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Integrated Yard Farming Patterns and Their Contribution to Household Income and Food Consumption in Peri-Urban Nganjuk, East Java

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Abstract

Purpose of Study: This study examines integrated yard farming patterns in peri-urban Nganjuk, East Java, and analyzes their contribution to household cash income, food consumption, and non-cash socio-economic benefits. The study positions yard farming as a household-scale integrated farming practice that combines subsistence production, informal exchange, and supplementary income generation.
Methodology: A descriptive survey-based approach was used, supported by field observations and household interviews conducted in 2023. The study involved 150 households with productive yard areas in peri-urban settlements of Nganjuk District. All respondents were selected using stratified random sampling based on yard size. The analysis relied on aggregated field records and tabulated survey results, focusing on commodity diversity, household use of yard products, production costs, cash income, and consumption benefits.
Main Findings: Household yards were used to cultivate vegetables, fruit trees, tubers, medicinal plants, ornamental plants, raise livestock, and maintain fishponds. Most vegetables and fruits were mainly used for household consumption, shared with neighbors or relatives, or exchanged informally. Cash income was primarily generated from commodities with higher marketable surplus, such as livestock, fish, and fruits harvested in larger quantities. Thus, the value of yard farming was reflected not only in cash income but also in food consumption benefits and reduced household food expenditure.
Novelty/Originality of This Study: This study contributes to the literature by distinguishing cash income, household consumption benefits, and informal social exchange in assessing the value of integrated yard farming in peri-urban households.

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INTRODUCTION

Background of the study:
Household yards remain an important agricultural space in many rural and peri-urban communities. Although they are often small and located around residential areas, yards can function as productive spaces for cultivating vegetables, fruit trees, tubers, medicinal plants, ornamental plants, raising livestock, and maintaining fishponds. In household livelihood systems, yard farming is not only related to agricultural production but also to food provisioning, expenditure saving, informal exchange, and supplementary income generation.
Home gardens and yard farming have been widely recognized as household-level food production systems that can improve access to diverse food sources. They may provide vegetables, fruits, herbs, spices, and animal-based food products that complement food purchased from markets. Previous studies have shown that home gardens are associated with improved food security and dietary diversity because they increase access to diverse and nutritious foods (Rammohan, Pritchard and

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Dibley, 2019). Food security in East Java is closely related not only to food availability but also to household access to food, making household-level food provisioning strategies increasingly relevant (Lisanty *et al.*, 2021). In Indonesia, home food gardening has also been promoted as a strategy to support household food security, particularly through its contribution to food availability, access, and utilization (Saediman *et al.*, 2021).

The role of home gardens is also closely related to biodiversity and household resilience. Korpelainen (2023) explains that home gardens can support food and nutritional security while conserving plant genetic resources and underutilized crops. However, home gardens do not automatically guarantee household food security. Du Toit et al. (2022) found that home gardens may fail to improve food security and dietary diversity when the garden space is not effectively used for food production or when households remain highly dependent on purchased food. This means that the contribution of yard farming depends on household management, crop selection, land availability, and the way products are used.

In peri-urban areas, yard farming has a distinctive role because households often live between urban and rural livelihood systems. Some households depend on non-farm employment, trading, or formal occupations, while still maintaining agricultural practices in their residential spaces. Urban and peri-urban agriculture has multifunctional value because it can contribute to food security, livelihood resilience, environmental benefits, and social well-being (Armanda, Guinée and Tukker, 2019; Lucertini and Di Giustino, 2021; Rao *et al.*, 2023). Urban agriculture has been increasingly recognized for its contribution to food security, sustainability, health, and socio-cultural benefits in urbanizing regions (Armanda, Guinée and Tukker, 2019; Audate *et al.*, 2019; Appolloni *et al.*, 2021; Ilieva *et al.*, 2022). Therefore, yard farming in peri-urban areas should not be viewed only as a traditional practice, but also as a household strategy for responding to food, economic, and land-use pressures.

In Nganjuk District, East Java, household yards are commonly used for various farming activities, including vegetables, fruit trees, medicinal plants, ornamental plants, chickens, goats, and fish. These activities indicate the presence of an integrated yard farming system at the household level. However, the economic value of this system cannot be understood solely from market sales. In practice, many vegetables and fruits produced in household yards are primarily used for family consumption, shared with neighbors or relatives, or exchanged informally. Cash income is usually generated only from commodities with marketable surplus, such as livestock, fish, and fruits harvested in larger quantities.

