Jurnal Lahan Suboptimal : Journal of Suboptimal Lands
ISSN: 2252-6188 (Print), ISSN: 2302-3015 (Online, www.jlsuboptimal.unsri.ac.id)
Vol. 10, No.1: 113-121 April 2021
DOI: 10.36706/JLSO.10.1.2021.545

Cultivation and Farming Analysis of Red Chili Intercropping with Celery

Budidaya dan Analisis Usahatani Tumpangsari Cabai Merah dengan Seledri

Syafri Edi[*1)], Suharyon Suharyon[1]

[1]Assessment Institute for Agricultural Technology (AIAT), Jambi, Indonesia
*)Corresponding author: edisyafri@gmail.com

(Received: 3 February 2021, Accepted: 31 March 2021)

Citation: Edi S, Suharyon S. 2021. Cultivation and analysis of red chili intercropping farming with celery. *Jurnal Lahan Suboptimal : Journal of Suboptimal Lands.* 10(1): 113-121. DOI: 10.36706/JLSO.10.1.2021.545.

ABSTRAK

Tumpangsari merupakan salah satu alternatif yang selayaknya dapat dikembangkan terutama untuk memanfaatkan lahan secara maksimal. Tanaman aromatik seperti seledri mengandung minyak esensial yang antara lain bersifat sebagai penolak hama. Oleh karena itu tanaman seledri dapat digunakan sebagai salah satu cara pengendalian hama dengan cara ditumpangsarikan dengan tanaman cabai sebagai tanaman utama. Penelitian ini bertujuan untuk mengetahui teknologi budidaya dan analisis usahatani tumpangsari tanaman cabai merah dengan seledri di tingkat petani. Penelitian dilaksanakan di Kelompok Tani Mekar Sari, Kelurahan Paal Merah, Kecamatan Paal Merah Kota Jambi, Provinsi Jambi bulan Oktober 2018. Data yang dikumpulkan meliputi data primer berupa informasi dari petani serta data sekunder dan kondisi wilayah penelitian, potensi sosial dan ekonomi. Data primer diambil menggunakan teknik survei yakni wawancara dengan petani dan informasi kunci menggunakan kuesioner. Sampel ditentukan secara acak pada populasi petani tumpangsari cabai merah dengan seledri di lokasi pengkajian sejumlah 15 orang petani kooperator. Teknik analisis data meliputi analisis tabulasi digunakan untuk pemahaman kondisi usahatani finansial petani dan analisis kelayakan ekonomi menggunakan R/C ratio. Hasil penelitian usahatani tumpangsari cabai merah dengan seledri, tanpa memperhitungkan biaya tenaga kerja dalam keluarga, menunjukkan bahwa usaha ini menguntungkan dengan total keuntungan sebesar Rp. 20.553.500,-. Usahatani ini sudah memberikan keuntungan dengan produksi seledri sebanyak 405 kg, produksi cabai merah sebanyak 585 kg, dan BEP harga Rp. 15.495,-/kg seledri dan Rp. 14.143,-/kg cabai merah per hektar. Nilai R/C ratio sebesar 2,95 dan B/C ratio sebesar 1,95 menunjukkan bahwa usahatani yang diamati memberikan keuntungan dan layak untuk diusahakan.

Kata kunci: cabai (*Capsicium annuum*); seledri (*Apium graveoleans*); tumpangsari

ABSTRACT

Intercropping is an alternative that should be developed especially to make maximum use of the land. Aromatic plants such as celery contain essential oils which, among other things, act as pest repellents. Therefore, celery plants can be used as a way of controlling pests by intercropping with chili plants as the main crop. This study aimed to determine the cultivation technology and analysis of the intercropping farming of red chilies with celery

