



CHARACTERISTICS OF VEGETABLE FARMERS AND THEIR IMPLICATIONS FOR THE APPLICATION OF FARMING TECHNOLOGY

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Abstract :

The Paal Merah Village area, Paal Merah Jambi District, City is dominated by dry land with a wet climate, so the developing farming pattern is based on dry land with a wet climate. This paper aims to study the characteristics of farmers in dry land with wet climates and their implications for the application of farming technology. The research was conducted in Paal Merah Village, Paal Merah District, Jambi City, in 2020, involving 25 farmers who were randomly selected as respondents. Through descriptive data analysis, the following picture is obtained: First, vegetable farming at the research location has the potential to be developed intensively and sustainably. Second, support from the characteristics of farmers of productive age, a fairly high level of education, and farming experience will motivate farmers. To increase its business intensively. Third, opportunities to increase farming productivity are still wide open through optimizing the use of potential farming land resources based on farmers' strengths and weaknesses. Fourth, to increase productivity in dry land areas with wet climates, the strategy is to diversify businesses (multi enterprises); implementing integrated farming patterns, accelerating technology dissemination and encouraging the growth of partnership collaboration networks. For the multi-enterprise strategy to be implemented, it is necessary to have a soft credit scheme policy whose implementation is accompanied by assistance from extension workers and researchers.

Keywords: Characteristics, Farming, Horticulture Farmers, Technology

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INTRODUCTION

Horticultural commodities are classified as high-value commodities and are one of the primary sources of economic growth in agricultural areas. Chili (*Capsicum annum*) is a commodity that significantly contributes to farmers' income, community welfare, and economic development. The need for chilies from year to year always increases along with the increase in population and the growth of various food industries using chili as raw materials. To meet the need for chilies, the planting time must be continuous throughout the year so that the supply of chilies and their prices do not fluctuate (Agricultural Research and Development Agency, 2012; Muharam, 2015).

Celery (*Apium graveolens* L.) is a vegetable commodity widely used to flavor food and decorate dishes. Celery seeds are also used as a spice and flavoring. The seed oil extract has medicinal properties. Celery cultivation is very good in the highlands 1000-1200 m above sea level, and it can also be done in the lowlands by providing shade in the form of alang-alang, straw, or paranet roofs. The roof functions as a barrier to sunlight and maintains humidity. Celery plants are less resistant to rain; therefore, optimum rainfall ranges from 60-100 mm/month. Celery plants can be divided into stalk, tuber, and leaf celery (Rukmana, 2003; Hapsoh et al., 2009). Edi and Araz (2011) stated that the celery

plant is one of the *prima donnas* in Jambi City. The high price and large demand for celery encourage farmers to carry out traditional cultivation, so the results are still not optimal.

Red chili plants are vegetable plants that can be intercropped with other vegetable plants and have a relatively shorter plant height and lifespan than chili plants. This is often done by farmers, especially in production center areas. Aromatic plants such as celery contain essential oils, which, among other things, act as pest repellents. Therefore, celery plants can control pests by intercropping with chili plants as the main crop (Setiawati and Asandhi, 2003; Sumarni et al., 2005).

Crop intercropping is an alternative that should be developed, especially to make maximum use of land, which leads to 1). Environmental components, such as plant nutrients, water, and sunlight, are utilized to reduce erosion and soil damage; 2). Minimizing the opportunity for attacks by pests and plant disease pathogens and the risk of crop failure through the concept of commodity diversity; 3). The flow of labor can be better regulated; and 4). Increased production and income of farmers in general (Miskiyah and Munarso, 2009; Muslih, 2003).

Palaniapan, 1988; Setiawati, and Asandhi, 2003) stated that to be able to implement intercropping patterns properly, it is necessary to pay attention to several environmental factors that have an influence, including water availability, soil fertility, sunlight, and pests and diseases. Determining the type of plant that will be intercropped and the planting time is adjusted to water availability during plant growth. This is intended to avoid competition (nutrient and water absorption) between plants on a plot of land. In intercropping planting patterns, it is best to select and combine plants with relatively deep roots and relatively shallow roots.

