Analysis of intercropping farming on red chili with celery in Jambi City

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Abstract. Farmers in Jambi City mostly cultivate vegetables due to the ease of selling their products and the supportive climate as well. This paper aims to see the level of farmer's income and characteristics of farmers on the application of farming technology. The research was conducted in Paal Merah Subdistrict, Jambi City, involving 25 farmers that were randomly selected as respondents. Through descriptive data analysis, it is known that red chili farming intercropped with celery has the potential to be developed intensively and sustainably. Support from the characteristics of farmers of productive age, level of education and fairly high farming experience will be able to motivate farmers to increase their business intensively while the obstacles faced are the limited use of seeds and labor, so that a superior variety and additional workers are needed from outside the family. The results also show that without taking into account to the family labor costs, this business is profitable with a total profit of Rp. 20,553,500.

1 Introduction

Horticulture commodities are classified as high-value commodities and become a mainstay source of economic growth of agricultural areas. Chili (*Capsicum annuum* L.) is commodities that make high contributions to farmers' income, welfare community and economic development. The need for chili from time to time has increased along with the increase in population and the development of various food industries with chili raw materials. To meet the needs of chili, the planting time must be continuous throughout the year so that the supply of chili and the price does not fluctuate [1,2].

Celery (*Apium graveolens* L.) is one of the many vegetable commodities used for food flavoring and decorating dishes. Celery seeds are also used as seasonings and flavoring. The seed oil extract is effective as a medicine. Cultivation of celery well on the highlands of 1000-1200 m above sea level, it can also be on the lowlands by giving a shade of the form of a roof, straw or paranet. The roofs function as sunshine and keep moisture. Celery plants are less rainy because it's rainfall optimum ranges of 60-100 mm/month celery plants can be divided into stalk celery, tubers celery and celery leaves [3,4]. The city of Jambi Celery plant is one of the belles, high prices and the number of requests for vegetable celery encourages farmers to cultivate Traditional so the results obtained are still not optimal [5]. Another obstacle is that farmers have not planted celery as the main commodity; on the other hand, researchers from universities and vegetable crop research centers have not done much

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research on celery. Therefore, it is difficult to determine the area of planting and production both locally and nationally [6].

Red chili plants are vegetable plants that can be paid with various types of other vegetable plants that have high and relative plants shorter than chili plants. This is often done by farmers, especially in the central area production. Aromatic plants such as celery contain essential oils among others Pest repellent. Therefore celery plants can be used as wrong one way of controlling pests by being pursued with chilli plants as main plants [7,8].

Intercrop plants are one of the alternatives that should be able to develop primarily to utilize the maximum land that leads to: (1) utilize the environmental components such as nutrients, water and sunlight, so able to reduce erosion and damage to soil; (2) minimize opportunities for pest attacks and plant disease pathogens and the risk of crop failure through the concept of diversity commodity; (3) outpouring of labor can be more regulated; and (4) increase in production and Farmers' income in general [9,10].

Carrying out well spoil planting patterns need to considered several environmental factors which has an influence including water availability, soil fertility, sunlight and pest disease [7, 11]. Determination of the types of plant is to be set and when planting adjusted with the availability of existing water during plant growth. This matter intended to avoid competition (nutrient absorption) on a land plot of plants. On a spoiled planting pattern it should be chosen and combined with plants that it has relatively rooted roots and plants that it has relatively superficial roots.

Paal Merah Village is one of the vegetable production center in the city of Jambi that located about 6 km from the capital city center of Jambi Province, some livelihood residents as farmers/farm labors. Palace Red Palace is the location of the production center area. Featured Agriculture, Agricultural Research and Development Agency through Prima Tani Program (Program Pilot and Investigation Acceleration of Agricultural Technology Innovation) was directly apply new concepts dissemination in the production center based on conformity Agro ecosystem and technological innovation needs by farmers [12].

Therefore it is necessary to conduct research that examines the characteristics of farmers and analysis natural chili farming and celery aimed at getting a picture of social conditions Economic farmers, feasibility of red chili farming, celery and its implications for implementation farming technology.

2 Methodology

The research was conducted in October 2018 at Mekar Sari farmers group of Paal Merah Village, Paal Merah Sub District, Jambi City, Jambi Province. The survey location was choice purposively with the following considerations: (1) quite potential for the development of vegetable farming, (2) vegetable-producing areas center, (3) the location is the "Prima Tani" area program of the Ministry of Agriculture in 2007-2011 [13]. The respondent of this survey is all 25 members of Mekar Sari Farmers Group.