at the farmer level. The research was conducted at the Mekar Sari Farmer Group, Paal Merah Village, Paal Merah District, Jambi City, Jambi Province in October 2018. The data collected included primary data in the form of information from farmers as well as secondary data and conditions of the research area, social and economic potential. Primary data were collected using survey techniques, namely interviews with farmers and key information using a questionnaire. Samples were randomly assigned to a population of 15 farmer cooperator farmers who were intercropping red chili and celery at the study site. The data analysis technique included tabulation analysis which was used to understand the farmers' financial farming conditions, and the economic feasibility analysis uses the R/C ratio. The results of the research on the intercropping of red chili and celery, without considering the labor costs in the family, showed that this business was profitable with a total profit of 20,553,500,-IDR This farming has benefited from the production of celery as much as 405 kg, production of red chilies as much as 585 kg, and BEP prices of 15,495,-IDR/kg of celery and 14,143,-IDR/kg of red chilies. The R/C ratio value of 2.

Keywords: celery (*Apium graveoleans*); chile (*Capsicium annuum*); intercropping

INTRODUCTION

Horticultural commodities are classified as high-value commodities and are one of the main sources of economic growth in agricultural areas. Chili (*Capsicum annuum*) is a commodity that provides a high contribution to farmers' income, community welfare and economic development. The need for chili from year to year has always been increasing along with the population growth and the development of various food industries using chili as raw material. To meet the demand for chilies, the planting time must be continuous throughout the year so that the supply of chilies and prices do not fluctuate (IAARD, 2012; Sastro et al., 2013; Gunadi & Sulastrini, 2013; Muharam, 2015). The red chili plant is a vegetable crop that can be intercropped with various other vegetable plants which have a relatively shorter plant height and age 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 be used as a way of controlling pests by intercropping with chilies as the main crop (Hermawati, 2016; Moekasan, 2018). The celery plant in Jambi City is one of the primadona, the high price and high demand for celery encourages farmers to cultivate traditionally in the moor and in the yard of the house, however, the results are not optimal. Intercropping of plants is an alternative that should be developed especially to make maximum use of the land which leads to: 1). utilization of environmental components such as plant nutrients, water and sunlight, so as to reduce erosion and soil damage; 2). minimizing opportunities for pests and plant disease pathogens and the risk of crop failure through the concept of commodity diversity; 3). the workforce distribution can be more regulated; and 4). increased production and income of farmers in general (Setyowati, et al., 2013; Sumarni et al., 2014; Prabaningrum & Moekasan, 2014). Paal Merah Village is one of the vegetable production centers in Jambi City, which is located about 6 km from the center of the capital city of Jambi Province, most of the population works as farmers/ agricultural laborers. Paal Merah Village is the location of leading agricultural production centers, the Agency for Agricultural Research and Development through the Prima Tani program (Agricultural Technology Innovation Pioneering and Acceleration Program) which directly applies the new concept of dissemination in production center areas based on the suitability of agro-ecosystems and the need for technological innovation by farmers. This study aimed to determine

the cultivation technology and analysis of the intercropping farming of red chili and celery at the farmer level that has been applied and the possibility of technological improvements and future developments. It is expected to be an input, especially for farmers as users and the Jambi City Government in making strategic vegetable commodity development policies, especially red chilies and celery.

MATERIALS AND METHODS

The research was conducted at the Mekar Sari Farmer Group, Paal Merah Village, Paal Merah District, Jambi City, Jambi Province in October 2018. The selection of the research location was carried out purposively with the following considerations: (1) Paal Merah Village, Paal Merah District is quite potential for development of vegetable farming, (2) Paal Merah Village is one of the vegetable crop-producing areas in Paal Merah District, (3) Paal Merah Village, Paal Merah District is a vegetable crop cultivation area which is still operating today and (4). Paal Merah sub-district is a program for the Prima Tani Area for 5 years (2007-2011) of the Ministry of Agriculture. The population in this study were all farmers who cultivated intercropping of red chilies with celery in Paal Merah Village, amounting to 15 farmers who are members of the Mekar Sari Farmer Group. The technique of determining respondents in this study was carried out by using the census method, namely by taking the entire population in Paal Merah Village as many as 15 respondents. Descriptive analysis was used to describe the general condition of the intercropping farming of red chilies and celery in the study area. In addition, descriptive analysis is also used to describe the description or explanation of the intercropping farming of red chilies with celery. Thus, this analytical method is expected to be able to provide an explanation of matters related to the intercropping of red chili and celery which cannot be explained in detail through quantitative analysis. Quantitative analysis was used to analyze data in the form of numbers used in analyzing the intercropping of red chili with celery. Some of the quantitative analyzes carried out in this study refer to formulas commonly used in simple analyzes for research. The data used in the study were:

