Feasibility analysis of hybrid corn farming in Karanganyar Regency

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Abstract. The productivity and price of hybrid corn in Karanganyar Regency are low than the productivity and price of the surrounding districts, especially during the la Nina storm. This study aims to determine the feasibility of mixed corn farming in the Karanganyar Regency. Determining the location and sampling was done using the purposive sampling technique with 80 farmers as respondents. The data analysis method used was the farm Cost-income analysis, R/C ratio, BEP (Break-Even Point), Profitability-cost ratio, Labor productivity, and Sensitivity analysis. The average income was IDR 3,975,741 per farm or IDR 7,795,571 per hectare. The average cost calculated was IDR 1,930,362 per farm and 4,257,302 per hectare. The analysis of BEP, R/C ratio, the profitability-cost proportion, labour productivity and sensitivity showed that hybrid corn is feasiblethe profitability-cost proportion was more significant than the applicable bank interest. Labour productivity was greater than the prevailing labor wage. The sensitivity showed that hybrid corn farming was feasible under decreasing prices by up to 50%. Therefore, farmers still benefit from cultivating hybrid corn. However, the effect of La Nina will continue, so farmers must be more adaptive to excessive water and pest attacks on their land.

1. Introduction

One of the districts with a focus on corn cultivation is Karanganyar. Most people cultivate corn since the climate is ideal for it in terms of temperature, humidity, water supply, and altitude. With an average hybrid corn productivity of only 6 tons/ha, Gao et al. [1] claim that the potential productivity of hybrid corn can be as high as 7 tons/ha. Corn is also a functional food-crop commodity that needs to be developed because of the increased demand for corn and the stagnant output of the crop [2].

According to BPS (Central Agency on Statistics) data in 2021, the productivity of hybrid corn growing fluctuated between 2016 and 2020. It was farming hybrid corn produced 6,981 tons of corn per hectare in Karanganyar Regency in 2016, 6,475 tons of corn per hectare in 2017, 5,513 tons of corn per hectare in 2018, 6,335 tons of corn per hectare in 2019, and 6,749 tons of corn per hectare in 2020, all of which decreased from 2016. In Karanganyar Regency, hybrid corn productivity ranged from 6,4106 tons/ha in 2016 to 2020. The Jumapolo subdistrict is one of the subdistricts in Karanganyar Regency that produces the most hybrid maize. Between 2016 and 2020, mixed corn farming's overall productivity fluctuated. In 2016 the productivity of hybrid corn farming in the Jumapolo district was 7,395 tons/ha; in 2017, the productivity of hybrid corn decreased to 6,477 tons/ha. Hybrid corn productivity increased to 6,629 tons per hectare in 2018, but it dropped to 6,320 tons per hectare in 2019 and then increased to

6,624 tons per hectare in 2020. From 2016-2020, the average productivity of hybrid corn in the Jumapolo district was 6,689 tons/ha [3].

The difference between the income of the farming business and the costs incurred can be used to calculate the income or profit that can be used to evaluate the success of farming. The selling price of hybrid corn is unstable, and mixed corn farmers sell to collectors so that farmers obtain a low selling price. This condition affects farmers' acceptance of the low selling price of hybrid corn [4].

Compared to the selling price of hybrid corn in the neighboring districts, the price of hybrid corn in Karanganyar Regency is low. In Karanganyar Regency, hybrid corn is sold for IDR 3,501/kg, whereas in the Sragen Regency, it is sold for IDR 3,777/kg. The change in the rainy season, which is more extreme in Jumapolo District, is to blame for the low selling price. As a result, it is important to revisit the financial aspects of growing sweet corn as the seasons change.

