The economic feasibility of hybrid corn farming on suboptimal dry land in Aceh

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Abstract. This study aims to determine the level of economic feasibility of corn farming in dry land through the application of technological innovations using hybrid corn New High-Yielding varieties seeds. This research used a randomized design and was conducted on 1 hectare of land owned by farmers in Blang Gandai Village, Jeumpa District, Bireun, from April to October 2016. The data collection method was a survey qualitative and quantitative. The qualitative is the characteristics of the research location and an explanation of the hybrid corn varieties. While the quantitative is the analysis data of hybrid corn farming that has been calculated. Sources of data were obtained from information directly from farmers as many as 6 cooperators, were 3 farmers with an introduction practice and 3 farmers with farmers practice. The varieties used were Bima 3 dan Bima 4. Data were collected by interview using a questionnaire with a structured list of questions. The farming data analysis carried out includes the use of production facilities, the use of labor, and the level of efficiency of farming with financial analysis of the R/C ratio. The analysis used is revenue and income, income-to-cost balance (R/C) and income balance cost B/C. The results showed that economically both Bima 3 and Bima 4 varieties provide favorable results where the R/C of both is 1.82. This means that Bima 3 and Bima 4 varieties are very feasible to be developed to increase corn production in Bireun Districts on dry land.

1. Introduction

Corn is one of the strategic crops as foodstuffs, feed, and industrial raw material. Corn has economic value and a big strategic chance to develop [1]. Corn is the second crop commodity after rice and substitute calorie sources from rice [2]. Corn production was increasing 5.6% every year along with the increase of productivity and cornfield. In Indonesia, corn was cultivated in many different kinds of land with a focus on agroecology type, soil fertility, water resources, plant season, and the financial ability of farmers. The enormous diversity resulted in the diversity of corn productivity. Aside from being a food need, corn is also used for feed and industrial which reach more than 50% of national needs [3]. Corn cultivated has an economic strategy and good perspective. Corn farming was hope giving the profit to the farmer. The demand for corn in Indonesia was increasing, so there are needed a solution to the gap problem between production and corn demand so the government will not depend on import activity. The effort to solve the problem is increasing production through field extension and increasing productivity [4].
Corn growth will be optimal if sufficient nutrients and light are available for the plant growth phase. Corn will grow well in the dry land, rice fields, lowlands, tidal lands with different soil orders, different climate types, and altitudes above sea level around 0-2,000 m [5]. Hybrid corn or free-pollinated corn can be cultivated in several types of land and soil orders. In Indonesia, corn is cultivated in several types of agroecology, including dry land, irrigated rice fields, simple rice field irrigation systems, and rainfed rice fields in less than optimal general conditions. Corn that is cultivated in dry land is always found to have problems such as soil salinity, low soil fertility, and dry land. [7] Sub-optimal land can be developed for cultivated plants covering an area of 70.41 million ha (58%) of the total sub-optimal land in Indonesia. The increase in national corn production can be overcome by increasing the productivity of the use of superior seeds from new varieties adapted to the developed land [8]. Corn has high adaptability from low land productivity (marginal land) to high land productivity (fertile land). The data shows that the area of corn development in upland agroecosystems reaches 60-70% and 30-40% in rainfed lowland areas.

Aceh is one of the provinces with the highest total of dryland around ± 562,789 ha [10], generally, the land type is sub-optimum dryland that could be used to corn cultivated. The total cornfield in Aceh is ± 52,326 with the production reach ± 202,319 tons, and it's still very low if compared with the center corn production province, Lampung (± 1,801,556 tons). The solution to increasing corn production in Aceh could be used in many steps like, the utilize of sub-optimum land to cultivate corn hybrid which hope will give contribute to increasing the productivity and fulfill the corn needs in Aceh.

In 2014 the production of corn in Southeast Aceh Districts was 122,331 tons, total harvesting area was 28,634 ha with productivity 4.272 t ha⁻¹. South Aceh Districts were 45,166 tons, total harvesting area was 10,572 ha with productivity was 4.272 t ha⁻¹. Bireuen Districts were 3,584 tons, total harvesting area was 839 ha with productivity 4.271 t ha⁻¹ and Pidie Jaya Districts was 572 tons, total harvesting area was 134 ha with productivity 4.268 t ha⁻¹ [11].