1. Income analysis
2. Pd = TR – TC, Information: Pd = farm income (Rp/Planting season),TR = Total Revenue, TC = Total Cost (According to Suratiyah, 2015)
3. Farming Feasibility Analysis

Suratiyah (2015) states that to determine the feasibility of a business, it can be calculated using Revenue Cost Ratio (R/C Ratio) analysis. R/C Ratio stands for Revenue Cost Ratio or 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 = Total Revenue/Total Revenue (IDR) TC = Total Cost/Total Cost (IDR) With decision criteria if: R/C = 1, meaning that the farm is not profitable and does not lose or break even. R/C < 1, indicating that the business is not feasible. R/C > 1, then the farming is feasible to be cultivated.

RESULTS AND DISCUSSION

Regional Characteristics

Paal Merah Village is located 3 km from the capital city of Paal Merah District, 3 km from the capital city of Jambi City and 6 km from the capital city of Jambi Province. Has an area of 78 ha, including the agro-ecosystem of Dry Land Lowland Wet Climate. Generally, the level of soil fertility in Paal Merah is low - moderate. Soil types were dominated by Red-Yellow Podsolic and Inceptisols, with a pH range of 4.5 - 5.5. It has a flat topography, with a soil texture dominated by sandy loam. Water resources to support vegetable gardens come from embungs that are built around farms (Table 1).

Table 1. Regional characteristics description of paal merah village

Regional Characteristics	Description
Distance from the capital city of Paal Merah District	3 km
Distance from the capital city of Jambi City	3 km
Distance from the capital city of Jambi Province	6 km
Large of area	78 ha
Soil type	Red-Yellow Podsolic and Inceptisols
Soil texture	Sandy loam
Level of soil fertility	Low - moderate
pH	4.5 - 5.5
Topography	Flat

The results showed that the average cultivated land area of farmers ranged from 0.1–0.5 ha/household. Generally, the labor used is in the family, especially for land cultivation, planting, weeding and harvesting. Some farmers use mutual assistance/mutual cooperation/arisan. This happened because there was still a family relationship.

Vegetable farming is the main commodity cultivated by farmers. The location of the vegetable garden in Paal Merah Village is located at RT 10, 11, 21, 23, and 28. Farmers cultivate quite a variety of vegetable crops, including: celery, lettuce, kale, spinach, mustard greens, basil, eggplant, tomatoes, chilies, long beans, cucumber, luffa, cabbage, kailan, pakcoy and curly cabbage. Of these types of vegetables the most cultivated are: mustard greens, celery, lettuce, kale, spinach, chilies, eggplant, long beans and cucumber. This vegetable crop is cultivated throughout the year. Besides planting in monoculture, some farmers also plant intercropping vegetables, namely chili plants intercropping with celery plants. Apart from vegetables, crops are also cultivated in dry/dry land in a very limited area, such as sweet corn.

State of Farming

Paal Merah Village, Paal Merah District, Jambi City is one of the supply areas for vegetable commodities in Jambi City. Farmers plant vegetables by dividing the existing land with several types of vegetable commodities including celery, mustard greens, spinach, kale, mustard greens, basil, lettuce, chilies, long beans, eggplant and cucumber. The planting of various vegetable commodities is aimed at avoiding an explosion in the quantity of vegetable products on the market which can reduce the price of the vegetable commodity.