This condition shows that yard farming in peri-urban Nganjuk operates along a continuum between subsistence farming and semi-commercial household agribusiness. Therefore, the contribution of yard farming should be assessed not only from cash income, but also from food consumption benefits, reduced household food expenditure, and informal social exchange.

Literature review:

Home gardens and yard farming systems have long been discussed as important components of household food systems. They are generally characterized by species diversity, intensive household labor use, and close connection with household food needs. Rammohan et al. (2019) found that access to home gardens was associated with enhanced dietary diversity and food security among rural households in Myanmar. Similarly, Saediman et al. (2021) reviewed the contribution of home food gardening programs in Indonesia and concluded that home gardening can support food availability, access, and utilization, although maintaining food stability requires continuity and household commitment. Home garden studies in different regions also show that plant diversity, household management, and agro-biodiversity are closely related to food security and household resilience (Castañeda-Ccori *et al.*, 2020; Sharma, Mina and Kumar, 2022; Korpelainen, 2023; Yaregal and Sime, 2024).

Besides food provisioning, yard farming can contribute to household welfare through income generation and expenditure saving. However, its contribution to cash income is not always large because many households use yard products primarily for self-consumption rather than sale. Irham et al. (2021) found that home-garden farming in Yogyakarta City contributed only 0.81% to household income. This relatively small contribution was related to narrow land size and the fact that production was mainly intended for household use rather than commercial purposes. This

finding is highly relevant for understanding yard farming as a semi-subsistence activity whose value cannot be measured only through cash income.

Home gardens may also shift toward commercialization when households respond to market opportunities. Abdoellah et al. (2020) showed that some households in rural Indonesia transformed land around their dwellings into income-generating spaces by planting commercial crops for urban and processing markets. However, commercialization may also change the role of home gardens in food security and food sovereignty. Therefore, the relationship between yard farming, household consumption, and income generation must be examined carefully, especially in areas where household production is not fully commercial. In Indonesia, home gardens have socio-ecological functions, including food provision, medicinal plant use, cultural value, and ecological conservation (Abdoellah *et al.*, 2020; Suwartapradja *et al.*, 2023).

The concept of integrated farming system is also relevant for understanding yard farming. Integrated farming systems emphasize the interconnection among crops, livestock, fish, organic waste, family labor, and local resources. Shanmugam et al. (2024) explained that crop–livestock integrated farming systems can improve agricultural production, nutritional security, and environmental sustainability through more efficient resource use. At the household level, integration may occur in simple but meaningful forms, such as using kitchen waste or crop residues as animal feed, using livestock manure as organic fertilizer, and combining vegetable production with livestock or fish farming.

In peri-urban settlements, this integration is usually informal and small in scale. Nevertheless, it reflects the basic principles of integrated farming: diversification, resource recycling, risk reduction, and household resilience. Yard farming can therefore be interpreted as a household-scale integrated farming system that combines subsistence food production, informal sharing, and limited market-oriented activities.

Gap analysis:

Previous studies have widely examined home gardens and yard farming in relation to food security, dietary diversity, biodiversity conservation, sustainability, and household income (Rammohan, Pritchard and Dibley, 2019; Abdoellah *et al.*, 2020; Saediman *et al.*, 2021; Korpelainen, 2023). Other studies have emphasized the multifunctional role of urban and peri-urban agriculture in supporting food systems, environmental benefits, and community resilience (Armanda, Guinée and Tukker, 2019; Lucertini and Di Giustino, 2021; Rao *et al.*, 2023). However, several research gaps remain.

First, many studies tend to discuss the contribution of home gardens either from the perspective of food security or household income, but fewer studies clearly distinguish between products used for household consumption, products shared or exchanged informally, and products sold for cash income. This distinction is important because yard farming in peri-urban communities often operates as a semi-subsistence and semi-commercial system rather than a fully market-oriented enterprise.

Second, previous studies often discuss home gardens as a general household practice without sufficient attention to how yard size shapes farming patterns. In reality, households with smaller yards may focus on vegetables, medicinal plants, ornamental plants, and small livestock, while households with larger yards may have more opportunities to integrate fruit trees, goats, and fishponds. Yard size therefore influences not only commodity diversity but also the possibility of producing marketable surplus.

Third, studies on integrated farming systems often focus on larger agricultural land or farm-level integration, while household yard integration remains less explored. In peri-urban areas, integration among crops, fruit trees, livestock, and fish may occur within limited residential spaces, making it important to understand how households manage these resources for food consumption, informal exchange, and supplementary income.

