



Farm Business Analysis of Broccoli (*Brassica oleracia* L.) and Lettuce (*Lactuca sativa* L.) Intercropping Farming System (a Case Study of a Farmer on Kayu Ambon Street, Lembang District, West Bandung Regency)

Samsul Arifin^{1*}, Firda Firdaosyah², Widi Yanti³

^{1,2} Department of Agribusiness, Faculty of Agriculture, Ma'soem University, Sumedang, Indonesia

³ Department of Agribusiness, Faculty of Agriculture, Ma'soem University, Sumedang, Indonesia

*Corresponding author email: samsularifin@masoemuniversity.ac.id

Abstract

Broccoli (*Brassica oleracia* L.) and lettuce (*Lactuca sativa* L.) were part of horticultural commodities that can be consumed and contain a lot of vitamins, such as vitamins A, B Complex, C, and essential minerals such as calcium and iron for fulfilling human nutrition. Lettuce plants can also be consumed as salad. The demand for horticultural crops, broccoli and lettuce, was increasing because people awareness on nutritional needs arise. Besides, these plants are also delicious. Intercropping pattern used by farmers on Jalan Kayu Ambon, Lembang District, West Bandung Regency was a form of mixed cropping pattern system that involve two or more types of plants in the same area and the same time. This intercropping pattern can maximize production in a limited land, and the risk of loss can be reduced. The objective of this research was to find out cost, revenue and the R/C ratio of the intercropping system of broccoli and lettuce. The method of the research was the survey method. The data consist of the primary and secondary data. The primary collected directly from the farmer. Meanwhile the secondary data collected from literature and any institutions that related to this research. The farmer was Bapak Jajang. The primary data consisted fix cost, variable cost, and revenue. The data were used to calculate Break Even Point and R/C ratio. Result of the research showed that total cost (TC) used in intercropping broccoli and lettuce system was IDR 5,462,142/planting season, with total revenue (TR) was IDR 5,958,000. The R/C ratio was 1.09. So this Intercropping Farming System was feasible because the R/C ratio more than 1.

Keywords: Broccoli, Lettuce, Intercropping, Farming.

1. Introduction

Broccoli is a plant from the Cabbage or Brassica tribe. The part that is consumed from this plant is the flower. Broccoli is a horticultural plant which is a source of vitamins A, B Complex, C, calcium, iron and essential minerals for fulfilling human nutrition and contains substances that can prevent cancer (Roeswitawati & Ningsih, 2018). Likewise, lettuce plants can be used as salads and can be grown in areas with moderate or tropical seasons (Palada & Crossman, 1999).

The demand for broccoli and lettuce also continues to increase along with the increasing population in Indonesia and the increasing awareness of the population on nutritional needs. People really like this vegetable because it has a good taste and good nutritional content (Yildirim & Turan, 2013).

Meanwhile, intercropping of broccoli and lettuce is a form of mixed cropping system that involves two or more types of plants in one area at the same time or almost simultaneously (Roeswitawati & Ningsih, 2018). This intercropping pattern must pay attention to the selection of plants to be combined so that they do not harm or inhibit the growth of one plant with another. Examples include intercropping on broccoli and lettuce (Yildirim & Turan, 2013).

The way to find out how an agricultural business is feasible or vice versa is to conduct farming analysis which is things that discuss or learn how to use resources efficiently and effectively in an agricultural business in order to obtain maximum results. These resources are land, labor, capital, and management. Farming is an activity in the agricultural sector, starting from production facilities, production/cultivation, post-harvest handling, processing, marketing of products, and/or supporting services (Maharany & Purba, 2020).

2. Literature Review

2.1. Broccoli and Lettuce Plants

The Broccoli plant is a plant that is eaten is a green head that is densely arranged like a leaf tree branch with a thick stem. Most of the heads of such flowers are surrounded by foliage.

Broccoli is a plant that lives in cold weather. This plant is very good if grown at a height of 1000-2000 meters above sea level, with a temperature of 18°C-20°C if broccoli is grown at a temperature below 20°C, then the broccoli plant will be hampered in growth. Meanwhile, the pH needed for broccoli growth is pH 6-7 (Kuhar et al., 2020).

The classification is:

Kingdom : Plantae
 Division : Spermathopyta
 Sub Division : Angiosperms
 Class : Dicotyledoneae
 Order : Brassicales
 Tribe : Brassicaceae
 Genus : Brassica
 Species : Brassica oleracea L. var. botrytis L.