Descriptive analysis is used to describe the general situation of farming to intercrop red chili plants with celery in the assessment area. Besides that analysis Descriptive is also used to describe the description or explanation of farming to intercrop red chili with celery. This method of analysis is expected able to provide an explanation of things related to farming Intercropping red chili with celery that cannot be explained in detail through analysis quantitative. Quantitative analysis is used to analyze data onto the form of numbers used to analysing to interconnect with red chili farming with celery. Some analysis Quantitative which is done in this assessment refers to the commonly used formula for simple analysis for research. The data analysis used in the study is:

1.1 Income analysis

PD = TR – TC, According to [14]

where :
PD = Farming Income (Rp / Planting Season)
TR = Total Revenue
TC = Total Cost

1.2 Analysis of farming feasibility

One measure of business feasibility is the analysis of the Return to Cost Ratio (R/C Ratio). R/C ratio analysis is a comparison between revenue and costs [15,16]. which is formulated as follows: R/C = TR/TC [14]. Decision criteria are:
R/C = 1, means farming is not profitable and does not lose or break even.
R/C < 1, indicates that the business is not worth the effort.
R/C > 1, then the farm is worth cultivating.

3 Results and discussions

3.1 Characteristics of the research area

Paal Merah Village is having an area of 778 ha, including in a wet climate dry land agro-ecosystem. Generally the level of soil fertility is in low Paal Merah -Mmedium. The type of land is in the dominance of red yellow podsolics and incepticol, with a pH range of 4.5 - 5.5. Having a flat topography, with land texture dominated by sandy clay [17]. Water resources to support vegetable gardens come from embung - embels made around farm gardens. The average area of farmer land ranges from 0.1-0.5 ha/kk. Available labor is limited, especially to soil processing, planting, weeding, and harvesting. With this condition, some farmers use farm laborers, while labor is mutually auxiliary /mutual cooperation generally grows because there is still a family relationship. Vegetable cultivation is very benefited by farmers, especially vegetables.

3.2 Characteristics of farmers and red chili farming and celery

To see the characteristics of the household of red chili farmers and celery can be known by seeing the age of farmers, the level of education, the number of family dependents, status farming, farmer's experience in running a business, a broad scale of business and origin of energy work. The characteristics are some aspects that affect skills the farmers to in managing to farm, including age, education, status and income in the household.

Table 1. Education level in Paal Merah Village in 2018

No	School Name	Total students	Percentage (%)
1	Primary School (Sd)	1.200	38,66
2	Junior High School (SMP)	1.079	34,77
3	High Schools (Sma)	789	25,41
4	Islamic Boarding Schools	36	1,16
	amount	3.104	100

Source: Monographs of the South Circle District in 2018.

The quality of the population depends on the level of education and in the South Ring Village. There are several educational facilities such as those that can be seen in Table 1. Table 3 showed that the majority of the population educated (1,200 people or 38.66%) followed by junior high school (1,079 students or 34.77%) .

3.3 Livelihood

Based on Table 2, the majority of people's livelihoods are workers (20.09%). Then residents with farmers' age of group as much as 15.32%, while the lowest livelihood is a resident as an employer (0.53%).

Table 2. The population of Paal Merah Village according to the age of group

No	Type of Livelihood	Total Population	Persentage (%)
1	Labor	3.245	20,09
2	Farmers	1.541	9,54
3	Breeder	934	5,78
4	Traders	301	1,86
5	PNS	197	1,22
6	Private	223	1,38
7	Employers	85	0,53
8	And Others	9.625	59,59
	Amount	16.151	100

Source: Monographs of the South Circle District in 2018.

3.4 The state of the population according to the age group and gender

Table 5 shows that the research area is dominated by productive population (15-56 years) of 9,819 people (60.80%) and toddlers (0-1 years) occupy the amount. Thus this area still has the potential to remain work.

Table 3. Residents are based on age groups.

No	Age Group ((Years)	Total Population	Percentage (%)
1	0-1	162	1,00
2	1-4	776	4,8
3	5-6	533	3,31
4	7-14	1.897	11,74
5	15-56	9.819	60,80
6	56>	2.964	18,35
	Amount	16.151	100

Source: Monographs of the South Circle District in 2018.

3.5 State of farming

Paal Merah Village, Paal Merah District, Jambi, is one of the areas of vegetable suppliers in Jambi City. Farmers grow vegetables by dividing existing land with several types of vegetable commodities including celery plants, mustard grave, spinach, kale, mustard mobiles, basil, lettuce, chili, long beans, eggplant and cucumber. Planting a variety of vegetable commodities aims to avoid explosion of quantity of vegetable products of the market that can reduce the price of the vegetable commodity.