Rationale of the study:

Nganjuk District provides a relevant setting for examining integrated yard farming in a peri-urban context. As the administrative center of Nganjuk Regency, the area has urban characteristics, but several residential settlements still retain semi-rural features. Many households still have yard spaces that can be used for small-scale agricultural activities, including vegetables, fruit trees, medicinal plants, livestock, goats, and fishponds.

The rationale of this study is based on the need to understand yard farming beyond a purely commercial perspective. In the study area, household yard products, particularly vegetables and fruits, are often used for family consumption, shared with neighbors or relatives, or exchanged informally. Only certain commodities, such as livestock, fish, and fruits produced in larger quantities, are commonly sold and recorded as cash income. Therefore, assessing yard farming only through sales revenue may underestimate its real contribution to household welfare.
By distinguishing between cash income and consumption benefits, this study offers a more realistic understanding of the economic and social value of yard farming. This perspective is important for designing agricultural extension programs, food security interventions, and peri-urban agribusiness strategies that fit the actual practices of households.

Purpose or Hypotheses of the study:
Based on the background, literature review, and gap analysis, this study aims to:

1. identify the patterns of household yard utilization in peri-urban Nganjuk District;
2. analyze the types of commodities that contribute to household consumption, informal exchange, and cash income;
3. examine the contribution of integrated yard farming to household cash income and food consumption benefits; and
4. formulate implications for developing yard farming as a household-scale integrated farming system in peri-urban areas.

METHOD

Research Design:
This study used a descriptive survey-based research design supported by field observations and household interviews. The design was selected to describe existing integrated yard farming practices, commodity diversity, household product utilization, and the contribution of yard farming to cash income and food consumption benefits. Since the study focused on describing household yard farming patterns rather than testing causal relationships, the analysis was conducted using descriptive statistics and qualitative interpretation of field information.
The study was conducted in peri-urban settlements of Nganjuk District, the administrative center of Nganjuk Regency, East Java, Indonesia. Nganjuk District was selected because it represents a transition area between urban residential development and semi-rural household agricultural practices. Although located near the urban center, several households in the area still maintain productive yard spaces for cultivating vegetables, fruit trees, medicinal plants, ornamental plants, raising livestock, and maintaining fishponds.
The study area was considered relevant for examining integrated yard farming because household yards were still used as spaces for food production, informal exchange, and supplementary income generation. This condition reflects the character of peri-urban agriculture, where residential land may still support small-scale farming activities alongside non-farm livelihoods.

Participant:
The participants of this study were households that owned or managed yard areas and practiced one or more forms of yard farming. Yard farming activities included cultivating seasonal vegetables, tubers, fruit trees, medicinal plants, ornamental plants, raising free-range chickens, ducks or geese, goats, and maintaining fishponds.
The household was used as the unit of analysis because decisions related to yard farming were generally influenced by household food needs, labor availability, yard size, production costs, and opportunities to consume, share, exchange, or sell yard products.

Population and the methods of sampling Instrumentation:
The target population consisted of households in Nganjuk District that had sufficient yard space for household-scale farming activities. Based on the original field records, 2,940 households were identified as having yard areas suitable for productive use. From this population, 150 households were selected as respondents.

The sampling method used was stratified random sampling based on yard size (Cochran, 1977; Etikan and Bala, 2017). Stratification was applied because yard size influences the possible combination of crops, fruit trees, livestock, and fish farming activities that can be practiced by households. Smaller yards tend to be more suitable for vegetables, medicinal plants, ornamental plants, polybags, and small livestock, while larger yards provide more opportunities for fruit trees, goats, fishponds, and commodities that may generate marketable surplus.
The sample was intended to describe yard-farming households in peri-urban Nganjuk District. Therefore, the findings should be interpreted as descriptive evidence of integrated yard farming practices among selected households with productive yard spaces, rather than as a representation of all households in Nganjuk Regency.

Instrument:
The study used household questionnaires, interview guides, field observation sheets, and field notes. The questionnaire was used to collect information on yard size, types of crops cultivated, fruit trees grown, livestock raised, fish farming activities, production costs, products sold, and estimated benefits from yard products.
The interview guide was used to obtain additional information about how households used their yard products, especially whether the products were consumed by household members, shared with neighbors or relatives, exchanged informally, or sold for cash income. Field observation sheets were used to verify the types of yard farming activities practiced by the respondents and to support the interpretation of survey responses.
The main variables observed in this study included yard-size category, commodity diversity, product utilization, production cost, revenue from sold products, cash income, and food consumption benefits.

