Analysis Factors Affecting the Income of Hybrid Corn Farming in Labuan District

Dafina Howara[1]*, Dewi Nur Asih[2], Alimudin Laapo[3], Wahyu Prianto[4], and Sulmi[5]

[1,2,3,4,5] Agribusiness Study Program, Faculty of Agriculture, Universitas Tadulako

* Correspondence: dafina.howara@gmail.com

ABSTRACT	Article Information

Hybrid corn is a leading commodity in Labuan District; however, farmers' income varies due to production factors and farming conditions. The purpose of this study is to analyze the factors affecting the income of hybrid corn farming. Method: This research employed a quantitative approach using 81 hybrid corn farmer respondents selected through random sampling. Data were analyzed using multiple regression analysis through F-test, t-test, and R^2. The results of the regression analysis indicate that land area, production, and selling price significantly positively affect income, while production costs negatively affect it; however, irrigation availability does not have a significant effect. The regression model was simultaneously significant with an R^2 of 0.76, meaning that 76% of the income variation could be explained by the independent variables. The study recommends improving production cost efficiency, enhancing market access, and strengthening irrigation infrastructure.

Keywords: income; hybrid corn farming; regression; Labuan District

1. Introduction

Hybrid corn is one of the strategic commodities that plays an important role in global food security and in increasing smallholder farmers' income [1], and it also serves as a raw material for the animal feed industry. Moreover, corn is considered a highly efficient commodity, as there is still potential to improve yields. The demand for corn in the feed industry will continue to rise in the future, thereby increasing its added value. The agricultural commodity, including corn, plays an important role in improving rural household income and reducing poverty [2].

If corn productivity is enhanced through the continuous use of superior varieties such as hybrids, it can become a competitive export commodity [3]. Hybrid corn is the result of crossing different types of seeds with desirable traits. It produces higher yields with more uniform growth. Hybrid corn is also highly suitable to be developed, as it can contribute to increasing national corn production [4].

One of the national strategic food commodities that is essential to promoting both regional economic growth and food security is corn. Corn production has been on the rise in Central Sulawesi Province. The harvested area of shelled corn in 2024 was 19,061 hectares, up roughly 5.88% from 18,003 hectares in 2023, according to data from the Central Bureau of Statistics (BPS) of Central Sulawesi Province [5]. The amount of 14 percent moisture-content dried shelled corn produced increased significantly as well, from 72,982 tons in 2023 to 84,798 tons in 2024. This increase highlights corn's enormous potential to become a commodity in the region and presents an opportunity to improve farmers' quality of life by maximizing productivity and the corn value chain.

Farm income depends on land size, harvest quantity, selling price, production costs, and the availability of irrigation, all of which are interrelated. The larger the cultivated land supported by adequate irrigation, the higher the harvest yield. Meanwhile, favorable selling prices will increase farmers' income. However, excessively high production costs can reduce the profits earned. Therefore, maintaining a balance between cost efficiency, land productivity, market prices, and irrigation availability becomes a key factor influencing farmers' income levels.

Although corn farming in Labuan District has shown fairly good results, most corn farmers still rely on traditional cultivation practices and face limited access to inputs due to financial constraints, which leads to differences in the profits obtained. A similar study by Pingali [6] emphasized that improving market access and input efficiency are key factors in increasing farm income, especially in low- and middle-income countries. Furthermore, Mahyuddin et al. [7] found that land area, seeds, urea fertilizer, and NPK fertilizer had a positive and significant effect on corn production. Another study by Fatmawati and Nasrul [8] showed that land area significantly affects corn farmers' income. Therefore, this study aims to analyze the factors affecting the income of hybrid corn farming in Labuan District.

2. Materials and Method

The study employed a quantitative research approach. Quantitative research focuses more on the amount of information obtained rather than the depth of that information, making this method suitable for large populations with limited variables [9].