Vegetable farming is generally carried out traditionally, but in the use of chemical pesticides, they are quite intensive to reduce the high attacks of pests and diseases. This

condition is, it is a concern for the local government. Since 2004, through the Jambi City Agriculture Service, this village is directed to become an organic vegetable development area. For this reason, farmers and groups have convenience in the coaching and assistance of the production facility package in the form of seeds and manure. The Provincial Agriculture Service with UPTD is the food and horticulture protection center (BPTPH) introducing the use of biological agents such as Trichoderma SP and Beauveria sp. The assistance package is given in limited quantities, in the generally used for once planting season. In general, farmers already use manure, namely chicken manure, every time it plants so that the soil structure is better and the administration of chemical fertilizers is used with relatively small doses functioning as a starter. There are 11 types of leaf-producing vegetables in the Prima Tani Laboratory of Paal Merah Paal Subdistrict, Jambi City have passed Prima 3 certification [13,18].

3.6 Some of the benefits of intercropping patterns

Intercropping not only belong to subsistence farmers that only do farm on land that can be said to be marginal with conscious capital but also has been widely applied by farmers both semi-commercial and commercial and also replayed on fertile lands which are indeed optimal for the growth and development of various kinds of plants. This is inseparable from some of the advantages possessed by intercropping patterns, namely:

3.6.1 Efficient use of space and time

Intercropping is a planting of more than one type of plant on one land in the same period of time. With this cropping pattern, more than one type of the result will be generated at the same time or almost simultaneously. More than one yield produced at one time is one of the efficiency of production in relation to time. In relation to space, in a splashing pattern, there are still empty spaces on planting plants with high habits us or other annual plants. The empty space used for other plant plantations so that land to use is more efficient.

Several studies show that intercourse is able to increase land productivity. Intercropping does reduce the results from each commodity that are pursued due to the influence of competition, but, based on the value of land equality (NKL), reduced the results of each commodity still in favorable conditions.

3.6.2 Prevent and reduce unemployment

On several types of plants, Labor work is needed a lot in the planting season and harvest season. As the result, many unemployed causes the planting season with the harvest season. In intercropping, plants that are tried are more diverse. Treatments made for each type of plant are also not at the same time. Thus, farmers will always have jobs during the plant's life cycle.

3.6.3 Soil processing becomes minimal

The minimal land processing is more visible to the glared cropping pattern. In overlap, it is as soon as a plant almost completed his life cycle, hurriedly planted with other plants. As a result, there is no more time to carry out soil processing. One advantage without processing soil or with minimal soil processing is no damage to soil structure because it is too intensively processed. In addition, minimal or without ground soil processing erosion land will be smaller than being processed perfectly

3.6.4 Invite community nutrition

The results of more than one type of plant will certainly provide diverse nutritional value. Every plant basically has different nutritional content. There are some that contain carbohydrates; some contain protein, fat, or vitamins. Plant of types diversification will also provide diversity of nutritional types of the community.

3.6.5 Pressing pest attacks and pathogens

The planting pattern with a intercropping system is the same as modifying the eco-system which in relation to opt controls provides advantages (1) of an inactive natural enemy phase (2) community diversity guard (3) the provision of the host alternative (4) providing natural food (5) place making Natural enemy shelter, and (6) the use of selective insecticides

3.6.6 Farm analysis

Based on observations in the field and from farmer experience, the age of chili and celery plants depends on cultivation technology, especially plant maintenance. Plant growth and the harvest period of celery plants can reach 6-8 months with a total harvest of 26-30 times for a harvest interval + 7 days once. On average from 15 cooperator farmers conducted a celery harvest 24 times with a result of 680 kg/ha and red chili harvest 8 times with 745 kg. The yield of the celery plant is far below the results of research from [5] of 18,068 kg/ha or on average every time 3,011 kg/ha harvest. The leaf celery plants can be harvested repeatedly, if the leaves are cut high above the ground to allow the re-growth of new leaves and added that the production of celery can reach 40-70 t/ha [19].

Table 4. Cost of Intercropping Red chili - Celery farming per ha Jambi 2018

No.	Description	Volume	Unit	Price Unit (Rp)	Amount (Rp)
I	Cost				
A.	Material costs/Ha				
1	Var red chili seeds. PM 999.	10	gr	135.000	135.000
2	Var Celery Seeds.Amigo	1	pack	24.000	24.000
3	Chicken Manure	180	sack	6.000	1.080.000
4	Dolomite Lime	8	Kg	25.000	200.000
5	Pearl NPK Fertilizers	150	Kg	11.000	1.650.000
6	Urea Fertilizer	75	Kg	2.300	172.500
7	Fertilizer KCL	50	Kg	8.000	400.000
8	liquid fertilizer	6	bottle	120.000	720.000
9	Curacron pesticides	2	Liter	150.000	300.000
10	Amistartop Pesticides	12	bottle	45.000	540.000
11	Agrimec Pesticides	10	bottle	75.000	750.000
12	Dethane Fungicides 45	500	gr	65.000	65.000
13	Paranet	2	rolls	1.200.000	2.400.000
14	Bamboo	300	sticks	5.000	1.500.000
Total A					9.936.500
B.	Family Workers				
1	Tillage	2 org x 5	HOK	100.000	1.000.000
2	Planting Celery	2 org x 4	HOK	100.000	800.000
3	Red Chili Planting	2 org x 2	HOK	100.000	400.000
4	Fertilization	2 org x 4	HOK	100.000	800.000
5	Maintenance Of Plants	1 org x 31	HOK	100.000	1.600.000
6	Harvesting Red Chilies	2 org x 8	HOK	100.000	3.100.000
7	Harvest Celery	1 org x 12	HOK	100.000	1.200.000
Total B					8.900.000
C.	Labour Cost				
1	Installation of Paranet	3 org x 2	HOK	100.000	600.000
Total C					600.000
Total I (A+B+C)					19.436.500
Total I (A+C)					10.536.500