Procedures and if relevant, the time frame:
Data collection was conducted throughout 2023 through household surveys, direct observations, and interviews with selected respondents (Kothari, 1990; Creswell, 2009). The survey documented the types of commodities cultivated or raised in household yards. Interviews explored the purpose of yard farming and the flow of yard products, including consumption, sharing, barter, and sale.
The fieldwork began with identifying households that had yard areas suitable for productive use. Respondents were then selected based on yard-size stratification. After respondent selection, household surveys and observations were conducted to document yard farming activities. Interviews were used to clarify how the products were utilized and whether they contributed to household consumption, informal exchange, or cash income.
This article uses aggregated field records and tabulated survey results from the 2023 fieldwork. The individual-level raw dataset was no longer available for re-analysis; therefore, the study focuses on descriptive interpretation of the documented findings.

Analysis plan (describe statistical tests and the comparisons made; ordinary statistical methods should be used without comment; advanced or unusual methods may require a literature citation):
The data were analyzed using descriptive statistics, including frequencies, percentages, and average values (Pallant, 2020; Field, 2024). Commodity diversity was described based on the proportion of households cultivating or raising each type of plant, livestock, or fish. Yard farming patterns were interpreted by comparing farming activities across different yard-size categories.
The economic contribution of yard farming was analyzed by distinguishing between cash income and food consumption benefits. Cash income refers to income obtained from yard products that were actually sold by households, such as livestock, fish, or fruits harvested in relatively large quantities. Food consumption benefit refers to the estimated non-cash value of yard products used for household consumption, shared with neighbors or relatives, or exchanged informally.
This distinction was important because most vegetables and fruits produced in household yards were not primarily intended for sale. Instead, they were mainly used to meet household food needs, reduce food expenditure, or maintain social exchange with nearby relatives and neighbors. Therefore, the value of yard farming was interpreted not only from revenue and cash income but also from its contribution to household food consumption and non-cash benefits.

The basic income calculation followed the common farm income approach:
Revenue = Value of products sold
Production Cost = Total cost of inputs and maintenance
Cash Income = Revenue − Production Cost
Food Consumption Benefit = Estimated value of products consumed, shared, or exchanged informally
In this study, revenue was calculated from yard farming products that were actually sold. Production costs included expenses related to seeds, feed, inputs, maintenance, and other relevant production activities. Cash income was calculated as the difference between revenue and production cost. Food consumption benefit was interpreted as the non-cash value obtained from products that supported household food consumption or informal exchange.

Scope and/or limitations of the methodology you used:
The scope of this study was limited to yard-farming households in peri-urban Nganjuk District. The findings should therefore be interpreted as descriptive evidence of integrated yard farming practices in the study area, rather than as a general representation of all households in Nganjuk Regency or East Java Province.
The study also has several methodological limitations. First, the analysis relied on aggregated field records and tabulated survey results from fieldwork conducted in 2023. Since the individual-level raw dataset was no longer available, this study did not conduct regression analysis, inferential statistical testing, or mathematical optimization. Second, the estimation of food consumption benefits was based on documented field records and household information, so it should be interpreted as an indicative value rather than a precise market valuation. Third, the study focused on household yard farming practices and did not compare them with larger agricultural land-based farming systems.
Despite these limitations, the available data remain useful for describing integrated yard farming patterns, identifying the role of yard products in household consumption and informal exchange, and explaining the contribution of yard farming to supplementary cash income among households in peri-urban Nganjuk.

RESULTS AND DISCUSSION

Results:

Characteristics of Yard Farming in Peri-Urban Nganjuk

The study found that household yards in peri-urban Nganjuk were used for diverse productive activities, including vegetable cultivation, fruit trees, medicinal plants, ornamental plants, livestock raising, and fish farming. Although Nganjuk District is the administrative centre of Nganjuk Regency, several residential areas still maintain semi-rural characteristics. These characteristics can be seen from the continued use of household yards for food production, small-scale livestock keeping, and informal agricultural activities around the house.
Yard farming in the study area was not practiced as a fully commercial farming system. Instead, it functioned as a household-scale production system that supported food consumption, informal exchange, and supplementary cash income. Households used their yards according to available land, family labour, food preferences, farming experience, and the opportunity to sell surplus products. This pattern is consistent with previous studies showing that home gardens and household food gardens may contribute to food security, dietary diversity, and household resilience, although their contribution depends on household management and land availability (Rammohan, Pritchard and Dibley, 2019; Saediman *et al.*, 2021; Du Toit *et al.*, 2022).
In general, households with smaller yards tended to cultivate vegetables, medicinal plants, ornamental plants, and small livestock. Households with larger yards had more opportunities to integrate fruit trees, goats, fishponds, and other commodities that could produce marketable surplus. Thus, yard size influenced both commodity diversity and the potential economic contribution of yard farming.

