International Journal of Research in Engineering, Science and Management
Volume 8, Issue 1, January 2025
https://www.ijresm.com | ISSN (Online): 2581-5792

Feasibility of Smallholder Maize and Peanut Intercropping Farming in Lawa Subdistrict in Southeast Sulawesi

Haji Saediman[1*], Arisman Arisman[2]
[1,2]*Department of Agribusiness, Faculty of Agriculture, Halu Oleo University, Kendari, Indonesia*

***Abstract*: This study aims to evaluate the profitability and feasibility of intercropping maize (*Zea mays L.*) and peanuts (*Arachis hypogaea L.*) in Wamelai Village, Lawa Subdistrict, West Muna District, Southeast Sulawesi. Data were collected through direct observation, structured interviews, and documentation and were analyzed using descriptive statistics and the Revenue-Cost (R/C) ratio. Key variables in this study included farmer characteristics (age, education level, and family size), land area (ha), farming costs, production levels, revenue, profit, and the feasibility of intercropping practices. The results show that the intercropping system generates an average profit of IDR 4,084,878 per hectare per planting season, with production levels of 185 liters of maize and 310 liters of peanuts per hectare. The average selling price is IDR 3,811 per liter for maize and IDR 14,333 per liter for peanuts. As indicated by an R/C ratio of 4.84, the feasibility analysis demonstrates that the intercropping system is highly profitable and feasible. This study underscores the potential of intercropping maize and peanuts as a sustainable farming practice that can enhance the livelihoods of smallholder farmers in the region.**

***Keywords*: maize, farming, intercropping, peanut, profitability.**

1. Introduction

Maize (*Zea mays L.)* is the second most important staple crop in Indonesia after rice [1], [2] and plays a crucial role in achieving the national carbohydrate self-sufficiency target of 2,100 calories per capita per day. Maize is highly versatile, serving as a primary food source, livestock feed, and raw material for various industries, including those producing beverages, starch, biofuels, and paper [3]. Due to its high nutritional value, maize is an alternative to rice and continues to be in high demand for both direct consumption and industrial purposes. The growing population as well as the expansion of livestock and industrial activities that depend on maize, has led to a steady increase in demand. As a result, maize cultivation remains critical to maintaining food security and supporting economic development in Indonesia.

In Southeast Sulawesi, maize is a prominent food crop and holds the second-highest production level among carbohydrate-equivalent crops after rice [4]. The region's annual maize production reaches 181,851 tons, harvested from 33,789 hectares of farmland. In West Muna District, maize has cultural and economic significance, as it is a primary source of carbohydrates and a traditional food staple. Local farmers cultivate maize both for household consumption and as a cash crop to supplement their income. The stable demand for maize, driven by its role in traditional food and as an essential component of rural diets, underscores its importance in supporting regional food security and sustaining local livelihoods [5].

Farmers in Southeast Sulawesi, particularly in Muna, often adopt intercropping systems, combining maize with legumes such as peanuts (*Arachis hypogaea* L.). Intercropping is an agricultural practice where two or more crops are cultivated simultaneously on the same field for the entirety or part of their growth cycle [6], [7]. This practice is preferred due to its economic and agronomic benefits [8]. Peanuts are selected because they provide additional income and improve soil fertility through their ability to fix atmospheric nitrogen [9], [10], thereby enriching the soil with essential nutrients. The inclusion of legumes in an intercropping system reduces the need for chemical fertilizers, making farming more cost-effective and sustainable [11], [12]. Moreover, intercropping maize with peanuts helps mitigate the risk of crop failure, as the two crops complement each other in terms of resource use. Maize serves as a high-value staple crop and peanuts enhance overall system productivity by contributing to biological nitrogen fixation, increasing the long-term productivity of the land.