2. Methods

In Karanganyar Regency's Jumapolo District, this study was carried out. This decision was made in light of the unpredictable price at which hybrid maize was sold in Karanganyar Regency and the production of subpar hybrid corn that resulted from the district of Jumapolo's shrinking corn-growing land. The sample used in this study was 40 people who grow hybrid corn and live in Jumapolo District, Karanganyar Regency, with a minimum land area of 1500 m^2 per person who plants corn in the planting season in February-May 2021. The sampling technique used was purposive sampling [5]. The methods used to collect data are observation, interviews, and questionnaires. The farming analysis of the data used includes the following:

2. 1. Cost analysis

The formula can be used to calculate the entire costs associated with hybrid corn growing mathematically:

$$TC = FC + VC \quad (1)$$

Note:
TC = Total cost (IDR) FC = Fixed cost (IDR), VC = Variable cost (IDR) [6]

2. 2. Revenue

The following formula can determine how much farmers produce from this hybrid corn crop.:

$$TR = P.Q \quad (2)$$

Note:
TR = Total revenue (IDR) P = Output price (IDR) Q = Output (kg) [7]

. Income

The difference between revenue and all production expenditures incurred during the production process is known as income. Use the following formula to determine income:

$$I = TR - TC \quad (3)$$

Note:
I = Income (IDR, TR = Total revenue (IDR), TC = Total cost (IDR)

2. 4. Profits

Profits from farming are the difference between overall costs, including both implicit and explicit costs incurred during production, and revenue. Profits are determined by the following formula:

$$\pi = TR - (TEC + TIC) \quad (4)$$

Description: π = Profit TR = Total revenue, TC = Total cost, TEC = Total explicit costs, TIC = Total implicit costs [8]

2.5. R/C ratio

The R/C-ratio is an abbreviation of revenue cost ratio or known as the ratio between total revenue (TR) and total cost (TC), which is formulated as follows:

$$R/C = TR/TC \quad (5)$$

Note:
TR = Total revenue (IDR) TC = Total cost (IDR)
C = Comparison between total revenue and total cost
A business is said to be feasible if the R/C value > 1, and if the R/C value < 1, then the business is not feasible to continue. [9].

2.6. π/C ratio (capital productivity)

π/C ratio compares absolute income or profit with total production costs. A business is said to be feasible if the value of π/C Ratio > the prevailing bank interest rate. The π/C ratio can be formulated as follows:

$$\pi/C \text{ ratio} = \pi/TC \text{ [10]} \quad (6)$$

2.7. BEP (Break Even Point)

BEP (Break Even Point) is the principal return point where the total revenue is equal to the total cost of the BEP, which will be calculated as the BEP price.

$$\text{BEP Price (IDR/kg)} = TC/Y \quad (7)$$

Note: TC = Total cost, Y = Production

2.8. Labor productivity

Labor productivity is the Ratio between revenue and total labor devoted per farm.
Labor productivity is formulated:

$$\text{Productivity} = TR/\text{number of workers} \quad (8)$$

Labor productivity must be higher than the current wage [10]

2.9. Sensitivity analysis

Sensitivity analysis of the selling price of the product, if the selling price has decreased as much as the price, its effect on other feasibility indicators will be observed.

3. Results and Discussion

3.1. Farmer characteristics

Farmers in the Karanganyar Regency's Jumapolo District have set aside the land for experiments with hybrid corn. Of the 40 respondents, 36.67% are farmers with land ownership in the 0.15 to 0.2 range, 10% are farmers with land ownership in the 0.21 to 0.3 range, 6.67% are farmers with land ownership in the 0.31 to 0.4 range, and 10% are farmers with land ownership in the 1 to 5 range. The average level of education among the 30 farmers who participated in the hybrid corn sample study in Jumapolo District, Karanganyar Regency, was 16. This represents 53.33% of the education level. Nine out of thirty percent of people have completed junior high school. Only five percent have completed high school.

3.2 Production cost and revenue analysis

The costs referred to in this study are the overall costs incurred in the production process of hybrid corn farming. The cost classification used is the fixed cost and the variable cost.

Table 1. Average cost, revenue, and income in the February-May 2021 Planting Period of Hybrid Corn Farming in Jumapolo District, 2021

No	Description	Per-farming (0.51 Ha)	Per-Hectare
1.	Fix Cost	(IDR)	(IDR)
	Equipment depreciation	89293	175084
	Land tax	28818	55506
	farmer group fees	10000	10000
	Total Fixed Cost	128111	240590
2.	Variable cost		
	Production input (seeds, fertilizers, pesticides)	2027270	3975037
	Labor (TKLK)	1930139	3784580
	Labor (TKDK)	1841069	4082218
	Total Variable Cost	5798478	11841835
	Total Cost	5916589	12072425
3	Revenue		
	Production (kg)	2017	3954.90
	Price (IDR)	4000	4000
	Total Revenue	8066667	15816994
4	Income	4070440	7991871
5	Profit	2150078	3744569