The research was conducted in the Donggala Regency's Labuan District from July to September of 2025. The population in this study consisted of all hybrid corn farmers in two villages in Labuan District, namely Labuan Toposo Village with 594 farmers and Labuan Panimpa Village with 348 farmers. These two villages were selected because they have the largest number of hybrid corn farmers in Labuan District. Based on calculations using the Slovin formula, a total sample of 81 hybrid corn farmers from both villages was determined, with a margin of error set at 15%. This relatively high margin of error was selected to account for the limited population size, time constraints, and available resources, while still allowing the study to capture sufficient variability within the farmer population to draw meaningful conclusions.

$$n = \frac{N}{1+Ne^2}$$

Explanation:

n = sample size

N = population size

e = margin of error (level of error), [10].

Primary data were obtained through interviews, while secondary data were sourced from BPS and the Department of Agriculture. This combination of data sources allowed for a comprehensive analysis of agricultural trends and practices. By integrating firsthand accounts with existing statistical information, the study aims to provide a more nuanced understanding of the challenges faced in the sector. To identify the factors affecting the income of hybrid corn farming, a multiple regression analysis was applied using the F-test, t-test, and coefficient of determination (R^2), with the following model:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$$

Explanation:

Y = Income

X_1 = Land area

X_2 = Production

X_3 = Selling price

X_4 = Production costs

X_5 = Irrigation availability

$\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ = Regression coefficients

ε = Error term

3. Result

General Condition of the Area

Labuan District, Donggala Regency, consists of seven villages, namely Labuan Lelea, Labuan Kungguma, Labuan Panimba, Labuan, Labuan Salumbone, Labuan Toposo, and Labuan Lumbubaka. Most of the villages still rely on the agricultural sector as their main source of livelihood. The population recorded in 2023 reached approximately 15,971 people, with more than 60% of the working-age population engaged in farming, either managing their own land or working as farm laborers, while the rest are working in trade, services, and other informal sectors. The dominance of the agricultural sector is particularly evident in Labuan Toposo and Labuan Panimba Villages, which are known as centers of hybrid corn production and have the largest number of farmers in Labuan District [11].

Natural resources also play a crucial role in determining agricultural activities in Labuan District, where most farming households rely primarily on bore wells or pumps as their main sources of water. The most widely cultivated crops are seasonal food crops, particularly hybrid corn, which are chosen by the farmers because of their relatively high yields and stable prices. In several villages, including Labuan Toposo, the area of land planted with hybrid corn shows the production levels continue to increase, which places this commodity as the main source of income for farming families [5].

Respondent Characteristics

The majority of farmers are in the productive age range (35–55 years), accounting for 60% of total respondents, while 20% are under 35 years old and 20% are above 55 years old. The average farming experience is 12 years. The education level of respondents is dominated by elementary school graduates (55%), followed by junior high school (30%), senior high school (10%), and university level (5%). The average cultivated land area is 1.20 hectares, with an average household size of 4 dependents. This indicates that farmers have adequate family labor potential but still face limitations in education and access to resources.

The age structure of respondents, which is dominated by the productive age group, combined with an average of 12 years of farming experience, tends to lead farmers to promote better cultivation practices such as the selection of hybrid seeds, balanced fertilization, and timely pest and disease control, thereby increasing yield per hectare. The average landholding of 1.20 hectares has provided farmers a sufficient space to optimize input use. However, limited formal education (mostly only up to elementary school) may hinder access to technical and financial information. Therefore, the role of agricultural extension workers and technical assistance is crucial in reducing production costs and improving decision-making in seed, fertilizer, and labor selection. Large household dependency provides family labor but, on the other hand, increases costs if land productivity is insufficient. Water quality and irrigation systems, mainly sourced from groundwater through bore wells and pumps, affect yield stability, particularly during flowering and grain-filling stages, thus influencing net income and selling prices at the farmer level.