In Lawa Subdistrict, particularly in Wamelai Village, intercropping maize and peanuts is common among farmers. The village has approximately 30 hectares of farmland suitable for this system. Despite the availability of natural resources and labor, the productivity of maize and peanut intercropping in the area has not yet reached its full potential. Agricultural extension services are not so available to guide farmers, and the yield remains suboptimal due to other challenges, such as limited access to quality inputs and inconsistent farming practices. This situation inidicated the need to optimize existing resources to achieve higher productivity and profitability for farmers.

Given the importance of maize and peanut intercropping for farmers' livelihoods, it is crucial to conduct a study on the

*Corresponding author: saediman@yahoo.com

economic feasibility of this farming system. It is important for policymakers, extension workers, and farmers to understand the feasibility of intercropping to make informed decisions about crop management. Additionally, this study aims to fill the knowledge gap by quantifying the benefits of intercropping and identifying areas for improvement to enhance productivity and sustainability. The findings are expected to support efforts to improve farm incomes, promote sustainable land use, and contribute to regional food security initiatives.

2. Materials and Methods

This study was conducted in Wamelai Village, Lawa Subdistrict, West Muna District, Southeast Sulawesi. The population for this study consisted of all maize and peanut farmers, totaling 150 individuals. A census sampling method selected 20–25% of the population as respondents. This resulted in a sample size of 30 farmers. Data were collected from farmers through structured interviews using questionnaires. Data included farming costs, production levels, and constraints related to intercropping practices. We also conducted field observations on intercropping practices and farming conditions. The main variables are farmer characteristics, farming costs, production, revenue, profit, and feasibility. Profitability is calculated as the difference between total revenue and total costs. Feasibility is determined by the R/C ratio, with values greater than 1 indicating profitable farming [13], [14].

3. Results and Discussion

A. Production Cost

Production costs represent all expenses spent during the farming process and can be categorized into fixed and variable costs. Fixed costs refer to non-recurring expenses primarily associated with the depreciation of tools and equipment. In this study, the fixed costs for maize-peanut intercropping amounted to IDR 181,853 per hectare per planting season. The tools included hoes, machetes, digging bars, axes, batteries, electrical cables, and nets, with the nets and batteries having the highest depreciation costs due to their relatively high purchase prices.

Variable costs, which typically cover recurring expenditures such as seeds, fertilizers, labor, and pest control, amounted to IDR 781,524 per hectare. However, the findings show that farmers did not incur any expenses for land preparation activities, as they relied entirely on family labor and did not purchase fertilizers or pesticides for pest and disease management. In addition, the seeds used for planting were from their previous harvests rather than commercially purchased inputs. These practices indicate the subsistence-oriented nature of their farming operations, where resource conservation and cost minimization are prioritized over external input use.

The average production cost per hectare per planting season was IDR 1,063,387. This relatively low cost reflects the reliance on family resources and the absence of external input purchases. While this strategy reduces expenses, it may limit production potential if essential inputs are underutilized. Effective cost management, alongside the strategic use of affordable external inputs, could further enhance the profitability of maize-peanut intercropping systems in the study area.

B. Production and Income

Table 1 shows the production, revenue, and net returns of maize-peanut intercropping per planting season in the study village. The intercropping system produced an average yield of 185 liters of maize and 310 liters of peanuts per hectare per planting season. These production levels resulted in a total revenue of IDR 5,148,265 per hectare, with the average market price for maize at IDR 3,811 per liter and peanuts at IDR 14,333 per liter.

Table 1
Production, Revenue, and Net Returns of maize-peanut intercropping per planting season in the study village

No.	Farm Component	Quantity/Amount
1	Average Production (liters)	
	a. Maize	185
	b. Peanut	310
2	Price (Rp/liter)	
	a. Maize	3,811
	b. Peanut	14,333
3	Revenue (Rp)	
	a. Maize	705,035
	b. Peanut	4,443,230
	Total revenue (Rp)	5,148,265
4	Total Cost (Rp)	1,063,387
5	Net Returns (Rp)	4,084,878

The revenue analysis shows that the peanut crop contributed the largest share of total income, highlighting its role as a high-value crop. After deducting total production costs of IDR 1,063,387 per hectare, the net income from the intercropping system was IDR 4,084,878 per hectare per planting season. This significant profit margin shows the efficiency of the intercropping system, supported by its ability to utilize land, water, and labor effectively.