Source: Primary Data (Data processed) 2020

Costs calculated in intercourse farming in red chili plants with celery include production facilities, family and family labor costs. Production costs include the cost of seeds, fertilizers, drugs, and paranets with a total cost of Rp. 9,936,500. Family labors costs used are Rp. 8,900,000 and labor outside the family of Rp. 600,000. If summing the total cost used for this farm is Rp. 19,436,500 by taking into account the cost of labor in the family, whereas if only taking into account the family workers of the farming costs used is Rp. 10,536,500. Acceptance received from farming in one period of timing the planting season or 24 times the celery harvest is Rp. 17,680,000, - with a total of 680 kg for Rp. 26,000/kg. While the acceptance of red chili 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, it can be calculated by reducing revenue at a cost, so that farm profits are obtained by Rp. 11,653,500. Whereas if without taking into account the cost of labor in the family, the profit obtained is Rp. 20,553,500.

Table 5. Income of Intercropping Red Chili - Celery Farming per ha, Jambi 2018

No.	Description	Volume	Unit	Price Unit (Rp)	Amount (Rp)
II	Revenue/ ha				
1	Celedri Harvest (24 Harvesters)	680	Kg	26.000	17.680.000
2	Chili crops (8 harvest times)	745	Kg	18.000	13.410.000
Total II					31.090.000
III	Profit/ha				
	Revenue – Total Costs I (A+B+C)				11.653.500
	Revenue - Total Costs II (A+C)				20.553.500
Cost A + C		10.536.500	Cost A+B+C		19.436.500
Revenue		31.090.000	Revenue		31.090.000
Profit		20.553.500	Profit		11.653.500
B/C ratio		2,95	R/C ratio		1,60
B/C ratio		1,95	B/C ratio		0,60
BEP Celedri Production (Rp)		405	BEP Celedri Production (Rp)		748
BEP Production of Red Chili (Rp)		585	BEP Production of Red Chili (Rp)		1.080
BEP Celery Price (Rp/Kg)		15.495	BEP Celery Price (Rp/Kg)		28.583
BEP Price of Red Chili (Rp/Kg)		14.143	BEP Price of Red Chili (Rp/Kg)		41.732

Source: Primary data (processed data) 2020

The feasibility of the farming was calculated using R/C ratio and B/C ratio. R/C ratio is a ratio to revenue and cost of farming. R/C ratio of the farming is 1.60 and 2.95 with and without taking into account the cost of Family Labor respectively. The Benefit Cost Ratio (B/C Ratio) is a ratio to the present value of the total income with the present value of total cost. B/C ratio of the farming is 0.60 and 1.95 with and without taking into account the cost of Family Labor respectively [20].

Break Even Point or BEP is a condition where income amount from selling product same with total farming cost [21]. Based on the calculation, obtained BEP by taking into account in the cost of family labor, this farm is not in a favorable position. Whereas if it only takes into account the cost of foreign workers, both celery farming or red chili, good production and prices is in a favorable position because of the production BEP > the amount of production and BEP price < Selling price.

4 Conclusions

The red chili and celery plants can be increasing farmer income, and avoid failure of one type of plant by adding one type of plantation that has compatible properties, such as celery plants. Research results in intercropping celery and red chili research by regardless of labor costs in the family, indicating that this farming is profitable with a total profit of rp. 20,553,500/ ha. These farmers have provided advantages with the production of 405 kg of celery, 585 kg of red chili production, and the BEP price of Rp. 15,495/ kg celery and Rp. 14,143/ kg of red chili. R/C ratio valued of 2.95 and B/C ratio of 1.95 to indicate that farming observed provides profits and deserves to be cultivated.

Performance of Red chili and celery intercropping farm can be improved, by applying good cultivation technology, harvest and post-harvest processed. Farming red chili with celery in Paal Merah Village, Jambi City has the potential to be developed intensively and

sustainably. Support of the characteristics of farmers what are in productive age, a fairly high level of education and a business experiences will be able to motivate farmers to improve their business intensively.

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