Vegetable farming is generally carried out in a traditional manner, however, in the use of chemical pesticides, they are intensive enough to suppress the high attack of pests and diseases. This condition is a concern of the local government. Since 2004, through the Jambi City Agriculture Office, this village has been directed to become an area for developing organic vegetables. For this reason, farmers and their groups have access to assistance and assistance in production facilities packages in the form of seeds and manure. The Provincial Agriculture Office and its UPTD, namely the Center for Food and Horticulture Protection (BPTPH), introduced the use of biological agents such as Trichoderma sp and Beauveria sp. The aid packages are given in limited quantities, generally used for one planting season. In general, farmers have used manure, namely chicken manure, every time it is planted so that the soil structure is better and chemical fertilizers are used with a relatively small dose which functions as a starter, the application of organic fertilizers is believed to be an important key in maintaining land health and crop production (Brevick, 2013; Ehmke, 2013; Vlahova & Oopov, 2013). Kusmarwiyah and Erni (2018) stated that the application of organic fertilizers to red chili plants can increase plant growth, affect

the rate of root and stem growth, leaf formation and increase the content of photosynthetic pigments, as well as improve quality and yield.

Farmers' Level Cultivation Technology

Soil processing is done manually with a hoe 20-30 cm deep and left for 15 days, then made beds with a width of 120 cm, height 30 cm, length 10 m and a distance between the beds 50 cm. The beds are shaded with a paranet with a height of 1.5 m. Giving dolomite is carried out during the second tillage or 15 days before planting, evenly on the surface of the beds, then stirring evenly with the surface of the beds, five days before planting, manure is applied from chicken manure, evenly distributed on the surface of the beds.

Planting celery is done after the seeds are 45 days old or have 3-4 leaves of leaves, remove the healthy celery seeds from the roots. Cut some of the roots, then the roots are soaked in a solution of Benlate pesticide at a concentration of 50% for about 15 minutes. Move the seeds to the prepared beds, one seed per planting hole, with a spacing of 20 x 20 cm and compact the soil around the stems, then flush the beds with water until moist. The maintenance of celery plants is done with embroidery 7-10 days after planting.

After the celery plants are 3 weeks after planting, plant the prepared chili seeds. Planting chili seeds after 30 days of nursery or after having 4-5 leaves, 50 x 60 cm spacing, zigzagging 1 stem per planting hole. Weeding is done in conjunction with loosening the soil at the age of 2 and 4 weeks after planting, the next weeding is adjusted to the state of the weeds. At the beginning of the growing period, watering is carried out 1-2 times a day, then reduced to 2-3 times a week or depending on the weather.

Some of the Benefits of the Intercropping Pattern

According to the farmers, from the results of the meeting at the field school accompanied by the Field Agricultural Extension Officer, it was stated that intercropping is not only owned by subsistence farmers who only do farming on land that can be said to be marginal with minimal capital. Tumpangsari 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 kinds of plants. This is inseparable from several advantages possessed by the intercropping planting pattern, namely:

1. Efficient Use of Space and Time

Intercropping is planting more than one type of crop on one land in the same period of time. This cropping pattern will produce more than one type of crop at the same time or almost simultaneously. More than one crop produced at a time is a production efficiency in terms of time. In relation to space, in the intercropping cropping pattern, there are still empty spaces in the spacing of plants with high habitus or other annual plants. The empty space is used for planting other crops so that land use is more efficient.

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

2. Prevent and Reduce Unemployment

In some types of crops, labor is required during the growing and harvest seasons. As a result, there is a lot of unemployment between the planting season and the harvest season. In intercropping, the cultivated plants are more diverse. Most of the treatments done for each type of plant are also not at the same time. Thus, farmers will always have a job throughout the life cycle of the plant.

3. **Tillage is Minimal**

Minimal tillage is more visible in the intercropping cropping pattern. In alternate shifts, as soon as a plant has almost completed its life cycle, other crops are quickly planted. As a result, there is no more time to cultivate the land. One of the advantages without tillage or with minimal tillage is that there is no damage to the soil structure because it is too intensively processed. In addition, at minimal or no tillage the risk of erosion will be less than if it is completely cultivated.

