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Factors That Influence Orange Farmers Using Mixed Cropping Pattern in Nagori Bandar Purba, Purba District, Simalungun Regency

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Abstract: The problems studied in this study are (1) How much additional income does orange farmers get by using intercropping planting patterns in the research area? (2) What are the business risks that occur in orange intercropping farming in Pura Subdistrict, Simalungun Regency? This study aims to determine what factors make farmers use orange intercropping planting patterns in Bandar Pura Village, Pura Subdistrict, Simalungun Regency. The data used are primary data obtained from intercropping orange farmers with a sample of 30 respondents, secondary data obtained from relevant agencies. The results of the study show that orange production of 15,882 kg received an income of Rp. 190,059,200 with a production cost of Rp. 83,170,162 with an income of Rp. 106,349,683, the feasibility of orange farming with intercropping planting patterns can be calculated by R/C analysis. Based on the research results, the R/C value was 2.23, meaning that each R/C result was 2.0 > 1, indicating that orange farming in Bandar Purba Village, Purba District, Simalungun Regency was profitable and worth developing.

Keywords: Citrus Farming; Feasibility; Intercropping; Planting Pattern.

Introduction

Indonesia is an agricultural country, meaning that agriculture plays a vital role in the overall national economy. This is evident in the large population and workforce living or working in the agricultural sector, as well as in the national products derived from agriculture (Girdziute et al., 2022; Ngadi et al., 2023). Agricultural development is crucial for a developing country like Indonesia (Afriyanti et al., 2023; Anwar, 2022). The rapid development of citrus in Indonesia requires the availability of healthy, disease-free seedlings. One citrus disease that has caused widespread destruction in the history of Indonesian citrus cultivation is huanglongbing, also known in Indonesia as CVPD (Citrus Vein Phloem Degeneration) (Poerwanto et al., 2024; Tuwo et al., 2024).

According to data from the Central Statistics Agency (BPS), in 2014, citrus productivity in North Sumatra reached 513,677 tons/ha, the second highest after East Java, with 592,328 tons (Hanif et al., 2025). Simalungun Regency is one of the citrus production centers in North Sumatra. In 2013, the citrus plantation area in Simalungun Regency reached 1,174 hectares, with production reaching 53,636 tons of Siamese and large oranges.

As a commodity with high economic value, citrus development deserves significant attention given its significant contribution (Aswal et al., 2025). Simalungun Regency is one of several regions in North Sumatra that still relies heavily on the agricultural sector. This is understandable, considering that approximately 90% of the Regency's 268,780 residents earn their living in this sector. This is due to its geographical conditions, which are highly conducive to agriculture (BPS, 2021).

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Limited land and planting areas force farmers to increase production per citrus plot (Onodera et al., 2021; Peter & Umweni, 2021). Every effort is made to increase citrus productivity. Monoculture cultivation carries a high risk, necessitating business diversification so that farmers do not rely solely on citrus yields (Chen et al., 2023; Fan et al., 2025). One approach is polyculture, which involves intercropping horticultural crops with citrus plants, which can also reduce the risk of crop failure.

Based on the explanations above, the author is interested in conducting research through writing a thesis entitled: "Factors Influencing Citrus Farmers' Use of the Intercropping Pattern in Bandar Purba Village, Purba District, Simalungun Regency." In relation to the background and identification of the problem, the research objectives that occurred in Tumpangsari with orange monoculture efforts in Purba District, Simalungun Regency can be formulated.

Method

Research Area Determination Method

This research was conducted in Purba District, Simalungun Regency. This area was selected purposively because farmers in this district generally use an intercropping system, particularly for horticultural and citrus crops. This area is also close to the researcher's residence, making data collection easier due to its proximity. This area also has the potential to produce citrus and various horticultural commodities.

Sampling Method

The sampling method was purposive (Permatananda & Pandit, 2023), drawn from the Bandar Purba Village, Purba District, Simalungun Regency, with varying areas of citrus and horticultural crops. Purba District has 14 villages.

In this study, the sample villages were villages engaged in horticultural crops within Purba District. Based on these considerations, one of 14 villages from Purba District was selected as the research village: Bandar Purba Village. Bandar Village operates citrus plantations based on the largest land area with various cropping patterns (polyculture and monoculture).

Singarimbun & Effendi (1999) stated that the sample size for analysis must follow a normal distribution, with samples categorized as having a normal distribution greater than or equal to 30 respondents. In this study, a sample of 30 respondents was selected from one selected village using a purposive sampling technique.

Table 1. Number of Polyculture and Monoculture Farmers in Purba District, Simalungun Regency.

Nagori	Farmers Use Intercropping Pattern
Bandar Purba	30 Family
Amount	30 Family

To determine the population and sample size of intercropping and monoculture farmers in Purba District, see Table 1.

Data Collection Method

The data collected consisted of primary and secondary data. Primary data were obtained through direct interviews with farmer respondents using a pre-prepared questionnaire. Secondary data were obtained from the Simalungun Regency Central Statistics Agency, the Simalungun Regency Plantation Service, and related agencies, as well as literature and other sources relevant to this research. The secondary data collected covered regional conditions, population status, and agricultural production.