The increase of corn production could be increased by using a new variety of superior seeds, optimum fertilizing, and managing plant population. The effort was supported by Agriculture Ministry regulation in 2014 with the target of hybrid corn cultivation reach 75% [12]. Besides that, the combining corn superior hybrid seed and free pollinated system by using the innovative technology through the application corn integrated crop management.

The productivity of superior corn seeds could be measured by genetic factors and the growth environment. Bima 3 variety has a high yield and stays green so it could be used as the feed for cows and sheep. While Bima 4 variety has the highest yield and stays green with high biomass could be harvested to get the seed as chicken fodder, as greener feed, or silage by fermentation. Bima 5 and Bima 6 variety has stayed green with yield potential reach 11 t ha⁻¹ and physiological maturity age was 104 days. It is shown that corn hybrid has the chance to develop in unfertile soil or minimum input. Bima 19 variety has a high yield, is tolerant to drought stress, resists root and stem fall, and is recommended to cultivate in a dry season like rice field or dryland [13]. In Indonesia, the total dryland is around 144,47 ha because the natural kinds are around 82% of the total dryland classified as sub-optimum dryland.

The research about hybrid corn farming of Bima 3 and 4 variety which cultivated in dryland sub-optimal in Bireun Districts Aceh Province has not been carried out and is written into a paper. So the research was important to conduct to find the answer about the analysis of farming and the increasing of corn hybrid production can archive in Aceh province.

2. Materials and Methods

The research used a randomized design and was conducted in farmer’s field around 1 ha in Blang Gandai Village, Jeumpa Sub-Districts, Bireun, from April until October 2016. The data collecting method used was a survey method with qualitative and quantitative data. The qualitative data in this research was characteristic of research location and description of hybrid corn variety. Quantitative
data was counted analysis data from hybrid corn farming. The data was got from direct information of 6 cooperator farmers, consists of 3 cooperator farmers with introduction practice and 3 cooperator farmers with farmer practice. The variety used was Bima 3 and Bima 4. The data were collected by interview using structure listed questioner. The farming data analysis consists of utilizing production facilities, utilize the labor, and farming efficiency with financial analysis R/C ratio. The analysis used was acceptance analysis and profit, revenue-to-cost balance (R/C), and revenue-to-cost balance analysis (B/C).

3. Results and Discussions

3.1 Research location characteristic

The area of Bireuen districts with the capital city of Juang geographically was located in the eastern part of Aceh Province consisting of 17 sub-districts and 609 villages which are located at 4°.54’- 5°.21’ North Latitude, 96°.20’.97°.21’ East longitude. Bireuen districts were ± 1,901.21 km2. The boundaries of Bireuen districts are: to the north, it is bordered by the Malacca Strait, to the south by Central Aceh Regency, to the west by Pidie Jaya, and the east by North Aceh Regency.

![Figure 1. Area of Bireun districts](image)

3.2 Farming feasibility analysis

Mubyarto (1989) in [15] argues that farming is a collection of natural resources available in that place that is needed for agricultural production such as land and water, improvements that have been made to the land, sunlight, buildings that are erected on the ground and so on. Technically, farming analysis is done to determine the level of business feasibility of an object of business carried out by farmers. The analysis of farming is influenced by production, farming costs, selling prices, and buying prices of production facilities which greatly affect farm income or profits [16]. In this activity, farming analysis was carried out on hybrid corn farming activities in Blang Gandai Village, Jeumpa District, Bireuen Regency. The business unit used is 1 ha, with a spacing of 70 x 40 cm so that the number of plants is ± 65,000. Hybrid corn farming costs are all costs incurred by farmers (paid out costs) in hybrid corn farming both in the form of money and goods and unpaid costs such as production factors originating from within the hybrid corn farmer's household, farming costs include fixed costs and variable costs.
Table 1. Farming analysis of hybrid corn varieties Bima 3