4. Diversify People's Nutrition

Crop products of more than one type will certainly provide various nutritional values. Each plant basically has different nutritional content. There are some that contain carbohydrates, some contain protein, fat, or vitamins. Diversity of plant species will also provide a diversity of types of nutrition to the community.

5. **Suppress Pests and Pathogens**

The cropping pattern with the intercropping system is the same as modifying the ecosystem, which in relation to pest control provides benefits (1) guarding the inactive phase of natural enemies (2) maintaining community diversity (3) providing alternative hosts (4) providing natural food (5) making place protect against natural enemies, and (6) selective use of insecticides.

Mistakes in determining the types of plants to be intercropped can make the ones that are actually the advantages of the intercropping cropping become the weakness of the intercropping. The competition between plants that is too high makes the yield for each plant very small which results in a land equality value of less than one. In addition, there can also be difficulty controlling pests and pathogens because the intercropping of plants allows pests and pathogens to host both. Not infrequently, the cost for intercropping plant care is also more expensive because you have to treat more than one type of plant. Kolvanagh and Shokati (2012) suggest that an environmentally friendly component of control technology is a technical culture control such as planting with an intercropping system. Mitiku et al. (2013) and Orluchukwu and Udensi (2013), stated the intercropping of red chilies with corn and sweet potatoes is able to suppress weed growth and potyvirus attack. Ahmad and Ansari (2013) stated that to suppress the attack of plant pests can be done by planting aromatic plants containing essential oil compounds that are toxic to pests. The toxicity of these essential oils has a broad spectrum as a fumigant, insecticide and insect pest behavior (Karamaouna et al., 2013).

Farming Analysis

Based on field observations and from the experience of farmers, the age of chili and celery plants depends on cultivation technology, especially plant maintenance. Plant growth and the harvest period of celery can reach 6-8 months with the number of harvests of 26-30 times with 7 days of harvest once. On average, 15 cooperator farmers harvest celery 24 times with a yield of 680 kg/ha and 8 times yield of red chilies with a yield of 745 kg.

Costs calculated in the intercropping of red chili and celery include the cost of production facilities, family labor costs and outside the family. Production costs include, among others, the cost of seeds, fertilizers, medicines and paranets with a total cost of 9,936,500,- IDR. The family labor costs 8,900,000,- IDR and labor outside the family of 600,000,- IDR. If the total cost used for this farming is 19,436,500,- IDR taking into account the labor costs in the family, whereas if only taking into account the labor outside the family the cost of farming used is 10,536,500,- IDR (Table 2).

Revenue received from the farm within one planting season or 24 celery harvests is 17,680,000,- IDR with a total of 680 kg for 26,000, IDR/kg. While the revenue from red chilies with an average of 8 harvests is

745 kg at a price of 18,000,- IDR/kg and total revenue of 13,410,000,- IDR. Based on this, the profit can be calculated by reducing the revenue with the cost, so that the farm profit is 11,653,500,- IDR. Meanwhile, if without considering the cost of labor in the family, the profit will be 20,553,500,- IDR (Table 3).

To see the feasibility of farming, the R/C Ratio and B/C Ratio were calculated. R/C ratio is an analytical method to measure the feasibility of a business by using the ratio of revenue (revenue) and costs (cost). The R/C ratio for this farm is 1.60 and without taking into account the family workforce the R/C ratio is 2.95. Either with or without taking into account family labor costs, R/C ratio> 1, which means that this farming provides benefits. According to Suastina et al. (2014) the Benefit Cost Ratio (BC Ratio) method is a comparison between the present value of the income obtained from an investment with the present value of expenses (costs) as long as the investment takes place within a certain period of time. Business feasibility analysis is used to measure the rate of return on business in applying a technology. The B/C ratio obtained is 0.60 or the B/C ratio <1 means it can be said that it is not feasible to continue.