Data Analysis Method

To test Hypotheses 1 and 3, analysis of variance (ANOVA) was used to test the hypothesis about the difference between two or more population means. Test Criteria: If F-count > F-crit, then Ho is rejected and H_1 is accepted, indicating a difference between two or more population means. $\mu 1$ = Average of variable 1 (polyculture farming pattern); $\mu 2$ = Average of variable 2 (monoculture farming pattern). Hypothesis 2 was tested using descriptive analysis to analyze the business risks encountered in horticultural polyculture (chili, eggplant, mustard greens) and Arabica coffee businesses to identify the most profitable business types.

Result and Discussion

Nagori Bandar Purba is located in Purba sub-district, Simalungun Regency, North Sumatra Province, the village is a highland village with an altitude of 1,932 meters above sea level. Nagori Bandar Purba is located at coordinates 03º03'13.7" North Latitude and 99º13'42.2" East Longitude, the orbital distance from Nagori Bandar Purba to the sub-district office is 10 km. This village covers an area of 3,000 hectares, divided into four villages. Bandar Purba Village borders the following villages: North, Dolog Silau Village; South, Danau Toba Village; East, Raya District; and West, Silima Huta Village

Land Use

Most of the land in Bandar Purba Village is used for agriculture. Table 2 shows the land area in Bandar Purba

Village based on its function. Bandar Purba Village covers an area of 2,932 hectares, consisting of 2,200 hectares of agricultural land, 700 hectares of housing/settlements, one village head office, one community health center, three preschools, and four elementary schools. Bandar Purba has an elevation of 1,392 meters above sea level, gray clay soil, and an average slope of 25°. The village has a hilly topography covering 520 hectares, 26 hectares of swamps, and 25 hectares of streams. The number of rainy months in Bandar Purba Village per year is six months, with an average daily temperature of 21°-27°C.

Table 2. Land Use in Bandar Purba Village, Purba District, Simalungun Regency

Land Types by Function	Unit	Area (ha)	Percentage %
Cultivation	-	2200	92.01
Housing/Settlements	-	700	29.28
Social		-	0.02
Village Offices/Halls	1	0.5	0.02
Health Centers/Auxiliary Offices	2	0.5	0.08
Early Childhood Education	3	2	0.08
Elementary Schools	2	2	0.06
Churches	4	1.5	0.00
Public Roads	-	8	0.33
Irrigation Channels	-	14	0.59
Fields	3	5	0.21

Source: Office of Pangulu Bandar Purba

Description of Research Objects and Respondent Characteristics

The research subjects in this study were monoculture and intercropping citrus farmers in Bandar Purba Village, Purba District, Simalungun Regency. A total of 30 farmers (respondents) were selected. The characteristics of monoculture and intercropping citrus farmers were analyzed in terms of age, education, occupation, number of dependents, experience, and cropping system (Jacobi et al., 2025; Martin-Gorriz et al., 2022).

Respondent Characteristics

The respondent characteristics taken from this study consisted of age, education, occupation, number of dependents, experience, and land area. These are illustrated in the Table 3.

Table 3. Respondent Characteristics Based on Age, Education, Occupation, Number of Dependents, Experience, and Land Area.

Description	Interval	Average
Age (years)	38 – 66	50.2
Education (years)	9 – 16	11.4
Experience (years)	6 -15	8.2
Number of Dependents (persons)	1-5	3.3
Land Area (rante)	10-25	15.5

Based on Table 3, the average age of all respondents was 50.2, education level 11.4, experience 8.2, number of dependents 3.3, and land area 15.5.

Labor Force

Labor is any person capable of performing work to produce goods or products to meet their own or the community's needs. Table 4 shows the labor force employed in citrus farming.

Table 4. Labor Force in Citrus Farming

Type of Activity	Amount HK/UT	Amount HK/ha
Weed Control	29	46,98639
Pest Control	117	189,5658
Fertilization	26	42,12573
Harvesting	49	79,3908
Quantity	221	358,0687

Table 4 shows that the largest labor expenditure in intercropping citrus farming is pest control, with 117 workers employed. Income is a person's source of income to meet daily needs and is crucial for their survival and livelihood, both directly and indirectly (Puspitasari et al., 2024; Wibisono et al., 2024; Yanuartati et al., 2023). Pest control in citrus using mixed cropping has been proven to reduce pest attacks and increase yields. This cropping pattern utilizes plant diversity to naturally suppress pest populations and reduce reliance on chemical pesticides. Intercropping increases plant diversity in the field, making it more difficult for pests to find their primary hosts and reducing their populations. This diversity also supports the presence of natural enemies of pests, such as predators and parasitoids, which help suppress pest populations (Boldorini et al., 2024; Kheam et al., 2024; Malá et al., 2020; Perrin, 1976; Tooker & Frank, 2012).

Conclusion

Based on the research that has been done, the following conclusions can be drawn: The income from intercropping orange farming is Rp. 5,717,760,000 with an average income of Rp. 190,592,000 per year with production costs incurred of Rp. 2,527,269,509 with an

average cost of Rp. 84,242,316 per farmer per year. Intercropping orange farming in Nagori Bandar Purba, Pamatang Purba District, Simalungun Regency, is profitable but not yet feasible to be developed because the R/C value of monoculture and intercropping orange farming is 2.26>1 for every expenditure of Rp. 1 will provide an income of Rp. 2.26. Simultaneously, the variables studied have an influence on monoculture and intercropping orange farming and of the 3 variables studied, partially affect income.

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Author Contribution
This paper wrote by single author to complete this paper finished.

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Conflicts of Interest
The authors declare no conflict of interest.

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