Diversity of Yard Farming Commodities

The respondents cultivated and raised diverse commodities in their household yards. These included vegetables, tubers, legumes, fruit trees, medicinal plants, ornamental plants, livestock, and fish. The diversity of commodities shows that yard farming in peri-urban Nganjuk reflects a household-scale integrated farming system.

Table 1. Diversity of Plants and Animals in Respondents' Yards

No.	Variety of Plants/Animals	Percentage (%)
1	**Vegetables**	
	Spinach	66.67
	Choy sum / bok choy	46.67
	Water spinach	40.00
	Lemon basil	73.33
	Cosmos	50.00
	Cucumber	26.67
	Eggplant	36.67
	Chili	33.33
	Tomato	20.00
	Asparagus bean	26.67
2	**Tubers**	
	Cassava	33.33
	Sweet potato	26.67
	Taro / elephant foot yam	53.33
3	**Legumes**	
	Peanut	20.00
4	**Fruit Plants**	
	Papaya	93.33
	Banana	100.00
	Guava	33.33
	Longan	30.00
	Star fruit	23.33
	Jackfruit	70.00
	Pitaya / dragon fruit	60.00
	Soursop	30.00
	Sapodilla	16.66
	Mango	86.67
	Coconut	83.33
	Rambutan	13.33
5	**Herbs and Medicinal Plants**	
	Ginger	73.33
	Turmeric	66.67
	Curcuma	53.33
	Lemongrass	40.00
	Piper betle	30.00
	Noni	56.66
	Aloe vera	63.33
6	Ornamental plants	100.00
7	**Animal Husbandry and Fish Farming**	
	Free-range chicken	93.33
	Goat	66.67
	Muscovy duck or goose	30.00
	Catfish	26.67
	Gourami	13.33
	Tilapia	30.00

Source: Aggregated primary data, 2023

Table 1 shows that banana was found in all respondents' yards, followed by papaya, free-range chicken, mango, coconut, lemon basil, ginger, jackfruit, turmeric, aloe vera, and goat. These findings indicate that yard farming was dominated by commodities that were easy to maintain, useful for household consumption, and culturally familiar to local households.

Vegetables such as lemon basil, spinach, cosmos, choy sum, and water spinach were widely cultivated because they are commonly used in daily meals and can be harvested repeatedly. Medicinal plants such as ginger, turmeric, curcuma, lemongrass, noni, and aloe vera were also commonly grown because they are traditionally used for household health needs. Fruit trees, especially banana, papaya, mango, coconut, jackfruit, and dragon fruit, played an important role because they provided food for household consumption and, in some cases, could generate cash income when harvested in larger quantities.

Livestock and fish farming were also important components of the yard farming system. Free-range chickens were found in most households, while goats were commonly raised by households with more available yard space. Fish farming, including catfish, tilapia, and gourami, was found in households that had sufficient space and water access. The combination of crops, fruit trees, livestock, and fish reflect the basic principles of integrated farming systems, which emphasize diversification, resource use efficiency, and household resilience (Shanmugam *et al.*, 2024; Sharma *et al.*, 2024).

Yard Farming Patterns Based on Yard Size

The use of household yards differed according to yard size. Smaller yards were generally used for vegetables, medicinal plants, ornamental plants, and small livestock. These activities required relatively limited space and could be managed using simple techniques such as pots, polybags, and direct planting around the house. Medium-sized yards allowed households to combine vegetables, medicinal plants, fruit trees, chickens, ducks, and limited livestock activities. Larger yards provided more opportunities for fruit trees, goats, fishponds, and commodities that could generate marketable surplus.

Figure 1 provides a visual explanation of how households allocated limited yard space for different farming components. In smaller yards, farming activities were concentrated on plants and small animals that required less space. In larger yards, the system became more diversified, allowing households to combine plants, livestock, and fish. This pattern supports previous evidence that home-garden farming in urban and peri-urban areas is often shaped by land availability, household purpose, and the extent to which production is intended for consumption or sale (Eigenbrod and Gruda, 2015; Irham *et al.*, 2021; Lin *et al.*, 2024).

