculated based on the unit price. This reflects the total value generated from each type of crop: vegetables: IDR 1,890,476 (highest total revenue). Legumes is IDR 486,170 (lowest total revenue).

Vegetables generate the highest total revenue (IDR 1,890,476), driven by a combination of high consumption and sales volume. Legumes have the highest unit price (IDR 10,000/kg) but generate the lowest total revenue (IDR 486,170), as their production and consumption are much lower compared to other crops. Tubers have moderate consumption (90.80 kg) and sales (187.43 kg), resulting in total revenue of IDR 926,506, making them a significant crop for both subsistence and income. These crops (e.g., bananas) contribute a balanced amount of non-cash and cash revenue, with total revenue of IDR 420,000. This table highlights the economic and nutritional contributions of various crops in East Ayamaru District like reported by Shelienna et al. (2024) in Probolinggo. Vegetables are the most lucrative crop, while legumes, despite their high value, contribute less due to lower production. Tubers and non-tuber carbohydrates play dual roles in both subsistence and income generation, emphasizing their importance in the district's agricultural system. These insights can help prioritize agricultural policies and practices to maximize revenue and food security in the region (Wijka et al. 2018; Ferdous et al. 2016; Hervas 2021; Ferdous et al. 2016; Hervas and Isakson 2020).

Table 8. Variable Costs, Fixed Costs, Total Costs, Non-Cash Income, Cash Income, and Total Income in Agriculture

No	Type of Agricultural Enterprise	Variable Costs (IDR)	Fixed Costs (IDR)	Total Costs (IDR)	Non-Cash Income (IDR)	Cash Income (IDR)	Total Income (IDR)
1	Tuber Crops	309,074	25,741	334,815	-32,451	289,291	256,840
2	Vegetables	113,238	50,000	163,238	42,476	1,521,524	1,564,000
3	Legumes	214,365	19,484	233,849	-207,996	226,468	18,472
4	Non-Tuber Carbohydrate Crops	88,712	14,244	102,956	152,044	62,044	214,088

Source: Author Processed

Cassava contributes the largest share to farmers' non-cash income. This indicates that the production of cassava is primarily allocated for family consumption compared to other tubers such as taro, sweet potato, and johar taro. Conversely, vegetables provide the highest contribution to cash income, followed by tubers and legumes (Hervas 2020; Syed 2018; Kirkpatrick and Davison 2018; Niftiyev and Ibadoghlu 2023; Ferdous et al. 2016; Petrovic et al. 2019). The relatively low cash income from legumes, which places them third, is due to the high variable production costs of legumes (especially peanuts) compared to mung beans or other agricultural crops. In terms of net income (after deducting production costs), vegetables remain the top-ranking crop, followed by tubers and non-tuber carbohydrates such as bananas.

Production Patterns and Technology

In East Ayamaru District, farmers typically practice polyculture farming, cultivating more than one type of crop on the same plot of land. In a garden primarily designated for tubers (e.g., taro gardens), vegetable crops are often planted as opening crops. For example, after burning the land, farmers simultaneously plant tuber seedlings along with spinach, bok choy, cabbage, corn, bananas, and gedi vegetables along the edges of the field. Within 3–4 weeks, spinach, bok choy, and cabbage are ready to harvest, making them the opening crops. In peanut gardens, long beans, cabbage, and spinach are often intercropped either within or along the edges of the same plot. Tubers and non-carbohydrate crops harvested twice a year on average. Vegetables and legumes harvested three times a year. Farmers apply No-Tillage Technology (NOT) and do not fertilize crops except for vegetables, where foliar fertilizers are used to stimulate vegetative growth (leaf fertility). Physical pest control methods are predominantly used. For vegetables, pesticides are applied only when pest infestation is severe (Reganold and Wachter 2016).

Major Challenges

A common issue in the region is a disease that causes tuber rot after the tubers have formed, resulting in dried leaves and non-edible fruit. Wild boars are a significant challenge in farming. Farmers stated during interviews that if wild boars were not an issue, the cultivated gardens would be more extensive and diverse. Post-harvest processing is rarely conducted. Most agricultural products are sold directly at markets. However, some products, such as peanuts, are processed into coated peanuts or fried peanuts, which increases their value. The price of dried peanuts is IDR 20,000 per kg, but when processed into fried or coated peanuts, the value increases to IDR 50,000 per jar (0.25 kg), equivalent to IDR 200,000 per kg. The challenges faced by farmers include technical agronomic issues, capital constraints, and the solutions or alternatives proposed either by the farmers themselves or through discussions with researchers. A summary of these technical agronomic issues, capital needs, and suggested solutions from farmers is presented in Table 9.

Table 9. Technical Agronomic and Capital Problems and Suggested Solutions

No	Type of Farming Branch	Technical Agronomic Problems	Capital Problems	Suggested Solutions According to Farmers
1	Tuber Crops	Wild Boar Pests, Leaf Blight Disease	Labor Costs	Need for Input Assistance (Saprodi) and Capital Funds
2	Vegetables	Wild Boar, Deer, and Diseases	Costs of Seeds and Medicine	Need for Input Assistance (Saprodi) and Capital Funds
3	Legumes	Wild Boar and Deer	Labor Costs and Seed Costs	Need for Input Assistance (Saprodi) and Capital Funds

4	Non-Tuber Carbohydrate Crops	Wild Boar and Deer	Labor Costs	Funds Need for Input Assistance (Saprodi) and Capital Funds
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Source: Author Processed

In agricultural development, the entire community stated that all agricultural activities face pest problems, specifically wild boars and deer (Yudha et al. 2022; Andrian et al. 2023). However, they acknowledge that these pests, especially wild boars, are a long-standing issue passed down through generations. To address this, every garden they cultivate is always fenced to protect against attacks by these pests. The capital challenges faced by farmers include the high cost of labor for activities such as land clearing, burning, and fencing for tuber and legume crops, as well as planting, harvesting, and peeling legumes. To overcome the capital issues mentioned above, during the field research, the community collectively suggested that the local government, particularly the Department of Food Crops and Horticulture, should provide financial assistance as capital support to aid the development of their farming activities. Furthermore, they expressed a strong preference for such financial assistance (Bianco 2016; Mwaura et al. 2021; Nabikyu and Kugonza 2016) to be provided in the form of grants, rather than loans, as a commitment to support and empower farming communities.

CONCLUSIONS AND RECOMMENDATIONS

The land suitability in East Ayamaru District falls within the range of moderately suitable (S2) to marginally suitable (S3). Some of the limiting factors related to land suitability in East Ayamaru District include water availability, soil physical conditions, and temperature. Lakes and flat areas are less prominent and may hold significance for specific ecological or economic purposes, such as fisheries or water resource management. It challenges for accessibility and development but may also serve as important conservation zones or sources of biodiversity.

Crops such as legumes, tubers, and vegetables (notably long beans, spinach, mustard greens, cabbage, beans, and collards) yield high production significantly contribute to farmers' income in the district. In terms of net income (after deducting production costs), vegetables remain the top-ranking crop, followed by tubers and non-tuber carbohydrates such as bananas. Physical pest control methods are predominantly used. For vegetables, pesticides are applied only when pest infestation is severe. In recommendation, local government particularly the Department of Food Crops and Horticulture should provide financial assistance as capital support to aid the development of their farming activities.

FURTHER STUDY

This research still has limitations, so further research is needed related to the topic of Land-Use Potential and Agribusiness Cycles in Ayamaru Timur District, Maybrat-Southwest Papua Province in order to perfect this research and increase insight for readers.

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