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SYSTEMATIC LITERATURE REVIEW: DEVELOPMENT OF AGRICULTURAL MANAGEMENT ON JERUK KEPROK FARMERS IN CENTRAL ACEH REGENCY, GAYO HIGHLANDS

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Abstract
This study aims to determine the tangerine (orange) farmers in Central Aceh District, Gayo Highlands. The cultivation of Orange Keprok in the Gayo highlands holds strong agribusiness potential due to a suitable agroclimate, available farmland, and growing national market demand. This research uses a Systematic Literature Review to analyze relevant literature and several case studies as a development Tangerine cultivation in Central Aceh District, specifically in the Gayo Highlands. 9 literatures were evaluated from Google Scholar based on keywords ("Citrus nobilis" OR "Keprok Tangerine" OR "Jeruk Keprok") AND ("farmer profile" OR "farmer characteristics" OR "land utilization" OR "land use" OR productivity OR "fruit-bearing trees") AND ("agribusiness development" OR "agricultural solution" OR "farm management" OR "business strategy" OR "agricultural innovation"). Despite these constraints, Jeruk Keprok remains a high-potential horticultural commodity with strong market demand and considerable economic value. Overall, the study shows that the integration of local government and active participation of farmers, a productive, sustainable, and resilient citrus cultivation system in the future needs to be realized to support a more advanced citrus farming agribusiness.

Keywords: *Farmers, Jeruk Keprok, Central Aceh District, Systematic Literature Review.*

INTRODUCTION

Indonesia is recognized as an agrarian country, as the majority of its population relies on agriculture as the primary source of livelihood. The agricultural sector plays a vital role in the nation's economic development (Pratama & Idawati, 2019). However, this sector still faces challenges, particularly in capital and investment (Mwangi & Kariuki, 2015). One promising sub-sector in horticulture is citrus cultivation. Several ideal agro-climatic conditions for growing Tangerine (*Citrus noble*) in Indonesia include: areas with an elevation ranging from 500 to 1,200 meters above sea level (masl); optimal temperature between 20°C and 30°C; ideal annual rainfall between 1,500 and 2,500 mm; and a dry spell of 1 to 3 months, which is essential to stimulate flowering. This crop thrives in light to medium textured soil, such as Sandy loam or silty loam, with sufficient organic matter content. The ideal soil pH ranges from 5.5 to 6.5, and good drainage is crucial. In addition, the ideal relative humidity for optimal growth is around 70% to 80% (Ministry of Agriculture of the Republic of Indonesia, 2016).

Citrus originated from Asia and adapted across Indonesian altitudes (Wu et al., 2018; Curk et al., 2022). Aceh Middle, located in the Gayo Highlands, is one of Indonesia's key production centers for citrus agriculture, especially Jeruk Keprok (Direktorat Merek, 2015). Citrus farming in this region has existed since 1920, supported by favorable ecological conditions such as altitude, temperature, rainfall, and soil type (Takengon et al., 2019). In 2012, the production of Keprok oranges was recorded at 1.6 million tons and increased by 31.25 percent to 2.1 million tons in 2018. Local Keprok varieties include Keprok Gayo, Keprok Batu 55, Keprok Siompu, Keprok Soe, and Keprok Borneo Prima. Keprok Gayo oranges, a variety native to the Gayo highlands, have increasingly received government attention through a development program covering a total planted area of 726 hectares across Aceh Tengah, Bener Meriah, and Aceh Jaya (Ministry of Agriculture, 2023).

Recent research on citrus agribusiness in Indonesia has addressed various themes across multiple regions, including marketing channels, profitability, and supply chains. While these studies offer valuable insights, there is a noticeable lack of focused and up-to-date research on the

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management aspects of Jeruk Keprok cultivation in Central Aceh. To address this gap, the present study does not limit its scope to Central Aceh, but instead conducts a Systematic Literature Review (SLR) of Jeruk cultivation practices in general, from diverse regional and scholarly sources. The aim is to critically evaluate the existing agricultural management approaches and derive evidence-based recommendations that can guide the future development of Jeruk Keprok as a key horticultural commodity in the Gayo Highlands, Central Aceh. In addition, this study analyzes the socio-economic characteristics of Jeruk Keprok farmers and their land use practices in the region to align the recommendations with the local context.

This study provides significant value in supporting the development of Jeruk Keprok agribusiness in Central Aceh by offering a strong scientific foundation for formulating more effective and sustainable cultivation management strategies. By integrating literature review findings from various regions and aligning them with the socio-economic conditions and local farming practices in the Gayo Highlands, this study is expected to serve as a reference for stakeholders, such as local government, agricultural extension officers, and horticultural entrepreneurs, in designing targeted, efficient, and competitive development programs for Jeruk Keprok in both national and international markets. Moreover, the findings of this study can contribute to academic discourse by filling gaps in existing research related to citrus cultivation management in highland tropical regions. It also has the potential to stimulate further research, innovation, and collaboration between agricultural institutions, policymakers, and local communities to enhance the resilience and productivity of citrus farming in Aceh Tengah.

