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ABSTRACT

Agriculture cultivation systems and farmer's income are the crucial issues in many agriculture-based developing countries. Our previous study proved that the polyculture system positively affects land productivity and land-use efficiency. This research investigated the relationship between intercropping farming systems and farmer's income. We hypothesized that the intercropping farming system increases farmer's income compared to monoculture. The farming income analysis was carried out using Microsoft Excel and STATA software. The results showed that the farmer's income derived from the intercropping farming system differs from monoculture. Based on the T-test, the intercropping farming system provided a higher income. Intercropping farming systems that have higher plant diversity, contributed to higher farmer income from different plant yields. Farmers that applied the intercropping system would harvest of 2-3 different plants from one cultivated land at the same time with regular planting distance. These indicated that the intercropping farming system reduces the risk of loss due to price fluctuations of products and the higher input costs during the production process.

INTRODUCTION

In evaluating the interactions between organisms, ecologists are often interested in whether the performance of an individual species by itself (in a monoculture) is different from the performance of that species when other species are present (in a polyculture) (Bracken, 2019). Monoculture and polyculture practices are two distinctive production systems. We hypothesize that polyculture farming hosts a greater diversity of species. Habitat complexity in smallholdings is influenced by multiple farming practices (i.e. polyculture and monoculture) (Syafiq et al., 2016) and offer competitive business opportunities for small-scale farmers. These contribute to biodiversity conservation (Jezeer, Verweij, Santos, & Boot, 2017), potentially increase farmers' income (Morgan-Davies, Wilson, & Waterhouse, 2017). Our previous study also proved that the polyculture system positively affects land productivity and land-use efficiency (Sabang, Agus, Bulkis, & Arsyad, 2019) in the agriculture sector.

Consumer demands for agricultural products have directed the agricultural practices to take any necessary efforts to maximize plant harvest. These are achieved through the increase of planting/harvest (extensification) area and productivity and yield per unit planted area (intensification). Intensification was employed by using high-yield crop varieties, fertilization, irrigation, and pesticides, and these systematic practice has contributed substantially to the tremendous increases in food production over the past 50 years. Land conversion and intensification, however, also alter the biotic interactions and patterns of resource availability in ecosystems that can have serious local, regional, and global

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environmental impacts (Matson, Parton, Power, & Swift, 1997). In the most productive agricultural area, modern agriculture practices have tended to ignore ecological principles thus contributed to unstable sustainable agroecosystems. Planting single crop variety on large scale (monoculture) for example, has proved to affect the biodiversity of related organisms like weeds, insects, and other herbivores. Monoculture has narrowed interactions among the organisms, such as the reduction of beneficial insects in which was an important component in providing ecological tools for the protection of plants. Other studies also confirmed that homogeneous farming systems contributed to the decrease of plant resistance to insect pests, especially related to the use of pesticides (Altieri & Nicholls, 2004).

Agricultural practices affect biodiversity, agroecosystems (Altieri & Nicholls, 2004), agricultural resource availability in the long term (Morgan-Davies, Wilson, & Waterhouse, 2017) and land capacity. Soil organisms are sensitive in responding to the change of soil microclimate due to land management practices. The land management practices also induced the environmental conditions on above ground microclimate. Soil organisms are well correlated with beneficial soil and ecosystem functions including water storage, decomposition and nutrient cycle, detoxification of toxicants, and suppression of noxious and pathogenic organisms. Soil organisms also illustrate the chain effect of land management decisions in promoting plant productivity and the life of inhabited animals (Doran & Zeiss, 2000). The raised plants and animals furtherly will affect on-farm diversification, food security, and income sufficiency (Anderzén et al., 2020). The dynamics and complexity of farmers' problems are empirically dominated by the activities of farmers (Anthropogenic). Farmers that put plant-environment interaction as a less considered factor in their production management will tremendously affect the ecosystem, and consequently, these will be correlated with the change of pest and disease cycles, soil, and water (Doran & Zeiss, 2000). Agriculture development that directed to boost production for self-sufficiency has resulted in the occurrence of environmental disasters, the over-exploited natural resources in time would result in the scarcity of resources (Jumiyati, Arsyad, Rajindra, Pulubuhu, & Hadid, 2018).

