Farming Analysis for Sorghum Seeding on Acid-Dry Land in South Lampung, Lampung Province

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Abstract. Sorghum is an alternative food, feed, and industrial raw material. Currently, sorghum is being developed in Indonesia, but it is necessary to know whether it is economically feasible to develop sorghum. This study aims to determine the cost and revenue, income, and feasibility of sorghum seed farming per hectare. The research was conducted in the Taman Sains Pertanian (TSP) of Natar District, South Lampung Regency, Lampung Province. The data collected is the volume and prices of production inputs and production output prices. Data were analyzed using cost structure analysis, income analysis and R/C ratio. The results showed that the total costs incurred were IDR 22.258.750, - and a total receipt of IDR 110.000.000, - so that a income of IDR 87.741.250, - per hectare. The R/C ratio for the total cost of farming is 4,94, this value is greater than one. Based on the profits obtained and the value of the R/C ratio, sorghum seed farming in dry sour land is feasible.

1 Introduction

The staple food for most Indonesians is rice, without eating rice it is felt incomplete. So that rice is a staple food that cannot be replaced with other ingredients. Even though there are other food ingredients that can be used as alternatives to rice, one of which is sorghum. Sorghum belongs to grain crops (cereals) such as corn, rice, wheat Which already grown by farmers in Indonesia, although the breadth is relatively small. Sorghum, an important cereal crop, holds the fifth position globally, behind corn, rice, wheat, and barley. Its importance stems from its diverse use in human nutrition, animal feed, bioethanol production, and green energy, while also exhibiting positive environmental implications. [20]. As a food ingredient, the nutritional content in sorghum is almost like rice and there are even nutrients that exceed rice such as protein 10,4 percent, fiber 2 percent, calcium 25 percent, and iron 5,4 percent [18]. The development of sorghum can be integrated as food, feed, energy, and industrial

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ingredients. All parts of the plant, starting from the roots, stems, leaves, can be utilized so that there is no waste [4].

Sorghum is a plant native to East Africa [21], which is now a crop that continues to spread to every country in the world. Sorghum is generally cultivated in several developing countries in Asia, Africa, and America. In India, about 1% of caloric needs are met from sorghum and partly from other cereal sources [17]. While in Indonesia, the level of intensity in sorghum production has historically been lower compared to that of staple food crops such as rice, corn, soybeans, and other widely consumed food sources. Sorghum agriculture in Indonesia is predominantly practiced in many locations, notably Java, South Sulawesi, Southeast Sulawesi, West Nusa Tenggara (NTB), and East Nusa Tenggara (NTT).. The productivity of potential sorghum plants has a seed weight of 40-100 grams per panicle. The average seed production is 6.36 tons/hectare and can even reach 8-9 tons/ha. Sorghum stalks weigh 400-800 grams/stick and can be used as a source of feed and fuel. Several superior varieties of sorghum from the Agency for Agricultural Research and Development can produce sorghum biomass reaching 45-50 tonnes/ha. The leaves and stems of the sorghum plant are a source of feed that can increase the weight of livestock and increase meat and milk production. Sweet sorghum stems are a source of bioethanol, liquid sugar, crystal sugar and other products depending on efforts to handle their derivative products [6].

Currently, the availability of productive land, such as irrigated rice fields and rainfed rice fields for growing food, is increasingly limited, including in the Lampung region. For this reason, dry land with a large enough area is a solution in the development of food commodities, including sorghum. The available dry land area in Indonesia, that is appropriate for food crop cultivation, is estimated to be approximately 13.26 million hectares [1]. The challenges associated with agriculture in arid regions include low productivity, suboptimal utilization, and dependence on rainfall for irrigation. The availability of water is a crucial factor in the production process, having a minimum contribution of 16% towards enhancing productivity. [3].

The practice of agriculture is subject to a number of elements, one of which is the availability of high-quality seeds that possess exceptional characteristics. There are three important elements associated with seed quality, specifically: (1) appropriate seed production methodologies, (2) ways for preserving the quality of distributed seeds, and (3) methods for assessing seed quality. [8]. The utilization of high-quality seeds derived from superior varieties plays a substantial role in influencing the phenotypic characteristics and yield components of plants. [5]. Several new superior varieties of sorghum were introduced by the Indonesian Agency for Agricultural Research and Development are Bioguma-1, Bioguma-2, and Bioguma-3 [6]. The revenue of farmers is significantly influenced by the quantity of sorghum output, as seen by the substantial impact of high seed production on their financial earnings. [2]. Seed is an important input in farming activities, so it is necessary to provide sustainable sorghum seeds with guaranteed quality. Farming the supply of quality seeds economically must be cultivated so that the farming that is carried out is profitable. If the farming is profitable, the farmer is enthusiastic about doing sorghum seed farming. The primary objective of a feasibility study is to systematically assess the current and potential strengths and weaknesses of a business, as well as the environmental possibilities and risks it may encounter. Furthermore, the study was performed to identify the necessary resources for its operation and objectively evaluate the prospects for achieving success in a logical manner. [10]. Feasibility study is initial research to identify information needed by end users, required resources, costs, benefits, and feasibility of the proposed project [9].