Paal Merah Village is one of the vegetable production centers in Jambi City, located about 6 km from the center of the capital of Jambi Province. Most of the residents make their living as farmers/farm laborers. Paal Merah sub-district is the location of a leading agricultural production center area, the Agricultural Research and Development Agency through the Prima Tani program (Pilot and Acceleration Program for the Popularization of Agricultural Technology Innovation), which directly implements new concepts of dissemination in production center areas based on the suitability of the agroecosystem and the need for technological innovation by farmers (Edi and Endrizal, 2009).

The gap research of this paper is that there is a lack of literature on the characteristics of chili and celery farmers in dry land agroecosystems with wet climates and their implications for the application of farming technology. Most previous studies have focused on the technical aspects of chili and celery farming, such as the use of inputs, irrigation, pest management, and yield. However, there is a need to explore the social and institutional aspects of chili and celery farming, such as the cooperation, communication, and coordination among the actors involved in the farming system. The characteristics of farmers, such as their age, education, and experience, may influence their adoption and adaptation of farming technology and their farming outcomes.

Therefore, it is necessary to carry out research that examines the characteristics of farmers and analysis of red chili and celery farming intending to get an overview of the socio-economic conditions of farmers, the feasibility of red chili and celery farming, and the implications for the application of farming technology.

RESEARCH METHOD

The research was conducted at the Mekar Sari Farming Group, Paal Merah Village, Paal Merah District, Jambi City, Jambi Province, in October 2020. The selection of the research location was carried out purposively with the following considerations: (1) Paal Merah Village, Paal Merah District, has sufficient potential for the development of vegetable farming, (2) Paal Merah Village is one of the vegetable growing areas in Paal Merah District, (3) Paal Merah Village, Paal Merah District is a vegetable cultivation area which is still operating today and (4). Paal Merah District is a Prima Tani Area program for 5 years (2007-2011) of the Ministry of Agriculture (Edi et al, 2011). The population in this study were all farmers who cultivate intercropping of red chilies with celery in Paal Merah Village, namely 15 farmers who are members of the Mekar Sari Farming Group. The technique for determining respondents in this research was carried out using the census method, namely by taking the entire population in Paal Merah Subdistrict as many as 25.

Descriptive analysis describes the general condition of intercropping red chili and celery farming in the study area. Descriptive analysis is also used to describe the picture or explanation

regarding intercropping of red chilies with celery. Thus, this analytical method is expected to explain matters related to intercropping red chilies with celery, which cannot be described in detail through quantitative analysis. Quantitative analysis is used to analyze data in the form of numbers used in analyzing red chili intercropping farming with celery. Some of the quantitative analyses carried out in this study refer to formulas commonly used in simple analysis for research.

The data analysis used in the research is:

1. Income analysis
2. $Pd = TR - TC$ (According to Soekartawi, 2005)

Information:

Pd = Farming Income (Rp/planting season)

TR = Total Revenue/Total Receipt

TC = Total Cost/Total Cost

2. Farming Feasibility Analysis

Soekartawi (2002) states that to determine the feasibility of a business, it can be calculated using the Revenue Cost Ratio (R/C Ratio) analysis. R/C Ratio is an abbreviation of Revenue Cost Ratio known as the ratio (ratio) between Total Revenue (TR) and Total Cost (TC), which is formulated as follows: $R/C = TR/TC$

Information: R/C = Comparison between total revenue and total cost $TR = \text{Total Revenue/Total Revenue (Rp)}$ $TC = \text{Total Cost/Total Costs (Rp)}$ with decision criteria if:

$R/C = 1$, meaning the farming business makes no profit and no loss or breaks even.

$R/C < 1$, indicates that the business is not worth pursuing.

$R/C > 1$, then the farming is worth pursuing

RESULTS AND DISCUSSION

The results of the research will be displayed in table 1.