As for the pests found in broccoli plants including leafworm pests, these pests cause damage to plant leaves, making leaves hollow. Aphids cause yellowing of the leaves and the period of dirty spotted flowers. Earthworm pests are characterized by irregularly perforated leaves and bases of plants, so the plant does not form a flower period because its growth is stopped. An inch caterpillar that causes the leaves to be hollowed out until only the bones and snails are left. For this reason, one of the concepts of plant pest control utilizes many biological materials and methods, including the use of refugia plants, spraying vegetable pesticides and *Beauveria bassiana*, and applying Plant Growth Promoting Rhizobacteria (PGPR).

While the lettuce plant is the most widely used plant for salads. This plant is the main winter vegetable that adapts best to the location of a temperate climate, which is widely grown.

Lettuce is a polymorphous year-old plant (it has many forms), lettuce belongs to the family Asteraceae. In the highlands with a humid climate, lettuce productivity is quite good. According to (Simpson, 2019) the position of lettuce in plant systematics is clarified as follows:

Kingdom : Plantae
 Super Division : Spermatophyta
 Division : Magnoliophyta
 Class : Magnoliopsida
 Order : Asterales
 Family : Asteraceae
 Genus : Lactuca
 Species : Lactuca sativa L.

Lettuce has a root system of fibers. The roots of the fibers attach to the stem and grow spreading in all directions at a depth of 20 - 50 cm or more. Lettuce leaves have a shape, size, color that varies depending on the variety. The height of leaf lettuce plants ranges from 30-40 cm and the height of head lettuce plants ranges from 20-30 cm (Simpson, 2019). The harvest age of lettuce varies according to the cultivar and season, its age ranges from 30-85 days after transplanting. Plant weights are very diverse, ranging from 100 g to 400 g. Too early harvest gives low yields and late harvests can degrade quality (Willey et al., 1983).

2.2. Intercropping Farming

Intercropping is a plant cultivation system where more than one plant is planted in one planting area. This system is used to maximize land function and is expected to increase land productivity and also increase farmers' incomes. Annuals in their cultivation often use the intercropping system. Obstacles are often faced in combining plants to be planted intercropping, this is related to the morphology of the plants of each species which are different that will affect the interaction between plants grown in the same field.

Factors that need to be considered are the need for proper addition of nutrients, planting time between plants, width of the canopy between plants, area of root distribution between plants, and it is necessary to pay attention to the physiological properties of plants related to compounds released by each plant that inhibit or support the growth of surrounding (McCormack et al., 2017).

3. Materials and Methods

3.1. Materials

Intercropping pattern used by farmers on Jalan Kayu Ambon, Lembang District, West Bandung Regency. The objective of this research was to find out cost, revenue and the R/C ratio of the intercropping system of broccoli and lettuce.

3.2. Methods

The method of the research was the survey method. The data consist of the primary and secondary data. The primary collected directly from the farmer. Meanwhile the secondary data collected from literature and any institutions that related to this research. The farmer was Bapak Jajang. The primary data consisted fix cost, variable cost, and revenue. The data were used to calculate Break Even Point and R/C ratio.

3.2.1. Formula / Equation

Farming is an applied science that discusses or studies how to make or use resources efficiently in an agricultural, livestock or fishery business.

Farm science is also an applied science that discusses or studies how to use resources efficiently and effectively in an agricultural business in order to obtain maximum results. Those resources are land, labor, capital and management.

3.2.2. Investment costs

Investment costs are costs incurred at the beginning of production such as for the purchase of equipment. The cost of investment includes buildings and cultivated land.

3.2.3. Fixed Cost (TFC)

Fixed costs or more commonly called fixed costs are costs whose value will be fixed and constant even though there are changes in production process. The change in question is the operation or non-operation of an enterprise to produce goods in a certain period. Fixed costs can be in the form of machine depreciation costs, building or warehouse rental costs, etc.

3.2.4. Variable Cost (TVC)

Variable costs or non-fixed costs, better known as variable costs, are costs whose value can change per unit. This change is due to the volume of production capacity that can increase or decrease in accordance with market demand.

The parallel relationship between variable costs and production capacity will be interrelated because if one of the increases occurs then the other will follow. Examples of variable costs are electricity costs, raw costs, transportation costs, etc.

3.2.5. Total Cost (TC)

Is the sum of fixed costs and variable costs.

Total Cost (TC) = Fixed Costs (FC) + Variable costs (VC).

3.2.6. Revenue (TR) Total Revenue

Receipt is the amount of money earned from the sale of broccoli and lettuce.

3.2.7. Income/Profit

Profit is the difference between income and total production costs (capital) or Total Cost (TC), obtained by the formula: Profit = Receipts (TR) – Total production costs (TC).

3.2.8. R/C

R/C ratio is the value of receipts obtained from each rupiah issued and can be used as a calculation to determine the efficiency of a business. If the $R/C > 1$, then the business is efficient and it is worth saying that production is profitable, if $R/C = 1$, then the business is not profitable and does not lose in a break-even state, but if it is $R/C < 1$, the more likely it is to experience losses or as an inefficient business.