The consequences of reducing biodiversity will be more clearly identified in the management of agricultural pests. The expansion of plant monocultures would wipe out natural vegetation thereby, reducing the diversity of local habitats, eventually leading to agroecosystem instability and increasing pest attacks. Generally, the more intensive the environment is modified, like the monoculture system, the more intensive the pests will attack the crops (Matson, Parton, Power, & Swift, 1997). Diversity varies according to environmental factor heterogeneities in lowland agriculture. The difference in diversity indexes between populations of pest insects and natural enemy insects can also be influenced by the heterogeneity of a physical environment. The more complex the flora and fauna community at the place induced higher diversity of species. Culliney & Pimentel (1986) explains that diverse plantations (polyculture) affect pest populations. Monophagous species tend to decrease in high diversity crops, while polyphagous species increase as well as natural enemies (predators and parasitoids). Plant diversification techniques have the potential to reduce pests (Culliney & Pimentel, 1986), affect the feeding activity (Reimer et al., 2018), insects activity (Chown, Sørensen, & Terblanche, 2011) and life cycle (Pereira et al., 2019). In the long term, applying a polyculture system (intercropping) can provide an alternative crop production method to improve biodiversity and encourage farmers' income.

The agricultural practice (such as monoculture) is vulnerable to suffer from various environmental constraints and affects the farmer's income. Several studies have reported that biodiversity and monoculture among farmers have been long-standing issues in many developing countries. Giving various agricultural practices related problems, there is an urgent need to address the intercropping farming system and farmer's income. We assumed that the intercropping farming system will positively affect the farmer's income. Therefore, this research focused on the intercropping farming system and farmer's income.

MATERIALS AND METHODS

Research Site and Sampling

The research was conducted in Talungeng Village, Bone District, South Sulawesi, Indonesia (as lowland agriculture area) from January to November 2019. Lowland agriculture sites were selected and have the following characteristics. The site was located at 154 m asl and the contour of the lands was flat. The agriculture sites were near and surrounded by residential areas and close to community facilities. The weather was mild, yet tend to be hot and dry with a daily temperature around 29.4°C. The agriculture site was far from the water sources, and lack of vegetation. The inhabitants' residents generally work in agriculture sectors. Most residents have senior high school attainment and easy to get information access. The agriculture practices composed of polyculture/intercropping system of corn-soybean and monoculture of corn and soybean. We interviewed 100 farmers (random sampling) for farmer's income analysis.

Farmers Income Analysis

The income of farmers that practicing the intercropping system were analyzed. Farmers were interviewed to answers the postulates whether intercropping or polyculture systems increased farmers household income. Two important components were calculated by analyzing the structure of revenue (R) and farming costs (C) from the the intercropping system and followed by R/C analysis. The ratio of revenues to costs shows how much revenue will be obtained from each cost incurred in farming production (Normansyah, Rochaeni, & Humaerah, 2014). The ratio of revenue to production costs can be used to measure the level of the relative profitability of farming activities. These means the ratio between revenue and the costs can describe whether the production process is profitable or not. R/C analysis or sometimes referred to Cost/Revenue analysis can be calculated as total revenue divided by total costs (Breen, Costa & Hendon, 1986):

$$R/C = \frac{TR}{TC} \quad \text{.. 1)}$$

If the R/C ratio > 1, then the business is profitable or is feasible to be developed. If the R/C Ratio < 1, then the business suffers losses (not feasible to be developed). Furthermore, if the R/C Ratio = 1, then the business is at the break-even point. We continued the analysis with the T-test (Bhattacharyya, Kan & Mitra, 2020) to test mean income differences between intercropping farming systems (polyculture) and monoculture.