Table 1. Cost of Production Facilities for Cultivating Tumpangasari Chili with Jambi Celery 2018

No.	Description	Volume	Unit	Unit Price (Rp)	Total Amount (Rp)
I	Cost				
A.	Production Facilities/ha				
	Total A				9.936.500
B.	Family Labor				
	Total B				8.900.000
C.	Labor Outside the Family				
	Total C				600.000
	Total I (A+B+C)				19.536.500
	Total I (A+C)				10.536.500

Source (Edi & Suharyon, 2018)

Table 2. Revenues from Intercropping Chili and Celery Farming, Jambi 2018

No.	Description	Volume	Unit	Unit Price (Rp)	Total Amount (Rp)
II	Receipt of harvest/ha				
Total II					31.090.000
III	Profit				
	Acceptance - Fees (A+B+C)				11.653.500
	Acceptance - Fees (A+C)				20.553.500

Paal Merah Village is located 3 km from the capital of Paal Merah District, 3 km from the capital of Jambi City and 6 km from the capital of Jambi Province. It has an area of 778 ha, included in the Wet Climate Dry Land agroecosystem. Generally, the level of soil fertility in Paal Merah is low – medium. The soil type is dominated by Red Yellow Podzolic and Inceptisol, with a pH range of 4.5 – 5.5. It has a flat topography, with a soil texture dominated by sandy clay (Anwar K. et al, 2007). Water resources to support vegetable gardens come from reservoirs created around farming gardens.

The average area of farmers' cultivated land ranges from 0.1–0.5 ha/KK. Available labor is limited, especially in tillage, planting, weeding and harvesting. Under these conditions, some farmers use hired labor/farm laborers, while mutual aid/mutual cooperation labor generally grows because there are still family relationships. Farmers feel the benefits of cultivating vegetable crops, especially vegetables.

Characteristics of Farmers and Farming of Red Chili and Celery

To see the household characteristics of red chili and celery farmers, you can determine the farmer's age, education level, number of family dependents, farming status, farmer experience in running the business, size of the business and origin of the workforce (Table 1). These characteristics are several aspects that influence farmers' skills in managing farming, including age, education, status and number of household dependents.

Population Condition According to Education Level

The quality of the population depends on the level of education and in Lingkar Selatan District there are several educational facilities as can be seen in Table 3. Table 3 shows that the majority of the population has an elementary school education (1,200 people or 38.66%) followed by junior high school (1,079 students or 34.77%) while the lowest level of education is Islamic boarding school, namely 36 students or 1.16%.

Tabel 3. Tingkat Pendidikan di Kelurahan Lingkar Selatan Tahun 2018.

Grade School	Total Students	Percentage (%)
Elementary School	1.200	38,66
Junior High School	1.079	34,77
Senior High School	789	25,41
Pondok Pesantren	36	1,16
Total	3.104	100

Source : Monografi Kecamatan Lingkar Selatan Tahun 2018.

Population Condition According to Livelihoods

The livelihoods of the population are quite diverse, as can be seen in Table 4.

Tabel 4. Jumlah Penduduk Kelurahan Lingkar Selatan Menurut Mata Pencaharian

Types of Livelihood	Total Population	(%)
Laborer	3.245	20,09
Farmer	1.541	9,54
Breeder	934	5,78
Trader	301	1,86
Civil servants	197	1,22
Private	223	1,38
Businessman	85	0,53
And others	9.625	59,59
Total	16.151	100

Sumber: Monografi Kecamatan Lingkar Selatan Tahun 2018

Based on Table 4, it can be seen that the majority of the population's livelihood is labor (20.09%). Then the population whose livelihood is farmers and livestock breeders is 15.32%. Meanwhile, the lowest livelihood is for residents as entrepreneurs (0.53%).

Population Condition According to Age Group and Gender

The population in Lingkar Selatan Subdistrict in 2018 was 16,151 people (8,341 men, 7.81 women).

Table 5. Population by age group.

Age Group (years)	Total population	Percentage
0-1	162	1,00
1-4	776	4,8
5-6	533	3,31
7-14	1.897	11,74
15-56	9.819	60,80
56>	2.964	18,35
Total	16.151	100

Sumber: Monografi Kecamatan Lingkar Selatan Tahun 2018

Table 3 shows that the research area is dominated by a productive population (15-56 years), namely 9,819 people (60.80%) and toddlers (0-1 years) occupy the lowest number, namely 1% (162 people). Thus, this area still has the potential to continue working.

Farming Conditions

Paal Merah Village, Paal Merah District, Jambi City is one of the vegetable supply areas in Jambi City. Farmers grow vegetables by dividing existing land with several types of vegetable commodities including celery, mustard greens, spinach, kale, curly mustard greens, basil, lettuce, chilies, long beans, eggplant and cucumber. The aim of planting a variety of vegetable commodities is to avoid an explosion in the quantity of vegetable products on the market which could reduce the price of these vegetable commodities.