$R/C = \text{Receipts (TR)} : \text{Expenses (TC)}$.

3.2.9. Break Even Point (BEP)

A Break Even Point (BEP) is a break-even point where the resulting profit has a value equal to the value required for the production process.

That being said, the break-even point is a condition in which the overall amount of income is equal to the overall amount of expenses in any production of goods or services. In this position, the profit will be worth absolute zero, or ordinary people call it by the term return on investment.

BEP per unit/Production

BEP Units = (Fixed Costs) / (Price per unit – Variable Costs per Unit).

BEP Sales Value

BEP = Fixed Costs / (1 – (Variable Costs/Price)).

BEP Admissions

BEP Currency = (Fixed Cost) / (Margin Contribution per unit / Price per Unit).

4. Results and Discussion

The research results can be explained in Table 1, Table 2, Table 3, and Table 4 below.

Table 1: Total Fixed Cost (TFC)

No	Name Tool	Volume	Unit Price (IDR)	Sum	JUE	NP Season
1	Land Lease	550m ²	IDR 20,000,000 Hectares/year	IDR 1,100,000	3 Months	IDR 275,000
2	Hol	1	IDR 65,000	IDR 65,000	3 Years	IDR 4,875
3	Handsprayer	1	IDR 750,000	IDR 750,000	5 Years	IDR 33,750
4	Hose	50 Meter	IDR 10,000/Meter	IDR 500,000	5 Years	IDR 22,500
SUM						IDR 336,125

Table 2: Total Variable Cost (TVC)

No	Means Production	Volume	Unit Price (IDR)	Sum (IDR)	NP Season
1	Broccoli Seeds	1,600 Plant	IDR. 300	IDR. 480,000	IDR. 480,000
2	Lattuce Seeds	3,000 Plant	IDR. 150	IDR. 450,000	IDR. 450,000
3	Manure	90 Sack	IDR. 13,600	IDR. 1,224,000 :	IDR. 408,000
4	NPK	25 Kg	IDR. 19,000	IDR. 475,000	IDR. 475,000
5	Saaf	1 Kg	IDR. 203,400	IDR. 203,400	IDR. 203,400
6	Cyclone	2 Warp	IDR. 51,980	IDR. 103,960	IDR. 103,960
7	Agristic	1 Litre	IDR. 115,260	IDR. 115,260	IDR. 115,260
8	Insecticides	1 Warp	IDR. 203,400	IDR. 203,400	IDR. 203,400
9	Demolish				
9	Nebizin	2 Kg	IDR. 48,025	IDR. 96,050	IDR. 96,050
10	Furadan	2 Kg	IDR. 31,640	IDR. 63,280	IDR. 63,280
11	Mulch	1/2 Rollers	IDR. 360,000	IDR. 360,000 :	IDR. 120,000
12	Bamboo	5 Stem	IDR. 22,600	IDR. 113,000 :	IDR. 37,667
13	Solar	5 Litre	IDR. 6,000	IDR. 30,000	IDR. 30,000
Total Variabel Cost or Total Variable (TVC) Production				SUM	IDR. 2,786,017

Table 3: Labor TVC Table (TVC)

No	Type of Work	Period	Work Duration (Day)	Male / Female Weekdays (HKP/ HKW)	Work Duration (5Hours/ Day)	Price (IDR)	Total Price (IDR)
1	Tillage with Tractor	-	1 Days	1 HKP	5 Hours	IDR. 60,000	IDR. 60,000
2	Bed Making	-	3 Days	1 HKP	5 Hours	IDR. 60,000	IDR. 180,000
3	Basic Fertilizer Application	-	2 Days	1 HKP	5 Hours	IDR. 60,000	IDR. 120,000
4	Fertilizer Closure and Refinement of Beds	-	6 Days	1 HKP	5 Hours	IDR. 60,000	IDR. 360,000
5	Mulching and Pinning	-	4 Days	1 HKP	5 Hours	IDR. 60,000	IDR. 240,000
6	Making Planting Distance, Perforating Planning Holes, Single Planting Holes	-	2 Days	1 HKP	5 Hours	IDR. 60,000	IDR. 120,000
7	Planting Broccoli and Lattuce	-	2 Days	1 HKP	5 Hours	IDR. 60,000	IDR. 120,000
8	Sowing Follow-up Fertiliter	3 Times	1 Days	1 HKP	2/5 Hours	IDR. 60,000	IDR.72,000
	Care : Sprinklin	35 Days	1 Days	1 HKP	1/5 Hours	IDR. 60,000	IDR. 420,000
9	Weeding / Sanitizing	2 Times	3 Days	1 HKP	5 Hours	IDR. 60,000	IDR. 360,000
	Pest Control	12 Times	1 Days	1 HKP	2/5 Hours	IDR. 60,000	IDR. 288,000
Total Variable Cost (TVC) of Labor							IDR. 2,340,000