Table 2. Cost of production facilities for chili intercropping with celery in Jambi 2018

No.	Description	Volume	Unit	Unit Price (IDR)	Amount (IDR)
I	Cost				
A.	Means of Production/ha				
1	Red chilli seeds var. PM 999	10	g	135,000	135,000
2	Celery seeds var. Amigo	1	sack	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 Fertilizer	150	kg	11,000	1,650,000
6	Urea Fertilizer	75	kg	2,300	172,500
7	KCl fertilizer	50	kg	8,000	400,000
8	Liquid fertilizer	6	bottle	120,000	720,000
9	Curacron pesticide	2	L	150,000	300,000
10	Amistartop pesticides	12	bottle	45,000	540,000
11	Agrimec Pesticides	10	bottle	75,000	750,000
12	Dethane fungicide 45	500	g	65,000	65,000
13	Paranet	2	roll	1,200,000	2,400,000
14	Bamboo	300	stem	5,000	1,500,000
Amount A					9,936,500
B.	Family Labor				
1	Cultivate the land	2 people x 5	days	100,000	1,000,000
2	Celery planting	2 people x 4	days	100,000	800,000
3	Red chilli cultivation	2 people x 2	days	100,000	400,000
4	Fertilization	2 people x 4	days	100,000	800,000
5	Plant maintenance	1 person x 31	days	100,000	1,600,000
6	Red chilli harvesters	2 people x 8	days	100,000	3,100,000
7	Celery harvest	1 person x 12	days	100,000	1,200,000
Total B					8,900,000
C.	Workers Outside the Family				
1	Paranet installation	3 people x 2	days	100,000	600,000
Total C					600,000
Total I (A + B + C)					19,436,500
Total I (A + C)					10,536,500

Table 3. Acceptance of chili tumpangsari farming with celery, Jambi 2018

No.	Description	Volume	Unit	Unit Price (IDR)	Amount (IDR)
II	Revenue from harvest / ha				
1	Celery yields (24 harvests)	680	kg	26,000	17,680,000
2	Chili yields (8 harvests)	745	kg	18,000	13,410,000
Number II					31,090,000
III	Profit				
	Admission - Fees (A + B + C)				11,653,500
	Admission - Fees (A + C)				20,553,500
A + C fee		10,536,500	Cost A + B + C		19,436,500
Reception		31,090,000	Reception		31,090,000
Income		20,553,500	Income		11,653,500
B/C ratio		2.95	R/C ratio		1.60
B/C ratio		1.95	B/C ratio		0.60
Celery production BEP (IDR)		405	Celery production BEP		748
BEP for red chili production (IDR)		585	BEP for red chili production		1,080
BEP price of celery (IDR/Kg)		15,495	BEP price of celery		28,583
BEP price of red chili (IDR/Kg)		14,143	BEP price of red chili		41,732

Meanwhile, the B/C ratio without taking into account the family workforce is 1.95 which 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 costs incurred and get a profit. Celery farming BEP is divided into production BEP and price BEP (Suratiyah, 2015). Based on the calculation, the BEP obtained by taking into account the cost of family labor, this farm is not in a profitable position. Meanwhile, if it only takes into account the labor costs outside the family, both celery or red chili farming, both production and price, are in an advantageous position because BEP Production > Total Production and BEP Price < Selling Price.

CONCLUSION

The intercropping of red chilies with celery can increase farmers' income, and prevent failure of one type of crop by adding another type of plant that has compatible properties, such as celery. The results of the research on the intercropping of celery and red chilies without considering the labor cost in the family, showed that this farming was profitable with a total profit of 20,553,500,- IDR/ha. This farming has benefited from the production of celery as much as 405 kg, production of red chilies as much as 585 kg, and BEP prices of 15,495,- IDR/kg of celery and 14,143,- IDR/kg of red chilies. The R/C ratio value of 2.95 and the B/C ratio of 1.95 indicate that the farms being observed are profitable and feasible to be cultivated. The intercropping of red chili plants with celery still has the opportunity to be improved, by applying good and correct cultivation technology, such as the use of superior seeds, cultivation technology and harvest and post-harvest processes.

REFERENCES

Ahmad T, Ansari M. 2013. Effect of intercropping on the infestation of diamondback moth, *Plutella xylostella* in cauliflower, *Canadian J. Plant Prot*. 1(2): 1-6.