Overview of Hybrid Corn Farming

Farmers in Labuan District cultivate hybrid corn twice a year through a monoculture system. The main inputs used are hybrid seeds, urea fertilizer, NPK fertilizer, and pesticides, where the largest share of costs is allocated to fertilizers (35%), followed by labor (25%) and pesticides (15%). The average production reaches 5.20 tons per hectare, with an average selling price of IDR 4,700 per kilogram. Most of the harvest (80%) is sold to middlemen, while the remaining 20% is sold to companies.

The pattern of cultivating hybrid corn twice a year in a monoculture system reflects an intensive production model that relies heavily on chemical inputs such as hybrid seeds, urea fertilizer, and pesticides. A similar cost structure is also found in Pesisir Selatan Regency, where farmers spend significant amounts on fertilizers, seeds, pesticides, and hired labor [12]. The distribution of agricultural products also shows a high dependency on middlemen (80%), which often tends to weaken farmers' bargaining position and leads to lower selling prices. This situation is also observed in Banyuasin, where it was found out that the income of hybrid corn farmers is influenced by the balance between production costs and selling prices, particularly when sales are dominated by middlemen [13].

Throughout main production costs, which consist of fertilizers (around 35%), labor (25%), and pesticides (15%), the input used efficiently becomes crucial in order to increase profits. If fertilizers are used inefficiently or excessively, profits remain low despite high yields. A study in Madura showed that the use of fertilizers (NPK and organic) and labor significantly affects hybrid corn production, thus providing opportunities to optimize input utilization in order to improve both technical and economic efficiency [14].

Regression Analysis Results

In order to determine the factors influencing the income of hybrid corn farming in Labuan District, a multiple linear regression analysis was conducted. The variables used include land area, production quantity, selling price, production costs, and irrigation conditions. The selection of these variables is based on production economics theory and previous research, which indicate that the productivity of corn farming is influenced by a combination of physical and non-physical factors, particularly input use and the condition of agricultural infrastructure [14, 15]. The objective of this analysis is to identify the extent of the influence of each variable on farmers' income as well as to measure their combined contribution, thereby highlighting the main factors that affect the success of hybrid corn farming. The regression analysis results are presented in Table 1 below.

Table 1. **Regression Analysis Results of Factors Affecting Hybrid Corn Farming Income in Labuan District**

Variable	Coefficient	Std. Error	*t-value*	*Sig. (p)*	Description
Constant	-25,440,000	9,420,000	-2.70	0.01	Significant (α=5%)
Land Area	18,880,000	1,840,000	10.25	< 0.00	Significant (α=5%)
Production	843	334	2.52	0.01	Significant (α=5%)
Selling Price	5,673	1,998	2.84	0.01	Significant (α=5%)
Production Cost	-1,27	0.18	-7.13	< 0.00	Significant (α=5%)
Irrigation	-234,000	746,000	- 0.31	0.76	Not significant

α = 0.05

t (76) ≈ 2.00

F (5, 76) = 47.83, p < 0.01   → significant model

R^2 = 0.76 (75.90%)

Adjusted R^2 = 0.74

partial η^2 = 0.76

Source: Processed Primary Data, 2025.

Based on Table 1, the calculated *F-value* of 47.83 is greater than the *F-table* value of 2.40 at α = 0.05. This indicates that the regression model is simultaneously significant. The coefficient of determination (R^2) is 0.76, it shows that 76% of the variation in income can be explained by the variables land area, production, selling price, production costs, and irrigation.