| No. | Details               | Unit Price (Rp) | Introduction Practice | Farmer Practice |
|-----|-----------------------|----------------|-----------------------|-----------------|
|     |                       | Vol            | Total (Rp)            | Vol            | Total (Rp) |
| I   | Production costs      |                |                       |                |            |
|     | a. Corn seed         | 65.000         | 20                    | 1.300.000      | 40          | 2.600.000  |
|     | b. NPK fertilizer    | 3.500          | 400                   | 1.400.000      | 200         | 700.000    |
|     | c. Organic fertilizer| 1.200          | 2000                  | 2.400.000      | -           | -          |
|     | d. Urea              | 2.500          | 270                   | 675.000        | 100         | 250.000    |
|     | f. SP-36             | 3.500          | -                     | -              | 100         | 350.000    |
|     | c. Insecticide       | 150.000        | 2                     | 300.000        | 4           | 600.000    |
|     |                       |                |                       |                |            |            |
| I   | Labour                |                |                       |                |            |
|     | a. Field preparation  | 50.000         | 20                    | 1.000.000      | 20          | 1.000.000  |
|     | b. Planting          | 50.000         | 30                    | 1.500.000      | 30          | 1.500.000  |
|     | c. Re-planting       | 50.000         | 25                    | 1.250.000      | 25          | 1.250.000  |
|     | d. Fertilizing       | 50.000         | 10                    | 500.000        | 10          | 500.000    |
|     | e. Spraying          | 10.000         | 8                     | 80.000         | 8           | 80.000     |
|     | f. Harvesting        | 50.000         | 15                    | 750.000        | 15          | 750.000    |
|     | h. Transportation    | 50.000         | 4                     | 200.000        | 4           | 200.000    |
|     |                       |                |                       |                |            |            |
|     | Total (Rp)           | 11.355.000     |                       | 9.780.000      |            |            |
| II  | Result (kg/ha)       | 4.600          |                       | 3.900          |            |            |
|     | Sell price (Rp/kg)   | 4.500          |                       | 4.500          |            |            |
| III | Receipt (Rp)         | 20.700.000     |                       | 17.550.000     |            |            |
| IV  | Profit               | 9.345.000      |                       | 7.770.000      |            |            |
| V   | R/C                  | 1.82           |                       | 1.79           |            |            |
| VI  | B/C                  | 0.82           |                       | 0.79           |            |            |

Source: Main data (2019)
Table 2. Farming analysis of hybrid corn varieties Bima 4

| No. | Details                        | Unit Price (Rp) | Introduction Practice | Farmer Practice |
|-----|--------------------------------|-----------------|-----------------------|-----------------|
|     |                                |                 | Vol                   |                 |
| I   | Production costs               |                 | Total (Rp)            |                 |
| 1   | a. Corn seed                   | 65.000          | 20                    | 1.300.000       |
|     | b. NPK fertilizer              | 3.500           | 400                   | 1.400.000       |
|     | c. Organic fertilizer          | 1.200           | 2000                  | 2.400.000       |
|     | d. Urea                        | 2.500           | 270                   | 675.000         |
|     | e. Insecticide                 | 3.500           | -                     | 100             |
|     | f. SP-36                       | 150.000         | 2                     | 300.000         |
|     |                                |                 |                       |                 |
| 2   | Labour                         |                 |                       |                 |
|     | a. Field preparation           | 50.000          | 20                    | 1.000.000       |
|     | b. Planting                    | 50.000          | 30                    | 1.500.000       |
|     | c. Re-planting                 | 50.000          | 25                    | 1.250.000       |
|     | d. Fertilizing                 | 50.000          | 10                    | 500.000         |
|     | e. Spraying                    | 10.000          | 8                     | 80.000          |
|     | f. Harvesting                  | 50.000          | 15                    | 750.000         |
|     | h. Transportation              | 50.000          | 4                     | 200.000         |
|     | Total                          |                 |                       | 11.355.000      |
|     |                                |                 |                       | 9.780.000       |
| II  | Result (kg/ha)                 | 4.600           |                       | 4.000           |
|     | Sell price (Rp/kg)             | 4.500           |                       | 4.500           |
| III | Receipt (Rp)                   | 20.700.000      |                       | 18.000.000      |
| IV  | Profit                         | 9.345.000       | 8.220.000             |
| V   | R/C                            | 1,82            | 1,84                  |
| VI  | B/C                            | 0,82            | 0,84                  |

Source : Main data (2019)

The greater the products produced and the selling price received by the farmer, the higher the income obtained, and vice versa if the smaller the production and the selling price received by the farmer, the lower the income obtained. Farming income is the profit obtained from the difference between revenue and total production costs incurred during the farming process. Based on the results of the farming analysis of the introduction pattern, the R/C and B/C values are higher than the farmer pattern, this is because the production is the highest so that it affects the profits obtained by the farmers (Tables 1 and 2).

4. Conclusion
Economically, the two varieties Bima 3 and Bima 4 gave favorable yields where the R/C of both was 1.82. This means that the Bima 3 and Bima 4 varieties are very feasible to be developed to increase corn production in Bireun Regency on dry land types.

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