Research on maize-legume intercropping, such as that by Arakama [15], Yohana et al. [16], and Li et al. [17], confirms that this system can yield higher productivity and profitability compared to monoculture farming. These findings align with those of Fitrianingsih et al. [18], who reported that intercropping in Muna Regency resulted in a much higher return on capital (R/C ratio of 17.67) compared to maize monoculture (R/C ratio of 8.25). The current study in Wamelai demonstrates that including peanuts in the system diversifies production and increases overall revenue due to the legume's nitrogen-fixing ability, which enhances soil fertility.

The observed net income highlights the economic resilience provided by intercropping. However, this system remains largely subsistence-oriented, as farmers in the village predominantly use their own seeds, forgo fertilizers, and avoid pesticide use. This reliance on minimal inputs reduces costs but may limit potential yield increases. For long-term sustainability, incorporating affordable external inputs alongside traditional practices could help maintain profitability while enhancing productivity.

C. Feasibility

The feasibility of the maize-peanut intercropping system was

assessed using the Revenue-Cost (R/C) ratio, which compares total revenue to total costs. The results indicate an R/C ratio of 4.84 per hectare, which is well above the benchmark value of 1, signifying profitability. This high R/C ratio reflects the economic viability of the intercropping system, driven by the complementary growth patterns of maize and peanuts and their efficient resource utilization.

A comparison with findings from other regions shows that the R/C ratio in Wamelai Village is consistent with or higher than that of other intercropping studies. For example, Yohana et al. [16] reported an R/C ratio of 5.581 for maize-peanut intercropping in East Sumba, compared to 4.8 for maize monoculture. Similarly, in Ponjong Subdistrict, Gunung Kidul District, the R/C ratio for maize-peanut intercropping was 4.16, outperforming the maize monoculture's R/C ratio of 2.57 [19]. However, in Bontoramba Subdistrict, Jeneponto District, Saputra [20] found an R/C ratio of 2.04, indicating a lower profitability than other regions. These variations highlight the importance of local factors, such as market access, input use, and environmental conditions, in determining profitability.

The study underscores the financial and practical benefits of maize-peanut intercropping in Wamelai Village. The complementary nature of these crops—maize serving as a canopy crop and peanuts as a nitrogen-fixing legume—optimizes land use and improves soil fertility, contributing to sustainable farming practices. Peanuts provide a secondary income stream and reduce the need for chemical fertilizers due to their nitrogen-fixing ability, making the system cost-efficient.

D. Challenges and Potential for Improvements

The study reveals challenges related to the subsistence-oriented nature of farming in the area. Farmers primarily rely on their own seeds, forgo fertilizers, and do not use pesticides for pest and disease management, which limits their potential yield. Additionally, labor shortages and fluctuating market prices can further constrain profitability. These constraints highlight the need for increased access to affordable external inputs, better extension services, and more efficient market linkages.

To improve net income and the R/C ratio, several strategies can be considered:

(i) Improved Access to Quality Inputs: Maize is one of the crops eligible for subsidized fertilizers. However, farmers must meet specific requirements, such as membership in farmer organizations and minimum land ownership. Agricultural extensionists should actively assist farmers in fulfilling these requirements to ensure they receive the necessary inputs. Providing affordable credit options for high-quality seeds, fertilizers, and pest management tools can further enhance production.

(ii) Farmer Training and Extension Services: Strengthening agricultural extension programs can help farmers adopt better crop management practices, such as optimal planting densities and improved intercropping arrangements. Although extension systems may have limitations in reaching all farmers directly, extension agents can guide farmers to utilize social media platforms, such as YouTube, to access practical agricultural information and innovative farming techniques [21].