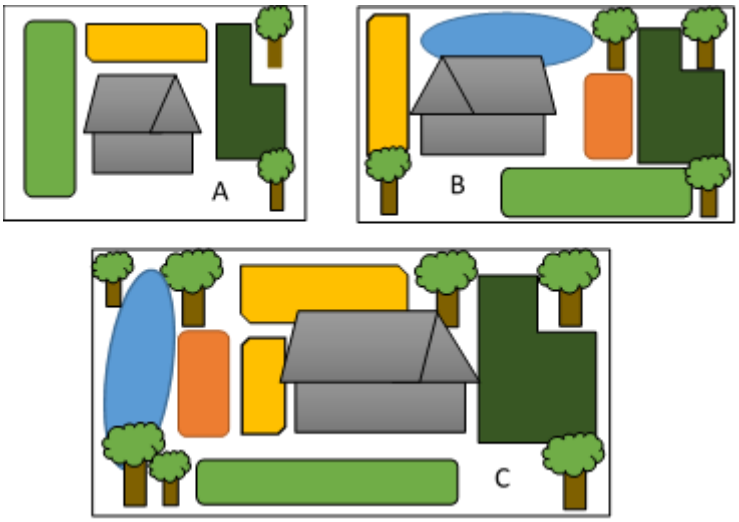

Figure 1. Yard Utilization Based on Area
(A) Less than 18 m^2, (B) 20–30 m^2, and (C) 30–50 m^2

Note: Light green = vegetables; yellow = animal husbandry; orange = legumes; dark green = tubers, medicinal plants, and ornamental plants; blue = fishpond; trees = fruit plants.
Source: Field observation and authors' illustration, 2023

Contribution to Cash Income and Food Consumption Benefits

The economic contribution of yard farming was analyzed by distinguishing between revenue, production cost, cash income, and food consumption benefit. Revenue refers to the value of products that were actually sold. Production cost includes expenses related to inputs, feed, seeds, maintenance, and other farming activities. Cash income refers to revenue minus production cost. Food consumption benefit refers to the estimated value of yard products consumed by the household, shared with neighbors or relatives, or exchanged informally.

Table 2. Average Monthly Cash Income and Consumption Benefits from Yard Farming

No.	Yard Area	Revenue (IDR/month)	Production Cost (IDR/month)	Cash Income (IDR/month)	Consumption Benefit (IDR/month)
1	< 18 m^2	333,571	253,096	80,475	320,500
2	18–30 m^2	473,400	323,156	150,244	540,500
3	> 30 m^2	464,875	311,146	153,729	650,000

Source: Aggregated primary data, 2023

Table 2 shows that cash income from yard farming was relatively modest, but the consumption benefit was higher than cash income across all yard-size categories. Households with yards of less than 18 m^2 obtained an average monthly cash income of IDR80,475 and a consumption benefit of IDR 320,500. Households with yards of 18–30 m^2 obtained an average monthly cash income of IDR 150,244 and a consumption benefit of IDR 540,500. Meanwhile, households with yards of more than 30 m^2 obtained an average monthly cash income of IDR153,729 and a consumption benefit of IDR 650,000.

These findings indicate that the main value of yard farming was not only in product sales but also in the non-cash benefits obtained by households. Larger yards tended to generate higher consumption benefits because they allowed households to cultivate more diverse crops, maintain fruit trees, raise livestock, or develop fishponds. When consumption benefits are considered, yard farming becomes more significant as a household food and welfare strategy. This supports previous studies showing that home-garden farming may contribute only a small share to household cash income when production is mainly intended for household use rather than market sale (Irham *et al.*, 2021; Saediman *et al.*, 2021).

Discussion:

Yard Farming as Household Food Provisioning

The findings show that integrated yard farming in peri-urban Nganjuk played an important role in household food provisioning. Vegetables, fruits, tubers, medicinal plants, livestock, and fish provided households with diverse food sources. Although not all products were sold, they contributed to household food availability and reduced dependence on purchased food.

This role is consistent with the function of home gardens as household food systems. Rammohan et al. (2019) found that home gardens can enhance dietary diversity and food security by increasing access to diverse food sources. In the Nganjuk case, yard farming supported food consumption through vegetables such as spinach, lemon basil, water spinach, choy sum, eggplant, chili, and tomato; fruits such as banana, papaya, mango, coconut, and jackfruit; and animal protein from chicken, fish, and goat. These commodities may not always generate high cash income, but they are valuable for daily consumption and household food resilience.