RESULTS AND DISCUSSION

The Intercropping System and Farmers Income

Farmers in the studied site planted soybean and corn on monoculture (Table 1) and polyculture (Table 2). In the monoculture system, the average income of planting corn was calculated was IDR 2,173,243/ha/season, while on soybean farmers was IDR 7,046,982/ha/season. The average of monoculture income was then IDR 4,610,112/ha/season. In the intercropping system, farmers receive an income of IDR 16,525,666/ha/season. It means the income derived from the intercropping system is four times higher than the monoculture. Based on T-test, the intercropping system provided higher income significantly. The intercropping systems have a higher diversity of primary plants. Planted with the same population as the monoculture system, the farmer would get more harvestable agricultural products than monoculture system, thus farmers gained more income. These findings in line with the study of Putri (2011) that the income of intercropping corn-peanut intercropping farming (IDR 8,449,479.00/ha/season) was greater than the amount of monoculture corn income (IDR 5,893,727.00/ha/season). These inferred that the intercropping system potentially increases household farming incomes (Morgan-Davies, Wilson, & Waterhouse, 2017).

However, it is a fact that the farm's income strongly depends on agriculture biodiversity. The biodiversity is also determined by the diversity and abundance of food sources and other resources available in their habitats. Insect pests and natural enemies (for example) in intercropping systems respond to these resources in complex ways. The condition of food that fluctuates seasonally will become a limiting factor for the existence of diversity in a place by competition between individuals. The number and types of diversity that increase in communities are those that have the quantity and quality of food ingredients in accordance with the needs of pest insects and natural enemies. There is a relationship between vegetation and insects that can stabilize the plant ecosystem. If one component is disturbed it will affect the existence of other components. Stefanescu, Herrando, & Páramo (2004) state that modern agriculture with a monoculture system caused a decline in natural enemy insect communities. In addition, a human disturbance was the second most important predictor for species richness. Pereira et al. (2019) stated that the differences in diversity index values of areas are influenced by the diversity of vegetation around primary and secondary crops (in terms of agricultural economics). Agroecosystem with single plant species (monoculture) results in a more fragile environmental imbalance (Park, Shin, Do, Yarish, & Kim, 2018) that can lead to pest outbreaks. In other words, there is a linkage between great diversity and an outbreak (Jiménez Aguilar et al., 2019). Both environmental components biotic and abiotic will affect diversity. These inferred that diversity characteristics were strongly dependent on the type of plantation (monoculture or intercropping, economically), heterogeneity of environmental conditions, availability of pest's food, and location of agricultural land (lowland or highland).

The Intercropping and Farms Production Cost

It was found that the intercropping (polyculture) closely related to farm production costs. The RC ratio of the monoculture system (corn) was calculated 1.1 (Table 1), while soybean was 3.4. This ratio differs from the intercropping system that revealed a value of 3.3 (Table 2). Higher R/C ratio in the polyculture system indicated that this system is more efficient. Putri (2011) found that R/C in monoculture corn is 1.70, while the ratio in corn-peanut intercropping is 1.90. The level of production efficiency between corn monoculture farming and corn-peanut intercropping was 4.672.

Table 1. Farming income analysis of the monoculture system

Monoculture System			
Corn		**Soybean**	
Item	**Value (IDR)**	**Item**	**Value (IDR)**
1. **Revenue**		1. **Revenue**	
a. Production (kg)		a. Production (kg)	
- Corn	1,608	- Soybean	1,400
b. Price (IDR)		b. Price (IDR)	
- Corn	2,500	- Soybean	6,500
Total (axb)		Total (axb)	
- Corn (1,608 x 2,500)	4,020,000	- Soybean (1,400 x 6,500)	9,100,000
2. **Production cost**		2. **Production cost**	
a. Fixed cost		a. Fixed cost	
- Land tax	48,250	- Land tax	54,712
- Depreciation	40,307 +	- Depreciation	41,384 +
	88,557		96,096
b. Variable cost		b. Variable cost	
- Corn seed	360,000	- Soybean seed	683,077
- Fertilizer	537,600	- Fertilizer	621,538
- Pesticide	318,200	- Pesticide	213,846
- Labour (6 man-day)	542,400 +	- Labour (5 man-day)	438,461 +
	1,758,200		1,956,922
Total cost (a + b)	1,846,757	Total cost (a + b)	2,053,018
3. **Income (1–2)**	2,173,243	3. **Income (1–2)**	7,046,982
4. **RC Ratio** = 1.1		4. **RC Ratio** = 3.4	