Research related to the analysis of sorghum farming has been carried out in several locations, including Situbondo Regency, East Java [2]. The findings indicated that the mean income derived from sorghum cultivation in Situbondo Regency (ha/year) amounted to IDR 50,342,873, therefore suggesting its profitability as the generated money surpasses the

expenses made by the farmers. Further investigations have demonstrated the viability of sorghum cultivation as a potential avenue for development, as it exhibits a favorable ratio of returns to costs (R/C) above 1. [29]. Therefore, it is imperative to foster the advancement of sorghum seed farming in order to bolster sorghum cultivation in the region of Lampung. The objective of this study is to assess the financial aspects, including cost and revenue, income generation, and overall feasibility, of sorghum seed farming on a per hectare basis.

2 Research Methods

The study was conducted at the Natar Agricultural Science Park, located in the South Lampung Regency of Lampung Province. The research was done during the second planting season (MT-2) which spanned from April to July 2021. This study was carried out through a collaborative mechanism involving BPTP Lampung and Indonesia Cerdas Desa (ICD) South Lampung Regency. The method used is a field demonstration plot with a planting area of about 2 ha. Subsequently, data is collected for analysis of the cost structure, benefits, and financial feasibility. This study aims to assess the financial feasibility of sorghum seed cultivation through a qualitative method, employing a financial feasibility analysis. The qualitative approach includes the analysis of cost structures, revenue generation, and profit margins, as well as the examination of the ratio between revenues and costs (R/C ratio). Calculation of the cost structure can be done by calculating the various cost components as follows:

$$TC = TFC + TVC \tag{1}$$

Information:
TC = Total cost
TFC = Total fixed costs
TVC = Total variable costs

Farming income can be defined as the net result obtained by subtracting total costs from farming revenue. The aggregate expenditures can be determined by summing fixed costs and variable costs. Mathematically, the formulation of income is expressed as follows.:

$$\pi = TR - TC \tag{2}$$

$$\pi = (Y.Py) - (\sum Xi.Pxi + TFC) \tag{3}$$

Information:
π : Income (IDR)
TR : Total Revenue (IDR)
TC : Total Cost (IDR)
Y : Production (kg)
Py : Production Price (IDR)
Xi : Factor of Production Variable i (kg)
Pxi : Factor Price of Production Variable i (IDR)
TFC : Total Fixed Cost (IDR)

The feasibility level of sorghum seed farming uses the R/C ratio. The R/C ratio equation can be written as follows:

$$RC\ ratio = \frac{TR}{TC} \tag{4}$$

Information:
TR = Total Revenue (IDR)
TC = Total Cost (IDR)
RC > 1, worth the effort; RC = 1, break-even; RC < 1, not worth the effort

3 Results and Discussion

3.1 Sorghum Seedling Farming Cost Structure

One of the important indicators in farming is the cost factor. Efficient farming expenses will affect income. The purpose of knowing the cost structure is to increase the efficiency of farming costs incurred. The cost structure of sorghum seed farming is presented in Table 1.

Table 1. Analysis of the cost structure of sorghum seed farming per hectare

Cost Component	Percentage Against		
	Fixed Cost	Variable Cost	Total Cost
A. Fixed Costs			
Rent	91.62		11.23
Scissors Cuttings	8.25		1.01
Cost of depreciation	0.14		0.02
Total Fixed Costs	**100.00**		**12.26**
B. Variable Costs			
Seeds		3.58	3.14
Fertilizer (NPK)		24.58	21.56
Manure		7.41	15.27
Herbicide		1.43	1.26
Packaging and Labels		2.05	1.80
Seed Labels		0.61	0.54
Labor		43.42	38.10
Certification		6.91	6.07
Total Variable Costs		**100.00**	**87.74**
Total Costs			**100**

The cost structure is a percentage of the components that make up the total cost of farming. The determination of the total cost involves the total fixed costs (FC) and variable costs (VC). Fixed costs in sorghum seed farming consist of land rent, cuttings, and depreciation costs. The fixed costs that contributed the most were land rents of 91,62 percent. This finding aligns with the results of previous studies on the profitability analysis of sorghum cultivation in India, which indicate that land rent is a fixed cost component that holds the greatest share in sorghum farming. [24]. Variable costs used in sorghum seed farming are seeds, chemical fertilizers, manure, herbicides, plastic packaging, labor and certification. NPK fertilizer costs and labor costs contributed the most to variable costs at 24,58 percent and 43,42 percent, respectively. These findings are in line with other research which states that labor costs are the main component of total costs [11, 12, 13, 14, 15, 16, 19, 26]. The research results also state that labor costs are the most dominant, namely 73 percent of the total sorghum production costs in Nigeria [17]. Fertilizer costs occupy the second largest position after labor costs, namely 24.58 percent. This finding aligns with other studies [15, 22, 28] that have indicated the significant contribution of fertilizer to Nigeria's agricultural sector, ranking it as the second biggest contributing factor.. Variable costs (VC) make the largest contribution compared to fixed costs to the total costs of sorghum seed farming. The present analysis reveals that variable costs accounted for 87.74 percent, whereas fixed expenses were only 12.26 percent of the total costs associated with sorghum seed production. These results align with the outcomes of a research study, which indicate that the variable costs associated with sorghum production in India and Nigeria account for a significant proportion of the overall expenses, specifically 57.35 percent and 68.10 percent, respectively. [15]. This is due to the high labor costs in each study area, namely 22.25 percent and 23.88 percent [15].