According to Table 1, the sample farmers' average total costs were IDR 5,916,589 per farm and IDR 12,072,425 per hectare. The yield from a single planting season is considered hybrid corn farming production. The average income from growing mixed corn is IDR 15,816,994 per hectare and IDR 8,066,667 per farm. The amount of hybrid corn produced in the study area, whether in large or small quantities, affects the price of the crop [11]. The farmers' harvests average just 4 tons per hectare, which is significantly less than the sweet corn (F2) variety's potential productivity of 10–13 tons per hectare. The difference between the money farmers make and the expenses they incur (or pay) during a planting season is their income. In Jumapolo District, Karanganyar Regency, the average income from hybrid corn cultivation is IDR 4,070,440 per farm and IDR 7,991,871 per hectare, according to Table 1. Profit for a farm is IDR 2,150,078 and for a hectare is IDR 3,744,569.

3.3 Feasibility analysis of hybrid corn farming

Table 2. Feasibility analysis of hybrid corn farming in Jumapolo District, Karanganyar Regency 2021

Description	Value
R/C ratio	1.363
BEP Price	2.933
π/C Ratio	36.3
Labor Productivity	227491/HKO
Price Sensitivity Analysis	25%

The R/C ratio is an analysis to determine whether hybrid corn farming in Jumapolo District, Karanganyar Regency is feasible. A business can be possible if the farmer obtains a decent profit from the business he runs [12–15]. Based on table two, the average number of R/C is 1.363, which means that

for every IDR 100 cost incurred, the hybrid corn farmers earn an IDR 136 .and. According to R/C > 1, this hybrid corn farming business is feasible to run/operate. Benefits hybrid corn farmers in Jumapolo District, Karanganyar Regency, because the income received is greater than the total costs incurred by the farmers. BEP is the break-even point where farmers do not experience profits or losses in their farming [16]. This analysis finds that the break-even point of Hybrid Corn farmers in Jumapolo District, Karanganyar Regency, is IDR 2,933. The price prevailing at the time of the study was higher than the BEP, so sweet corn farming was feasible. л/C ratio analysis (capital productivity) to determine the feasibility of hybrid corn farming with the applicable bank interest ratio [17,18]. The relevant bank interest in BRI Karanganyar Bank for BRI deposit investment is 2.75%. The average л/C ratio is 36.3%, which means that according to the criteria л/C ratio is more significant than bank interest, and hybrid corn farming is feasible. Labour productivity analysis determines the feasibility of farming by comparing revenue and the total labour devoted to farming [19,20]. Farming is feasible if labour productivity exceeds the prevailing wage level. Table 2 shows that the labour productivity of IDR 227,491/HKO is higher than the prevailing wage of IDR 100,000/HKO. This shows that hybrid corn farming is feasible. Sensitivity analysis or analysis of price changes is emphasized on product prices because, in general, the prices of production factors are more stable than product prices [21,22]. In other words, production costs are relatively stable while the amount of revenue fluctuates according to product price. The product price (P) at the time of the study was IDR 4,000/kg. If the price decreased by 25% to IDR 3,000/kg farmer still gained a profit of IDR 134,411. These calculations explain that if the decrease in product prices does not exceed 25%, the farmers do not experience losses. This 25% figure is a limit point that must be considered to protect farmers as hybrid corn producers. If there is a downward pricing trend, several authorized institutions focusing on farmers can take quick action.

4. Conclusion

From the research results of hybrid corn farming in Jumapolo District, Karanganyar Regency, it can be concluded that the total cost the average total cost for mixed corn farming is IDR 5,916,589 per farm or IDR 12,072,425 per hectare. From the analysis, the R/C ratio, BEP of price, л/C ratio, and labour productivity are feasible. The price sensitivity of hybrid corn is 25%. This shows the limit point that must be considered to protect farmers as mixed corn producers. The increase in rainfall during La Nina is generally approximately 20-40% higher than the rainfall during a neutral year. For pest control, especially during the rainy season, the use of chemical pesticides tends to be ineffective because if exposed to rainwater, the active ingredients of pesticides tend to be washed off faster even if they are mixed with adhesives. As a result, production does not obtain maximum results and is far below the potential for plant productivity.

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