Table 2. Farming income analysis of the intercropping system

Polyculture (Intercropping) System	
Corn Soybean	
Item	**Value (IDR)**
1. Revenue	
a. Production (kg)	
- Corn	3,250
- Soybean	2,058
b. Price (IDR)	
- Corn	2,500
- Soybean	6,500
Total (axb)	
- Corn (3,250 x 2,500)	8,125,000
- Soybean (2,058 x 6,500)	13,377,000 +
	21,502,000
2. Production Cost	
a. Fixed cost	
- Land tax	87,500
- Depreciation	68,000
	155,500
b. Variable cost	
- Seeds	
Corn	700,000
Soybean	1,012,500
- Fertilizer	1,135,000
- Pesticide	313,334
- Labour (18 man-day)	1,660,000 +
	4,820,834
Total cost (a + b)	**4,976,334**
3. Income (1-2)	16,525,666
4. RC Ratio = 3.3	

This means that corn-peanut intercropping was more efficient (lower production cost) to be developed than corn monoculture farming (Putri, 2011), especially for increasing plant species diversity (Jiménez Aguilar et al., 2019). In the field, farmers have a large impact on biodiversity through the management decisions of the production process on their land. Farmers' perceptions of biodiversity and its different values influence their willingness to apply biodiversity-friendly farming practices (Kelemen et al., 2013) for-profit orientation, habitat biodiversity (van Rensburg & Mulugeta, 2016) and conservation strategies (Sardaro et al., 2016). Many farmers perceive biodiversity from a narrow perspective and often excluded the species directly related to plants and their ecosystem (Herzon & Mikk, 2007). Crop biodiversity plays a fundamental role in minimizing the farmers' risk when the available modern varieties are not adaptive to the existing environment and not supported by the applied culture method (Coromaldi, Pallante, & Savastano, 2015). The environmental structure developed to form the agriculture/plant production process might serve a shift semi-natural habitat fragmentation that can negatively affect species richness and abundance of insects (Rizali, Buchori, Susilawati, Pudjianto, & Clough, 2018). It means the intercropping system will be a crucial factor in gaining farm income.

The amount of farmer income from farming activities of both intercropping (polyculture) and monoculture systems are determined by the farmer's preferences in choosing plant types. These will affect the utilization of production factors. In other words, the difference in income between the polyculture and the monoculture system lies in the difference in the diversity of cultivated plant species. The income of highland and lowland farmers is indirectly affected by, not only climatic conditions but also the fluctuating price of agricultural products. In a polyculture system, farmers planted and harvested 2 to 3 different plants from one cultivated land at the same time, with regular planting distance. One plant product would compensate for other products when the price was uncompetitive. The polyculture system also reduces operational costs such as labor and plant maintenance. These would minimize the risk of farmer loss due to price fluctuations and increase the potential benefit through production cost efficiency.

CONCLUSION

Economically, intercropping farming systems increase the farmer's income. Farmer's income derived from the intercropping farming system is higher than the monoculture. In addition, the intercropping farming systems also reduced the farmer's economic loss due to fluctuating product prices. The reduction of operational costs in a polyculture system such as labor and plant maintenance, potentially increase the benefit of the production system through agricultural production cost efficiency.

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REFERENCES

Altieri, M., & Nicholls, C. (2004). *Biodiversity and pest management in agroecosystems* (2nd ed.). CRC Press. Retrieved from https://books.google.co.id/books/about/Biodiversity_and_Pest_Management_in_Agro.html?id=gQI0PCnnbI8C&redir_esc=y

Anderzén, J., Guzmán Luna, A., Luna-González, D. V., Merrill, S. C., Caswell, M., Méndez, V. E., … Mier y Terán Giménez Cacho, M. (2020). Effects of on-farm diversification strategies on smallholder coffee farmer food security and income sufficiency in Chiapas, Mexico. *Journal of Rural Studies*, *77*, 33–46. https://doi.org/10.1016/j.jrurstud.2020.04.001