Yard Farming as Informal Social Exchange

Yard farming also supported informal social exchange. Vegetables and fruits were not always sold. In many cases, they were consumed by the family, shared with neighbors or relatives, or exchanged informally. This practice reflects the social function of yard farming in peri-urban communities.

Informal sharing and exchange strengthen neighborhood relationships and create non-market food flows. Porter (2018) emphasized that home and community gardens provide benefits beyond food production, including cultural services, social connection, and broader community value. In peri-urban Nganjuk, sharing vegetables, fruits, and medicinal plants can be interpreted as part of social reciprocity among households. Although these benefits are difficult to measure in monetary terms, they contribute to household welfare and community resilience. Similar evidence from community garden studies indicates that gardens provide not only food but also social, psychosocial, and community-level benefits (Hume *et al.*, 2022; Litt *et al.*, 2023).

Yard Farming as Supplementary Cash Income

Cash income from yard farming was mainly generated from commodities that had marketable surplus. In the study area, these included livestock, fish, and fruits harvested in relatively large quantities. This shows that yard farming functioned as a supplementary income source rather than the main livelihood.

The modest level of cash income is not necessarily a weakness. Instead, it reflects the semi-subsistence character of household yard farming. Irham et al. (2021) also found that home-garden farming in Yogyakarta contributed only a small proportion to household income because production was primarily for household use. Therefore, yard farming should not be evaluated only by its ability to generate cash income. Its contribution to food consumption, reduced expenditure, and household resilience should also be considered.

Yard Farming as a Household-Scale Integrated Farming System

The diversity of crops, fruit trees, livestock, and fish indicate that yard farming in peri-urban Nganjuk can be understood as a household-scale integrated farming system. The integration was not always formally designed, but it occurred through the coexistence of multiple farming components within the household yard.

At the household level, integration may occur through simple resource flows. Kitchen waste and crop residues can be used as feed for chickens or goats. Livestock manure can be used as organic fertilizer for plants. Fruit trees provide shade and food, while fishponds add protein sources and potential income. Such practices reflect the principles of integrated farming systems, which emphasize diversification, resource recycling, and efficient use of limited resources (Shanmugam *et al.*, 2024). Recent reviews emphasize that integrated farming systems and crop–livestock integration can support resource recycling, farm resilience, income diversification, and circular agricultural development (Bhagat *et al.*, 2024; Shanmugam *et al.*, 2024; Swastika *et al.*, 2024).

The Nganjuk case shows that integrated farming does not always require large agricultural land. Even in peri-urban residential areas, households can apply small-scale integration according to yard size and household capacity. This finding is important for agribusiness and integrated farming system studies because it expands the understanding of integrated farming from farm-level production to household-level livelihood strategies.

Peri-Urban Agribusiness Implications

The findings have implications for peri-urban agribusiness development. Yard farming should not be forced into a fully commercial model because many households use yard products mainly for consumption and social exchange. A more suitable approach is a subsistence-plus model. In this model, the first function of yard farming is to support household food consumption. The second function is to strengthen social exchange and reduce food expenditure. The third function is to generate cash income from surplus or marketable commodities.

Agricultural extension programs can use this model to design more realistic yard farming interventions. Households with small yards can be encouraged to cultivate vegetables, medicinal plants, and ornamental plants using pots, polybags, and vertical gardening. Households with medium-sized yards can integrate vegetables, fruit trees, chickens, and ducks. Households with larger yards can develop goats, fishponds, and fruit trees that may generate marketable surplus.

This approach is more appropriate than viewing all yard farming households as commercial producers. It recognizes that household farming decisions are shaped by land size, labor availability, food needs, social relationships, and market opportunities.

Implications:
This study implies that integrated yard farming in peri-urban Nganjuk can be developed as a household food security and micro-agribusiness strategy. Previous agricultural studies in Nganjuk also indicate that farming practices remain closely connected with food security and household income considerations (Lisanty *et al.*, 2023). However, development programs should not assess yard farming only from sales revenue. Since many yard products are consumed, shared, or exchanged informally, agricultural extension programs should also recognize food consumption benefits and reduced household food expenditure as important outcomes.
A practical implication of this study is the need for yard-size-based recommendations. Households with small yards may be supported through vegetables, medicinal plants, polybags, and vertical gardening. Households with medium-sized yards may be encouraged to combine vegetables, fruit trees, chickens, and ducks. Meanwhile, households with larger yards may be assisted in developing goats, fishponds, and fruit trees that produce marketable surplus. This approach is more realistic than applying a single commercial model to all households.