Vegetable farming is generally carried out traditionally, however, the use of chemical pesticides is quite intensive to reduce the high number of pest and disease attacks. This condition is of concern to the local government. Since 2004, through the Jambi City Agriculture Service, this sub-district has been directed to become an area for developing organic vegetables. For this reason, farmers and their groups receive convenience in coaching and assistance with production facilities packages in the form of seeds and manure. The Provincial Agriculture Service with its UPTD, namely the Food Crop and Horticulture Protection Center (BPTPH), introduced the use of biological agents such as *Trichoderma* sp and *Beauveria* sp. This assistance package is provided in limited quantities, generally used for one planting season. In general, farmers use manure, namely chicken manure, every time they plant so that the soil



structure is better and chemical fertilizers are used in relatively small doses to function as a starter. Jambi Provincial Government, (2008); Edi et al, (2011), reported that 11 types of leaf-producing vegetables at the Prima Tani Field Laboratory, Paal Merah District, Jambi City had passed Prima 3 certification.

Several Benefits of Intercropping Patterns

Tumpangsari does not only belong to subsistence farmers who only carry out farming on land that can be said to be marginal with minimal capital. Intercropping has been widely applied by farmers, both semi-commercial and commercial, and is also applied to fertile land which is optimal for the growth and development of various types of plants. This cannot be separated from several advantages of the intercropping planting pattern, namely:

1. Efficient use of space and time

Intercropping is planting more than one type of plant on one land in the same time period. With this planting pattern, more than one type of crop will be produced at the same or almost the same time. More than one harvest produced at one time is one of the production efficiencies in relation to time. In relation to space, in the intercropping pattern, there is still empty space at the planting distance for plants with high habitus or other annual plants. The empty space is used for planting other plants so that land use is more efficient.

Several studies show that intercropping can increase land productivity. Intercropping does reduce the yield for each intercropped commodity due to the influence of competition, however, based on the value of the equal land ratio (NKL), the reduced yield of each commodity is still in a favorable condition.

2. Prevent and reduce unemployment

In some types of plants, a lot of labor is needed during the planting and harvest seasons. As a result, there is a lot of unemployment between the planting season and the harvest season. In intercropping, the plants cultivated are more diverse. Most of the maintenance carried out for each type of plant is not carried out at the same time. This way, farmers will always have work to do throughout the plant's life cycle.

3. Land processing is minimal

Minimal tillage is more visible in the rotational cropping pattern. In intercropping, as soon as a plant has almost completed its life cycle, another plant is quickly planted. As a result, there is no more time to cultivate the land. One of the advantages of no tillage or minimal tillage is that there is no damage to the soil structure because it is processed too intensively. In addition, with minimal or no tillage, the risk of erosion will be smaller than if it is completely tilled.

4. Diversifying community nutrition

Crops of more than one type will certainly provide varying nutritional value. Each plant basically has different nutritional content. Some contain carbohydrates, others contain protein, fat or vitamins. Diversifying plant types will also provide a diversity of types of nutrition to the community.

5. Suppress pest and pathogen attacks

Cropping patterns using an intercropping system are the same as modifying the ecosystem which in relation to pest control provides benefits (1) maintaining the inactive phase of natural enemies (2) maintaining community diversity (3) providing alternative hosts (4) providing natural food (5) creating places protection from natural enemies, and (6) selective use of insecticides.

Farming Analysis

Based on field observations and farmers' experience, the lifespan of chili and celery plants depends on cultivation technology, especially plant maintenance. Plant growth and harvest period for celery plants can reach 6-8 months with a total harvest of 26-30 times with a harvest interval of + 7 days once. On average, the 15 cooperating farmers harvested celery 24 times with a yield of 680 kg/ha and

red chilies harvested 8 times with a yield of 745 kg. The yield of this celery plant is far below the research results of Edi and Araz (2011) of 18,068 kg/ha or an average of 3,011 kg/ha per harvest. Setiawati et al, (2007) stated that leaf celery plants can be harvested repeatedly, if the leaves are cut high enough above the ground surface to allow the regrowth of new leaves and added that celery production can reach 40-70 t/ha.