Bhattacharyya, D., R. Kan & M. Mitra (2020). A non-parametric test for comparison of mean fast lives. *Statistics and Probability Letters*. 161 (June), 108722. https://doi.org/10.1016/j.spl.2020.108722

Bracken, M. E. S. (2019). Monocultures versus polycultures. In *Encyclopedia of Ecology* (2nd ed., pp. 483–486). Oxford, UK: Elsevier. https://doi.org/10.1016/B978-0-12-409548-9.11169-8

Breen, E., F.J. Costa & W.S. Hendon (1986). Annexation: An Economic Analysis:Whether a small village or town should annex adjacent land is a Cost?Revenue Problem. *The American Journal of Economics and Sociology*, *45*, 159-171. https://doi.org/10.1111/j.1536-7150.1986.tb01916.x

Chown, S.L., J.G. Sarensen & J.S. Terblanche (2011). Water loss in Insects: An environmental change perspective. Journal *of Insects Physiology*, 57, 1070-1084. https://doi.org/10.1016/j.jinsphys.2011.05.004

Coromaldi, M., Pallante, G., & Savastano, S. (2015). Adoption of modern varieties, farmers' welfare and crop biodiversity: Evidence from Uganda. *Ecological Economics*, *119*, 346–358. https://doi.org/10.1016/j.ecolecon.2015.09.004

Culliney, T. W., & Pimentel, D. (1986). Ecological effects of organic agricultural practices on insect populations. *Agriculture, Ecosystems and Environment*, *15*(4), 253–266. https://doi.org/10.1016/0167-8809(86)90124-6

Di Bitetti, M. S. (2000). The distribution of grooming among female primates: Testing hypotheses with the shannon-wiener diversity index. *Behaviour*, *137*(11), 1517–1540. https://doi.org/10.1163/156853900502709

Doran, J. W., & Zeiss, M. R. (2000). Soil health and sustainability: Managing the biotic component of soil quality. *Applied Soil Ecology*, *15*(1), 3–11. https://doi.org/10.1016/S0929-1393(00)00067-6

Herzon, I., & Mikk, M. (2007). Farmers' perceptions of biodiversity and their willingness to enhance it through agri-environment schemes: A comparative study from Estonia and Finland. *Journal for Nature Conservation*, *15*(1), 10–25. https://doi.org/10.1016/j.jnc.2006.08.001

Jezeer, R. E., Verweij, P. A., Santos, M. J., & Boot, R. G. A. (2017). Shaded coffee and cocoa – double dividend for biodiversity and small-scale farmers. *Ecological Economics*, *140*, 136–145. https://doi.org/10.1016/j.ecolecon.2017.04.019

Jiménez Aguilar, M., Rodríguez, D. L., Muñoz Estrada, V. F., Cázarez Salazar, S. G., Velarde Félix, J. S., & Méndez Martínez, R. S. (2019). Great diversity of oncogenic human papillomaviruses is revealed in an outbreak of multifocal epithelial hyperplasia. *Journal of the American Academy of Dermatology*, *In Press*. https://doi.org/10.1016/j.jaad.2019.12.041

Jumiyati, S., Arsyad, M., Rajindra, Pulubuhu, D. A. T., & Hadid, A. (2018). Cocoa based agroforestry: An economic perspective in resource scarcity conflict era. *IOP Conference Series: Earth and Environmental Science*, *157*, 012009. https://doi.org/10.1088/1755-1315/157/1/012009

Kelemen, E., Nguyen, G., Gomiero, T., Kovács, E., Choisis, J. P., Choisis, N., … Balázs, K. (2013).

Farmers' perceptions of biodiversity: Lessons from a discourse-based deliberative valuation study. *Land Use Policy*, *35*, 318–328. https://doi.org/10.1016/j.landusepol.2013.06.005

Magurran, A. E. (1988). *Ecological diversity and its measurement*. Dordrecht: Springer. https://doi.org/10.1007/978-94-015-7358-0

Matson, P. A., Parton, W. J., Power, A. G., & Swift, M. J. (1997). Agricultural intensification and ecosystem properties. *Science*, *277*(5325), 504–509. https://doi.org/10.1126/science.277.5325.504