Brevick EC. 2013. *Soil Healt and Productivity. Soils, Plant Growth and Crop Production Vol 1*. Dickinson State University.

Ehmke T. 2013. *Soil Health: Building for the Future.* Crop and Soils Magazine. American Society of Agronomy. January-February.

Gunadi N, Sulastrini I. 2013. The use of netting house and plastic mulch to

increase growth and yield of red chilies. *J, Hort*. 22(1): 36-46.

Hermawati D. 2016. Economic study of monoculture planting patterns and intercropping of corn, cabbage and spinach. *Inovasi* 18: 66-85.

IAARD (Agricultural Research and Development Agency). 2012. *Horticulture Agribusiness Development Support Program* (*PDPKAH*). Agricultural Research and Development Agency, Ministry of Agriculture: Indonesia.

Karamaouna F, Kimbaris A, Michaelakis A, Papachristos D, Possiou M, Papatsakona P, Tsora E. 2013. Insecticidall activity of plant essential oils against the vine mealybug, *Planococcus ficus. J. Insct Sci*. 13(1): 1-13. DOI: 10.1673/031.013.14201.

Kolvanagh J, Hokati B. 2012. Effect of different intercropping patterns on shot part of dill and fenugreek. *Int. J. Plant, Animal and Environmental Science.* 2(3): 115-120.

Kusmarwiyah R, S Erni. 2018. The effect of growth media and liquid organic fertilizers on the growth and yield of celery (*Apium graveolens* L.). Crop Agro: *Scientific Journal of Agronomy*. 4(2): 7-12.

Mitiku A, Chala A, Beyene Y. 2013. The effect of intercropping of pepper with maize and sweet potato on infection of pepper (*Capsicum annuum* L.) by Potyvirus and yield of pepper in Southern Etthiopia, *Int. J. Tech. Enhancements & Emerging Eng. Res*. 1(4): 28-35.

Moekasan T. 2018. Effect of Aromatic Plants on Thrips and Aphid Infestation in Intercroping System with Hot Pepper. *J. Hort*. 28(1): 87-96.

Muharam A. 2015. Horticulture Agribusiness Development Assistance (PKAH) 2015-2019; Stages and Introductions of Performance. The Role of Assistance in the Development of Horticultural Agribusiness Areas. Center for Agricultural Studies and Development. Agricultural Research and Development Agency. *Ministry of Agriculture*. p. 1-16.

Orluchukwu J, Udensi U. 2013. The effect of intercropping pattern of okra, maize, pepper on weeds infestations and okra yield, *African J. Agric, Res.* 8(10): 896-902.

Prabaningrum L, Moekasan T. 2014. Management of plant-disturbing organisms in the cultivation of red chili in the highlands. *J. Hort*. 24(2): 179-188.

Sastro Y, Eva Rosmala, Junaidi, Indarti P Lestari. 2013. Growth and yield of curly red chilies treated with granule compost at two levels of NPK fertilization. *Urban Affairs Bulletin*. 3(2): 28-33.

Setyowati ML, E Sulistyaningsih, ETS Putra. 2013. Cabbage growth and yield (*Brassica oleraceae* L.) in an intercropping system with scallions (*Allium fistulosum* L.). *Vegetalika.* 2(3): 32-44.

Suastina, IGP Bagus, Kayana IG Ngurah. 2014. *Financial Analysis of Beef Cattle Agribusiness Business. Agribusiness Journal.* Faculty of Animal Husbandry. Udayana University. p. 1-11.

Sumarni N, Setiawati W, Hudayya A. 2014. Nutrient and plant management to support red chili farming using low outdoor inputs in the highlands. *J. Hort*. 24(2): 141-153.

Suratiyah K. 2015. *Farm Management*. Penerbar Swadaya: Jakarta.

Vlahova VI, Oopov VI. 2013. Influence of the biofertilizerseasol on yield of pepper (*Capsicum annuum* L.) cultivatedunder organic agriculture condition. *Journal of Organic Systems.* 8(2): 6-17.