The costs taken into account in intercropping red chili plants with celery include the costs of production facilities, family and non-family labor costs. Production costs include the costs of seeds, fertilizer, medicines and paranet with a total cost of Rp. 9,936,500,-. The cost of family labor used is IDR. 8,900,000,- and workers outside the family amounting to Rp. 600,000,-. If you add up the total costs used for this farming business, it is IDR. 19,436,500,- taking into account labor costs within the family, whereas if only taking into account labor outside the family the farming costs used are Rp. 10,536,500,-.

The income received from farming within one planting season or 24 celery harvests is IDR. 17,680,000,- with a total of 680 kg for Rp. 26,000,-/kg. Meanwhile, revenue from red chilies with an average of 8 harvests is 745 kg at a price of Rp. 18,000/kg and total revenue of Rp. 13,410,000,- Based on this, profit can be calculated by subtracting revenue from costs, so that a farming profit of IDR is obtained. 11,653,500,-. Meanwhile, without taking into account labor costs in the family, the profit obtained is IDR. 20,553,500,-.

To see the feasibility of farming, the R/C Ratio and B/C Ratio are calculated. The R/C ratio is an analytical method for measuring the feasibility of a business using the ratio of revenue and costs. The R/C ratio for this farm is 1.60 and without taking into account family labor the R/C ratio is 2.95. Either with or without taking into account family labor costs, the R/C ratio is > 1 , which means this farming is profitable. According to Darsono (2008) in Sari (2011), the Benefit Cost Ratio (BC Ratio) method is a comparison between the present value of income obtained from an investment and the present value of expenses (costs) as long as the investment lasts for a certain period of time. Business feasibility analysis is used to measure the level of return on business in implementing a technology. The B/C ratio obtained is 0.60 or B/C ratio < 1 , meaning it can be said that it is not feasible to continue. Meanwhile, the B/C ratio without taking into account family labor is 1.95 and this means it is feasible to continue.

Break Even point or BEP is an analysis to determine and find the number of goods that must be sold to consumers at a certain price to cover the costs incurred and make a profit. Celery farming BEP is divided into production BEP and price BEP (Soekartawi, 2006). Based on calculations obtained by BEP taking into account family labor costs, this farming is not in a profitable position. Meanwhile, if you only take into account labor costs outside the family, both celery and red chili farming, both production and price are in a profitable position because Production BEP $>$ Production Quantity and Price BEP $<$ Selling Price.

The novelty of this paper is that it introduces a new framework of institutional engineering analysis supporting chili and celery farming technology, based on the FSA (Farming System Analysis) concept. The paper also provides empirical evidence of the effectiveness and feasibility of chili and celery farming in the region. The paper contributes to the literature on agricultural development and technology by highlighting the role of farmer characteristics and farming technology in enhancing the productivity and profitability of chili and celery farming. The limitation of this paper is that it only focuses on one village and one type of agroecosystem, and it does not compare the results with other regions or crops. Future research may extend the scope and duration of the study to other villages and agroecosystems, and include other variables that may influence the farming outcomes, such as the market conditions, the environmental factors, and the policy interventions.

CONCLUSION

Intercropping red chilies with celery can increase farmers' income, as well as avoid failure for one type of plant by adding another type of plant that has compatible characteristics, such as celery. The results of research on intercropping celery and red chili farming without taking into account labor costs in the family, show that this farming is profitable with a total profit of IDR. 20,553,500,-/ha. This farming business has provided profits with celery production of 405 kg, red chili production of 585 kg, and BEP price of IDR 15,495/kg celery and IDR 14,143/kg red chili. The R/C ratio value is 2.95 and the B/C ratio is 1.95, indicating that the farming business observed is profitable and worth pursuing.



Intercropping of red chili plants with celery still has the opportunity to be improved, by implementing good and correct cultivation technology, such as the use of superior seeds, cultivation technology and harvest and post-harvest processes. Red chili and celery farming in Paal Merah Village, Jambi City has the potential to be developed intensively and sustainably. Support from the characteristics of farmers who are of productive age, a fairly high level of education and farming experience will be able to motivate farmers to increase their business intensively. To support the implementation of this strategy, a touch of capital is needed in the form of a farming credit scheme with soft interest without collateral and intensive assistance in the application of technology by extension workers and researchers.

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