Morgan-Davies, C., Wilson, R., & Waterhouse, T. (2017). Impacts of farmers' management styles on income and labour under alternative extensive land use scenarios. *Agricultural Systems*, *155*, 168–178. https://doi.org/10.1016/j.agsy.2017.04.011

Normansyah, D., Rochaeni, S., & Humaerah, A. D. (2014). Analisis pendapatan usahatani sayuran di kelompok tani jaya, desa Ciaruteun Ilir, kecamatan Cibungbulang, kabupaten Bogor. *Agribusiness Journal*, *8*(1), 29–44. https://doi.org/10.15408/aj.v8i1.5127

Park, M., Shin, S. K., Do, Y. H., Yarish, C., & Kim, J. K. (2018). Application of open water integrated multi-trophic aquaculture to intensive monoculture: A review of the current status and challenges in Korea. *Aquaculture*, *497*, 174–183. https://doi.org/10.1016/j.aquaculture.2018.07.051

Pereira, P. F., Lourenço, R., Lopes, C., Oliveira, A., Ribeiro-Silva, J., Rabaça, J. E., … Marques, J. T. (2019). The influence of management and environmental factors on insect attack on cork oak canopy. *Forest Ecology and Management*, *453*, 117582. https://doi.org/10.1016/j.foreco.2019.117582

Putri, M. P. (2011). Analisis komparatif usahatani tumpangsari jagung dan kacang tanah dengan monokultur jagung di Kabupaten Wonogiri [*Skripsi*]. Surakarta: Fakultas Pertanian, Universitas Sebelas Maret. Retrieved from https://core.ac.uk/download/pdf/12350131.pdf

Reimer, A., Wiebe, K., Kao, J., Yao, B., Gui, Y., Jian, F., … Hu, C. M. (2018). A compact microwave device for monitoring insect activity in grain samples. *Biosystems Engineering*, *175*, 27–35. https://doi.org/10.1016/j.biosystemseng.2018.08.010

Rizali, A., Buchori, D., Susilawati, Pudjianto, & Clough, Y. (2018). Does landscape complexity and semi-natural habitat structure affect diversity of flower-visiting insects in cucumber fields. *AGRIVITA Journal of Agricultural Science*, *40*(1), 107–117. https://doi.org/10.17503/agrivita.v40i0.1722

Sabang, Y., Agus, N., Bulkis, S., & Arsyad, M. (2019). Land equation value of secondary plant polyculture system in high land and low land farmers. *International Journal of Scientific Research in Science and Technology*, *6*(1), 95–99. https://doi.org/10.32628/ijsrst196115

Sardaro, R., Girone, S., Acciani, C., Bozzo, F., Petrontino, A., & Fucilli, V. (2016). Agro-biodiversity of Mediterranean crops: farmers' preferences in support of a conservation programme for olive landraces. *Biological Conservation*, *201*, 210–219. https://doi.org/10.1016/j.biocon.2016.06.033

Spellerberg, I. F., & Fedor, P. J. (2003). A tribute to Claude-Shannon (1916-2001) and a plea for more rigorous use of species richness, species diversity and the "Shannon-Wiener" Index. *Global Ecology and Biogeography*, *12*(3), 177–179. https://doi.org/10.1046/j.1466-822X.2003.00015.x

Stefanescu, C., Herrando, S., & Páramo, F. (2004). Butterfly species richness in the north-west Mediterranean Basin: The role of natural and human-induced factors. *Journal of Biogeography*, *31*(6), 905–915. https://doi.org/10.1111/j.1365-2699.2004.01088.x

Syafiq, M., Nur Atiqah, A. R., Ghazali, A., Asmah, S., Yahya, M. S., Aziz, N., … Azhar, B. (2016). Responses of tropical fruit bats to monoculture and polyculture farming in oil palm smallholdings. *Acta Oecologica*, *74*, 11–18. https://doi.org/10.1016/j.actao.2016.06.005

van Rensburg, T. M., & Mulugeta, E. (2016). Profit efficiency and habitat biodiversity: The case of upland livestock farmers in Ireland. *Land Use Policy*, *54*, 200–211. https://doi.org/10.1016/j.landusepol.2016.01.015

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