The regression analysis results in Table 1 show that each independent variable has a different influence on the income of hybrid corn farming. Several factors have a significant effect, meaning they truly contribute to increasing farmers' income, while others are not significant, indicating that their influence is relatively minor. These differences are important for determining the strategic direction for improving corn farming. The significant and non-significant factors can be seen more clearly in Figure 1.
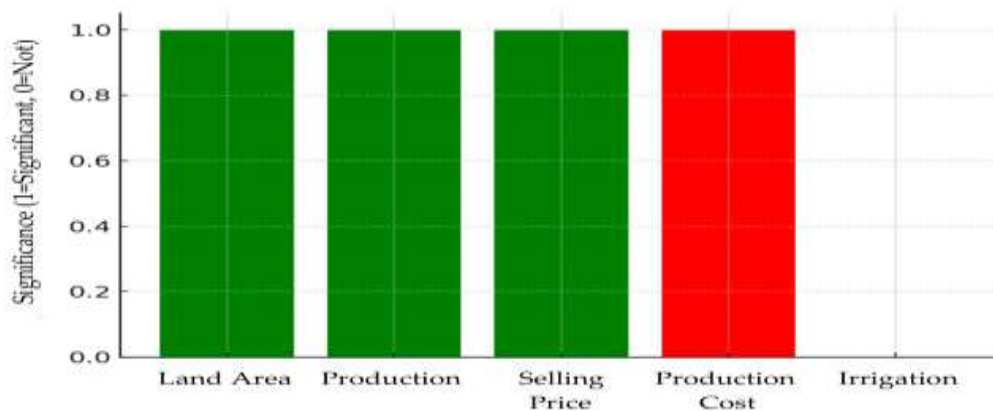
Figure 1. Significant vs. Non-Significant Factors

Figure 1 illustrates the differences between the factors that significantly and insignificantly affect hybrid corn farming income in Labuan District. The variables of land area, yield, and selling price positively and significantly influence income, while production costs negatively and significantly affect income. In contrast, the irrigation variable shows no significant effect on income. This visualization highlights the regression analysis results, indicating that farmers' income largely depends on a combination of production and cost factors, whereas irrigation conditions have not been proven yet to provide a tangible impact.

4. Discussion

The analysis shows that the land area has a coefficient of 0.42 and a t-value of 3.65. This is greater than the t-table value of 2.00, making the land area statistically significant and positively affecting the income from hybrid corn farming. This finding is consistent with conditions in Labuan District, where farmers cultivate an average of 1.2 hectares of land. As farmers have more land, their income increases due to larger-scale operations. The more land that is cultivated, the higher the potential production, thereby increasing total farmer income. This situation also highlights the importance of economies of scale in hybrid corn farming, where cost efficiency can more easily be achieved on larger farms. Thus, access to land is essential for enhancing farmers' competitiveness and strengthening the sustainability of hybrid corn farming in Labuan District. This research aligns with that of [16], who

studied factors affecting the cultivation of hybrid corn by the majority of people in Marobea Village, Sawerigadi District, West Muna Regency. They found that only the land area variable had a positive and significant effect on corn production. This study emphasizes the significant impact of land area on hybrid corn production, which has implications for the income of hybrid corn farming.

Production also has a significant positive effect (coefficient 0.37; t-value 4.10). The average maize yield reaches 5.2 tons per hectare, where this increase in yield provides a tangible addition to farmers' income. Those farmers who apply better farming techniques usually achieve higher yields, which automatically increases their income. This finding is confirmed by [17], who found that the income and feasibility of hybrid corn farming in Sidondo I Village, Sigi Biromaru District, Sigi Regency, are greatly influenced by the size of the hybrid corn production at the average cost of IDR 4,482,814 or IDR 5,212,574, and the income of hybrid corn farmers at IDR 4,500/kg is IDR 16,055,186 or IDR 18,668,821/ha per hectare in one growing season. This indicates that improving productivity is a key factor in raising earnings, making the use of technological innovations and the application of proper agricultural practices very important for the success of hybrid maize farming in Labuan District. In addition [18], it was suggested that farmers should be encouraged to use seed inputs effectively by adding more production inputs in order to increase output and to achieve optimal corn production.