Research contribution:
This study contributes to the literature on yard farming and integrated farming systems in three ways. First, it distinguishes between cash income and food consumption benefits in assessing the value of household yard farming. Second, it highlights informal sharing and exchange as important but often overlooked functions of household food production. Third, it shows that integrated farming systems can operate at the household yard scale in peri-urban areas, not only at the farm level.
By using peri-urban Nganjuk as a case, this study provides a contextual understanding of how household yards function as spaces for subsistence production, social exchange, and supplementary income generation. This perspective may enrich agribusiness and integrated farming system studies by emphasizing household-scale integration and non-cash economic benefits.

Limitations:
This study has several limitations. First, the analysis was based on aggregated field records and tabulated survey results from fieldwork conducted in 2023. The individual-level raw dataset was no longer available for re-analysis. Therefore, the study did not conduct inferential statistical testing, regression analysis, or mathematical optimization.
Second, the estimation of consumption benefits was based on documented field records and household information. Therefore, the values should be interpreted as indicative rather than precise market valuation. Third, the study focused only on yard-farming households in peri-urban Nganjuk District. The findings should not be generalized to all households in Nganjuk Regency or East Java without further research.

Suggestions:
Future research should collect individual-level household data to enable more detailed statistical analysis of the relationship between yard size, commodity diversity, household characteristics, income, and food consumption benefits. Further studies should also examine the economic value of self-consumption, informal sharing, barter, and reduced food expenditure using more systematic valuation methods.
For practical development, local agricultural extension programs should design yard farming models based on yard-size categories and household capacity. Small yards can be directed toward vegetables, medicinal plants, polybags, and vertical gardening. Medium-sized yards can be developed through combinations of vegetables, fruit trees, chickens, and ducks. Larger yards can be encouraged to integrate goats, fishponds, and marketable fruit trees. This differentiated approach would make yard farming development more suitable for household conditions in peri-urban areas.

CONCLUSION

This study shows that integrated yard farming in peri-urban Nganjuk functions as a household-scale strategy that combines food provisioning, informal social exchange, and supplementary cash income. Household yards were used to cultivate vegetables, tubers, fruit trees, medicinal plants, ornamental plants, raise livestock, and maintain fishponds. This diversity indicates that yard farming in the study area reflects a small-scale integrated farming system.

The findings reveal that the value of yard farming should not be assessed only through cash income. Most vegetables and fruits were primarily used for family consumption, shared with neighbors or relatives, or exchanged informally. Cash income was mainly generated from commodities with marketable surplus, such as livestock, fish, and fruits harvested in larger quantities. Therefore, yard farming provides both direct economic benefits from product sales and indirect benefits through food consumption, reduced household food expenditure, and social exchange.

Yard size influenced farming patterns and potential benefits. Smaller yards were mainly used for vegetables, medicinal plants, ornamental plants, and small livestock, while larger yards provided more opportunities to integrate fruit trees, goats, and fishponds. Therefore, yard farming development should be designed according to household land capacity and commodity potential.

Overall, integrated yard farming in peri-urban Nganjuk can be developed as a subsistence-plus household strategy. Its primary function is to support household food consumption, while its additional function is to generate supplementary income from surplus and marketable commodities. Future studies should use individual-level household data to provide stronger statistical evidence on the contribution of yard farming to household income, food consumption benefits, and food security.

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AUTHOR CONTRIBUTION STATEMENT

DR and NL contributed to the conceptualization and design of the study. DR contributed to field coordination, supervision, and initial data organization. NL contributed to methodology development, data interpretation, manuscript writing, academic editing, and final revision. NAW contributed to field data collection, respondent communication, and local field assistance during the survey process. All authors read, reviewed, and approved the final version of the manuscript.

AI DISCLOSURE STATEMENT

The authors used ChatGPT during the preparation of this manuscript for language refinement, structural organization, academic editing, and reference formatting support. After using the tool, the authors thoroughly reviewed, revised, and verified the manuscript content, including the interpretation of data, citations, and references. The authors take full responsibility for the accuracy, integrity, and final content of the publication.

CONFLICTS OF INTEREST

The authors declare that there are no financial, institutional, personal, or other potential conflicts of interest that could have influenced the conduct of this study, the analysis and interpretation of data, the preparation of the manuscript, or its publication.

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