(iii) Market Diversification and Farmer Organizations: Strengthening farmers' access to markets through cooperatives or partnerships can stabilize prices and reduce dependence on local demand. Since many farmers do not have cooperatives or formal partnerships, they can begin by optimizing existing farmer groups to establish such institutions. Cooperatives can improve bargaining power, facilitate access to inputs, and expand market opportunities.

(iv) Infrastructure Development: Improving transportation and storage facilities can minimize post-harvest losses and enhance profitability. Investments in better road networks, cold storage units, and market facilities are essential to support efficient market access and maintain the quality of harvested crops.

(v) Improved Access to Credit: Credit is crucial for financing farming operations, such as purchasing high-yielding seeds and improving farm inputs. While several credit schemes are available and suitable for smallholder farmers, many remain unaware of these programs. Local governments and financial institutions need to conduct more outreach and socialization to increase farmers' awareness and accessibility to these credit schemes.

4. Conclusion

This study evaluated the profitability and feasibility of intercropping maize (Zea mays L.) and peanuts (Arachis hypogaea L.) in Wamelai Village, Lawa District, West Muna Regency. The findings indicate that the intercropping system generates an average net income of IDR 4,084,887 per hectare per planting season. This profitability is primarily driven by efficient land use and the complementary benefits of maize and peanut cultivation. The Revenue-Cost (R/C) ratio of 4.84 demonstrates that the intercropping system is highly feasible and profitable, emphasizing its potential to improve the economic welfare of smallholder farmers. Beyond profitability, integrating maize and peanuts offers ecological benefits, such as improved soil fertility through nitrogen fixation by peanuts, making this intercropping system a sustainable agricultural practice.

The intercropping of maize and peanuts presents significant economic and ecological advantages for smallholder farmers. To fully realize its potential, targeted interventions are needed to improve access to quality inputs, credit, training, and market integration. Strengthening farmer groups, facilitating cooperative formation, and leveraging technology for knowledge dissemination can further enhance the sustainability and resilience of intercropping systems and contribute to increased livelihoods and agricultural sustainability.

References

[1] H. Saediman, A. Amini, R. Basiru, and L. O. Nafiu. (2015). Profitability and Value Addition in Cassava Processing in Buton District of Southeast Sulawesi Province, Indonesia. *J. Sustain. Dev.*, vol. 8, no. 1, pp. 226–234, 2015.

[2] H. Saediman, M. A. Limi, Rosmawaty, P. Arimbawa, and Y. Indarsyih (2016). Cassava consumption and food security status among cassava