The selling price has a considerable positive impact (coefficient 0.29; t-value 2.75). According to the field conditions, most farmers sell their harvest to middlemen at a price of IDR 4,700 per kilogram, while companies offer higher prices. This price difference is an important factor that influences farmers' income levels. As reported [19], due to the productivity and selling price, which is relatively low, the corn farming income in Banten Province is IDR 4,008,703/ha/planting season with a B/C value of 0.7, which means this farming is not profitable. This reveals the role of the selling price in determining the income of corn farming in the research area. Therefore, broader market access and a stronger marketing system can enhance farmers' ability to determine prices and maintain the stability of their income.

Conversely, production costs have a significant negative effect (coefficient -0.26; t-value -2.30). High expenses for fertilizers and pesticides rarely yield proportional

increases in production. This situation puts additional pressure on farmers' income when input prices rise, as seen in Labuan District, where subsidized fertilizers are difficult to obtain, forcing farmers to purchase more expensive non-subsidized fertilizers. This results in a line with [20], who conducted research in Majalengka Regency regarding the effect of transactional cost economics on hybrid corn farming income. The result shows production costs on fertilizer, seed, and labor are variables that influence the level of income from hybrid corn farming in Majalengka Regency. This indicates that the efficiency of input use and the availability of fertilizer subsidies play a crucial role in sustaining the income of hybrid corn farming in the research area.

Irrigation availability had a coefficient of 0.05 with a t-value of 0.95, which is lower than the t-table value, indicating a statistically insignificant effect. This has reflected the situation in Labuan District, where most of the farmland still relies on rainfall for the hybrid corn farming irrigation. The existing irrigation channels are unevenly distributed and not well developed, thus limiting the potential increase in farmers' income. This condition highlights the need for improving irrigation infrastructure to ensure more stable and sustainable productivity of hybrid corn farm income in the Labuan District area.

5. **Conclusions**

The results indicate that land area, crop yield, and selling price positively and significantly impact hybrid corn farming income in Labuan District, while production costs negatively and significantly impact it. No significant impact was found in terms of irrigation. The R-squared value of 0.76 indicates that the model can explain 76% of the variation in farmers' income; the remaining 24.1% is influenced by factors not included in the model. These findings align with conditions in Labuan District and provide valuable insight into factors affecting hybrid corn farming income. Farmers' income largely depends on cultivated land size, yield levels, price differences between middlemen and companies, and high production costs, particularly for fertilizers and pesticides. These factors suggest that increasing farmers' income depends on production capacity, efficient use of inputs, and access to competitive markets. Therefore, policies should be implemented to improve land

access, enhance input efficiency to better control production costs, expand market access to secure favorable selling prices, and develop adequate irrigation infrastructure to support the sustainability of hybrid corn farming in Labuan District.

However, the results should be interpreted with caution due to the study's limitations. The analysis was based on a relatively small sample size of 81 respondents, with a margin of error of 15%. These limitations may affect the precision and generalizability of the results. Thus, further research with a larger sample size and a smaller margin of error is needed to validate and strengthen these findings.

6. Patents

This study does not result in a patent. The findings emphasize concepts and practical applications, which can serve as a basis for developing models related to cost efficiency, market access, and input management in hybrid corn farming. However, they do not produce intellectual property rights in the form of a patent.

References

1. Sari, H. The Role of Hybrid Seeds in Addressing Global Food Security. Adv. Crop Sci. Technol. 2024, 12(8), 730. https://doi.org/10.4172/2329-8863.1000730

2. Wang, S.; Liu, C.; Han, L.; Li, T.; Yang, G.; Chen, T. Corn Grain or Corn Silage: Effects of the Grain-to-Fodder Crop Conversion Program on Farmers' Income in China. Agriculture (Switzerland) 2022, 12(7), 1–17. https://doi.org/10.3390/agriculture12070976

3. Kusumadinata, A.A. Corn Marketing Communications Network in Gowa, South Sulawesi. J. Agric. 2015, 6(2), 75–82.

4. Chresnawan, A.; Masahid; Haribudiyanto, N. Analysis of Income and Feasibility of Hybrid Corn Farming (Zea mays L.) Variety DK 77 (Deklab). Sustain. Agribus. J. (ORYZA) 2018, 3(2), 19–23.