3.2 Analysis of Revenue and Feasibility of Sorghum Seed Farming

Income can be defined as the residual amount obtained when all expenditures are subtracted from revenue. Revenue, on the other hand, is derived from the multiplication of the selling price by the quantity of production generated. According to the findings of the study, the sorghum seed production yielded 2,200 kg per hectare, with a corresponding seed price of IDR 50,000 per kilogram. Consequently, this resulted in a total income of IDR 110,000,000 per hectare. Table 2 displays an examination of the revenue and viability associated with the cultivation of sorghum seeds.

Table 2. Analysis of acceptance, income, and feasibility of sorghum seed farming per hectare

Costs Component	Amount	Unit (kg/lt/bottle/pack)	Unit Price (IDR)	Value (IDR)
A. Fixed Costs				**2,728,750**
Rent	1	Ha	2,500,000	2,500,000
Scissors Cuttings	3	Unit	75,000	225,000
Cost of depreciation	3	Unit	1,250	3,750
TFC				**2,728,750**
B. Variable Costs				
Input Production				**9,700,000**
1. Seed	7	Kg	100,000	700,000
2. Fertilizer (NPK)	400	Kg	12,000	4,800,000
3. Manure	200	Sack	17,000	3,400,000
4. Herbicide	4	Liter	70,000	280,000
5. Packaging and Labels	400	Unit	1,000	400,000
6. Seed Labels	400	Unit	300	120,000
Labor				**9,830,000**
Land processing	25	HOK	80,000	2,000,000
Planting	8	HOK	80,000	640,000
Fertilization (NPK)	10	HOK	80,000	800,000
Fertilization (NPK)	15	HOK	80,000	1,200,000
Weed spraying	2	HOK	80,000	160,000
Harvest	12	HOK	60,000	720,000
Transportation	16	HOK	80,000	1,280,000
Appearance	8	HOK	80,000	640,000
Seed Sorting	12	HOK	60,000	720,000
Drying	2	HOK	80,000	160,000
Packaging	2	HOK	80,000	160,000
Certification	18	HOK	75,000	1,350,000
TVC				**19,530,000**
TC				**22,258,750**
C. Revenue	2,200	Kg	50,000	**110,000,000**
D. Income				**87,741,250**
E. R/C ratio				**4.94**

The revenue generated by sorghum seedlings can be determined by calculating the difference between the total revenue (TR) and the total costs (TC) incurred. The income created serves as a measure of the potential profitability derived from agricultural activities. Profits serve as a reliable metric to assess the viability and potential for growth in the agricultural sector. Higher agricultural revenue can be achieved through a combination of increased earnings and reduced total farming costs, hence leading to greater profitability for farmers. [30]. Total costs consist of total fixed costs (TFC) and total variable costs (TVC). The aggregate fixed cost associated with sorghum seed farming amounts to IDR 2,728,750,

encompassing expenses related to rent, scissors cuttings, and depreciation of agricultural equipment. While the total variable costs of IDR 19,530,000, - which consists of the cost of input production IDR 9,700,000, - and labor costs IDR 9,830,000, - so that the total cost of sorghum seeding is IDR 22.258.750, -.

Based on the results of revenue and income analysis (Table 2), sorghum seed farming revenue is IDR 110.000.000, - and the total cost is IDR 22.258.750, - then the income generated is IDR 87.741.250, - per hectare. In addition to financial returns, the viability of agricultural endeavors can be assessed by evaluating the R/C (Revenue to Cost) ratio. The Revenue Cost Ratio (R/C) is calculated by dividing the total revenue (TR) by the total cost (TC). According to prevailing discourse, the viability of farming is contingent upon the attainment of an R/C (Return on Investment to Cost) ratio exceeding a value of 1 (one). The R/C ratio for sorghum seed farming is 4.94, indicating that for every IDR 1.00 invested in sorghum seed farming, the income generated is IDR 4.94, resulting in a profit of IDR 3.94. Based on the obtained R/C ratio exceeding 1, it may be inferred that the cultivation of sorghum seeds in acidic and arid terrain is both viable and financially advantageous. These findings are in line with research [15, 17, 23, 25, 27] that sorghum farming is profitable.

4 Conclusion

The aggregate cost for sorghum seed cultivation per hectare amounts to IDR 22,258,750. The farming income per hectare is recorded as IDR 110,000,000. However, the specific income generated from sorghum seed farming amounts to IDR 87,741,250 per hectare. The R/C ratio score of 4.94 indicates that sorghum seed cultivation is a viable pursuit, as an R/C ratio value beyond 1 signifies its economic feasibility. The feasibility and profitability of sorghum seed planting on acid-dry land in South Lampung can be determined based on the income generated and the R/C (revenue-to-cost) value.

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