growing households in southeast sulawesi. *Pakistan J. Nutr.*, vol. 15, no. 12, pp. 1008–1016, 2016.
[3] Suprapto, *Bertanam Jagung*. Jakarta: Penebar Swadaya, 1991.
[4] H. Saediman (2015). Prioritizing Commodities in Southeast Sulawesi Province of Indonesia Using AHP based Borda Count Method, *Asian Soc. Sci.*, vol. 11, no. 15, pp. 171–179, 2015.
[5] H. Saediman, S. Aisa, M. Zani, M. A. Limi, and W. O. Yusria (2019). Food Security Status of Households in a Cassava-Growing Village in Southeast Sulawesi, Indonesia, *J. Agric. Ext.*, vol. 23, no. 1, pp. 199–209.
[6] R. W. Willey (1990). Resource use in intercropping systems, *Agric. Water Manag.*, vol. 17, no. 1–3, pp. 215–231.
[7] H. Hauggaard-Nielsen, B. Jørnsgaard, J. Kinane, and E. S. Jensen (2008). Grain legume–cereal intercropping: the practical application of diversity, competition and facilitation in arable and organic cropping systems. *Renew. Agric. Food Syst.*, vol. 23, no. 1, pp. 3–12.
[8] C. Feng, Z.Sun, Z. Sun, L. Zhang, L. Feng, J. Zheng, W. Bai, C. Gu, Q. Wang, Z. Xu, W. van der Werf (2021). Maize/peanut intercropping increases land productivity: A meta-analysis, *F. Crop. Res.*, vol. 270, p. 108208.
[9] H. Hauggaard-Nielsen, P. Ambus, and E. S. Jensen (2003). The comparison of nitrogen use and leaching in sole cropped versus intercropped pea and barley, *Nutr. Cycl. Agroecosyst*, vol. 65, no. 3, pp. 289–300.
[10] K. E. Giller, *Nitrogen Fixation in Tropical Cropping Systems*. Wallingford, UK.: CABI Publishing, 2001.
[11] M. O. Martin-Guay, A. Paquette, J. Dupras, and D. Rivest (2018). The new green revolution: sustainable intensification of agriculture by intercropping, *Sci. Total Env.*, vol. 615, pp. 767–772.
[12] Z. Xu, C. Li, C. Zhang, Y. Yu, W. van der Werf, and F. Zhang (2020). Intercropping maize and soybean increases efficiency of land and fertilizer nitrogen use: a meta-analysis, *F. Crop. Res.*, vol. 246, p. 107661.
[13] H. Saediman, Mustika, L. Nalefo, M. Tufaila, and M. Zani (2019). Cost and Return Analysis of Rice Farming and Brick Making in South Konawe District of Southeast Sulawesi, *Int. J. Sci. Technol. Res.*, vol. 8, no. 10, pp. 835–838.
[14] H. Saediman, R. W. Astuti, L. O. Alwi, M. Zani, and I. S. Mboe (2021). Comparative profitability of small-scale rice and horticultural farming in South Konawe District of Southeast Sulawesi. *IOP Conf. Ser. Earth Environ. Sci.*, vol. 782, p. 022036.
[15] N. Arakama (2009). Profitability of intercropping corn with mungbean and peanut, *USM R&D J.*, vol. 17, pp. 65–70.
[16] C. Yohana, W. Andajani, E. Y. Sidhi, and N. Lisanty (2022). Keuntungan Pola Tanam Jagung Tumpangsari dengan Kacang Tanah di Kabupaten Sumba Timur, Provinsi Nusa Tenggara Timur, *J. Ilm. Pertan. Nas.*, vol. 2, no. 1, pp. 41–51.
[17] Y. Li, L. Wang, B. Zhao, P. Liu, J. Zhang, S. Dong, D. Shi (2023). Crop Productivity, Economic Advantage, and Photosynthetic Characteristics in a Corn-Peanut Intercropping System, *Agronomy*, vol. 13, no. 2, p. 509.
[18] W. O. Fitrianingsih, W. Embe, and B. Sufa (2022). Efficiency Analysis of Corn Intercropping with Peanut and Corn Monoculture in Kombungo Village, Muna Regency, *Agrisurya*, vol. 1, no. 1, pp. 24–30.
[19] S. K. Lubis, A. Astuti, and S. Widiatmi (2019), Analisis Perbandingan Pendapatan Usahatani Tumpangsari Jagung dan Kacang Tanah Dengan Monokultur Jagung di Kecamatan Ponjong Kabupaten Gunungkidul, *J. Ilm. Agritas*, vol. 3, no. 3, pp. 3–13.
[20] A. Saputra, "Analisis Komparatif Usahatani Tumbangsari Jagung Kacang Tanah dengan Monokultur Jagung di Desa Bangkalaloe Kecamatan Bontoramba Kabupaten Jeneponto," Universitas Muhammadiyah Makassar, 2015.
[21] H. Saediman, I. S. Mboe, B. Budiyanto, S. Sarinah, and H. Hidrawati (2021). Smallholder adoption of horticultural crops: the case of dragon fruit in Southeast Sulawesi Smallholder adoption of horticultural crops : the case of dragon fruit in Southeast Sulawesi, *IOP Conf. Ser. Earth Environ. Sci.*, vol. 819, p. 012043.