Table 4: Production TVC and Labor TVC

Production TVC and Labor TVC	IDR. (Price)
Production TVC	IDR. 2,786,017
Labor TVC	IDR. 2,340,000
Sum	IDR. 5,126,017

Total Cost (TC)

$$\begin{aligned}
 \text{Total Cost (TC)} &= \text{Total Fixed Cost (TFC)} + \text{Total Variabel Cost(TVC)} \\
 &= \text{IDR. 336,125} + \text{IDR. 5,126,017} \\
 &= \text{IDR. 5,462,142}
 \end{aligned}$$

Total Revenue (TR)

The land area for intercropping broccoli and lettuce in BBPP Lembang Blok BEC 1 is 550m². With the effectiveness of the land used in an area of 80%, then:

Land Effectiveness = 80% x 550m² = 440m².

The total seeds used were about 1,600 for broccoli and 3,000 for lettuce seeds and 10% for preparation for embroidery. The average weight of one broccoli plant is 400gram/fruit.

Then the Broccoli Population = 1,440.

Then the Lettuce Population = 2,700.

Where in 1 kg of lettuce there are usually about 5 lettuce plants. Then the quantity possessed by broccoli and lettuce plants is:

Quantity of Broccoli = 1,440 x 400gr = 576 Kg.

Quantity of Lettuce = 2,700: 5 pieces = 540 Kg.

The formula for calculating acceptance: TR = Y. hy

Where:

TR = Total Revenue (Total Revenue)

Y = Quantity (Production or Volume)

Hy = Price (Selling Price)

TR Broccoli = Y. hy
 = 576 x IDR. 8,000/Kg
 = **IDR. 4,608,000**

TR Lettuce = Y. hy
 = 540 x IDR. 2,500/Kg
 = **IDR. 1,350,000**

TR Broccoli and Lettuce = TR Broccoli + TR Lettuce
 = IDR. 4,608,000 + IDR. 1,350,000
 = **IDR. 5,958,000**

Farming Income/Profit Analysis

The income calculation formula is: Pd = TR – TC

Where:

TR = Total Revenue (Total Revenue)

Pd = Revenue

TC = Total Cost (Total Cost)

Then:

Pd = TR – TC
 = IDR. 5,958,000 - IDR. 5,462,142 = **IDR. 495,858.**

Farming R/C Analysis Formula for calculating R/C

R/C Total Acceptance

$$R/C = \frac{\text{Total Financing}}{\text{Total Cost}}$$

Provision:

- a) R/C is greater than 1 then the farm is profitable or feasible.
- b) R/C is equal to 1, so the farm does not make a profit or a loss (break even).
- c) R/C is less than 1 then the farm suffers a loss or is not feasible to operate.

$$R/C = \frac{\text{Total Financing}}{\text{Total Cost}}$$

$$= \frac{\text{IDR.5.958.000}}{\text{IDR.5.462.142}}$$

= **1.09078086948 or 1.09** (In broccoli and lettuce farming in BBPP Lembang Blok BEC 1 the R/C ratio value is more than 1, so the farming is feasible).

Break Even Point (BEP)

$$\text{Total BEP} = \frac{FC}{1-VC/S}$$

$$= \frac{\text{IDR.336,125}}{1-\text{IDR} 5,126,017/\text{IDR.5,958,000}}$$

$$= \frac{\text{IDR.336,125}}{1-\text{IDR.0.86035867741}}$$

$$= \frac{IDR.336,125}{0.13964132259} = \mathbf{IDR. 2,407,059}$$

$$\begin{aligned} \mathbf{Broccoli\ BEP} &= \frac{70}{100} \times IDR. 2,407,059 = IDR 1,684,941 \\ &= \frac{IDR 1,684,941}{IDR 8,000} = \mathbf{210,617625Kg} \end{aligned}$$

$$\begin{aligned} \mathbf{Lattuce\ BEP} &= \frac{30}{100} \times IDR. 2,407,059 = IDR 722,117 \\ &= \frac{IDR 722,117}{IDR 2,500} = \mathbf{288,8468Kg} \end{aligned}$$

5. Conclusion

Based on the analysis of broccoli and lettuce farming intercropping. The amount of costs used in intercropping broccoli and lettuce farming, the total cost (TC) is IDR. 5,462,142/planting season, with a total revenue (TR) of IDR. 5,958,000. The value of R/C ratio obtained from intercropping broccoli and lettuce was 1.09. So this farming is feasible because the R/C ratio value is more than 1.

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