5. entral Sulawesi Provincial Statistics Agency. Harvested Area and Corn Production in Central Sulawesi 2024 (Final Figure); BRS No. 19/03/72/Th. XXVIII; Central Statistics Agency: Palu, Indonesia, 2025.

6. Marion, P.; Lwamba, E.; Floridi, A.; Pande, S.; Bhattacharyya, M.; Young, S.; Villar, P.F.; Shisler, S. The Effects of Agricultural Output Market Access Interventions on Agricultural, Socio-Economic, Food Security, and Nutrition Outcomes in Low- and Middle-Income Countries: A Systematic Review. Campbell Syst. Rev. 2024, 20, e1411. https://doi.org/10.1002/cl2.1411

7. Mahyuddin; Firman, C.M.; Salam, M. Analysis of Farm Income from Hybrid Maize Farming and the Factors Influencing Its Production: A Case Study in Soppeng District. J. Agrikultura 2023, 34(3), 483–494.

8. Fatmawati; Nasrul, M. The Influence of Land Area and Selling Price on the Income of Corn Farmers (Zea mays) in Dulomo Village, Patilanggio District, Pohuwato Regency. ARview J. Sci. 2023, 2(1), 18–27.

9. Sudaryono. Research Methodology; Rajagrafindo Persada: Jakarta, Indonesia, 2022.

10. Sevilla, C.G.; Ochave, J.A.; Punsalan, T.G.; Regala, B.P.; Uriarte, G.G. Introduction to Research Methods; UI Press: Jakarta, Indonesia, 1993.

11. Labuan District. Village Profile; Unpublished, 2024.

12. Fadil, M.; Fitriana, W.; Khairati, R. Analysis of Income and Feasibility of Hybrid Corn Farming. Agribusiness Forum: J. Sci. Community Thought Agribus. Insight 2025, 11(1), 444–452.

13. Kurniati, R.A.E.; Kertasari, V.D.; Susiana; Junaidi. The Cost of Hybrid Corn Farming and Its Contribution to Farmers' Income in Sembawa District, Banyuasin Regency. Jimanggis 2021, 2(1), 1–16.

14. Firdaus, M.W.; Fauziyah, E. Economic Efficiency of Hybrid Corn Farming on Madura Island. Agrisci. 2020, 1(1), 74–87.

15. Taryana; Setiawan, I.; Rachmawati, J. Factors Affecting Hybrid Corn Farming Production in Girimukti Village, Cisaga District, Ciamis Regency. Agroinfo Galuh Stud. Sci. J. 2025, 12(1), 188–208.

16. Mingdzura, S.; Taridala, S.A.A.; Hidrawati. Factors Affecting Hybrid Maize (Zea mays L.) Production in Morobea Village, Sawerigadi Sub-District, West Muna District. Int. J. Technol. Educ. Res. (IJETER) 2025, 3(2), 476–489.

17. Asih, E.W. Effect of Production on Income and Feasibility of Hybrid Corn Farming in Sidondo I Village, Sigi Biromaru District, Sigi Regency. Int. J. Health Econ. Soc. Sci. (IJHESS) 2021, 3(4), 304–311.

18. Fitriana, W.; Khairati, R.; Fadil, M. Factors Affecting Hybrid Corn Production. IOP Conf. Ser.: Earth Environ. Sci. 2025, 1469(1), 012041.

19. Siagian, V.; Resmayeti; Yuniarti, S.; Hidayah, I. Analysis of Factors that Influence Production and Cost of Corn in Banten Province. E3S Web Conf. 2021, 232, 01007.

20. Rachmadina, V.; Saidah, Z.; Trimo, L.; Wulandari, E. The Effect of Transaction Cost Economics on Hybrid Corn Farming Income in Cihaur Village, Maja Subdistrict, Majalengka Regency. J. Manag. Agribus. 2021, 18(1), 90–100.