RESEARCH METHODS

The research methodology follows a systematic procedure based on the framework proposed by Okoli & Schabram, (2015) (**Figure 1**), and is refined in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. In the initial phase, relevant journals were identified and screened based on two key research questions. Duplicates and irrelevant studies were excluded, leaving selected candidate papers. These were then reviewed in detail to extract data addressing the research objectives. The systematic literature review consists of a structured sequence of activities, which includes the following key stages:

1. Planning – definition the research questions and establish the review protocol,
2. Conducting – which involves searching for relevant literature, choose appropriate studies, and synthesizing the data,
3. Reporting – presenting the results in a coherent and transparent manner.

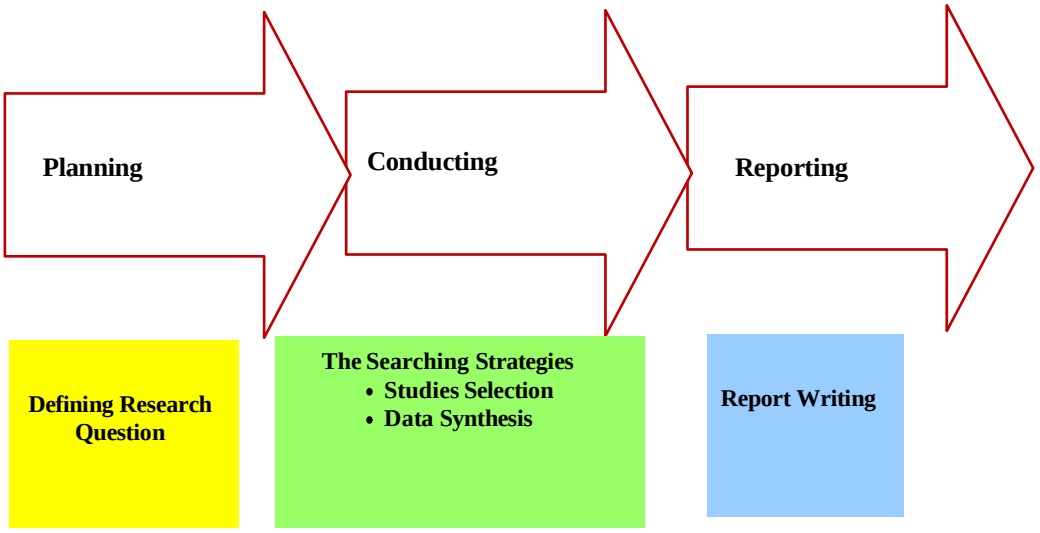

Figure 1. Systematic Literature Reviews (SLR) Model
Source: (Okoli & Schabram, 2015)

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Database And Search Strategy

We reviewed relevant literature from Google Scholar to explore farmer profiles, land utilization, productivity, and the number of fruit-bearing Jeruk Keprok trees. The article search was conducted using the following conceptual keyword string: ("Citrus nobilis" OR "Tangerine tangerine" OR "Tangerine") AND ("farmer profile" OR "farmer characteristics" OR "land utilization" OR "land use" OR productivity OR "fruit-bearing trees") AND ("agribusiness development" OR "agricultural solution" OR "farm management" OR "business strategy" OR "agricultural innovation"). The findings from the reviewed studies serve as evaluation material and reference for improving Jeruk Keprok agribusiness strategies in Gayo, Central Aceh.

Inclusion Criteria

The inclusion criteria for articles in this review consist of relevant studies published within the last five years. Articles were selected based on their relevance to farmer profiles, land utilization, productivity, and the number of fruit-bearing trees. Studies with relevant topics, findings, and research designs were included and discussed in this review.

Data Extraction

The research findings were directly extracted by the authors based on the research objectives and the article selection criteria. The relevance of the information was further reviewed by considering the study location, research design, publication year, analytical methods, research variables, and findings related to *citrus farming.* The extracted data are presented in Table 1.

RESULTS AND DISCUSSION

Among the 58 studies screened, 31 articles were selected from Google Scholar and then re-selected based on their relevance to the research objectives from the title and abstract of each article. **9** publications were evaluated (**Figure 2**). Overall, the reviewed studies emphasized the importance of an integrated and locally-based approach in developing a sustainable and competitive tangerine agribusiness. The review results can be seen in **Table 1**.

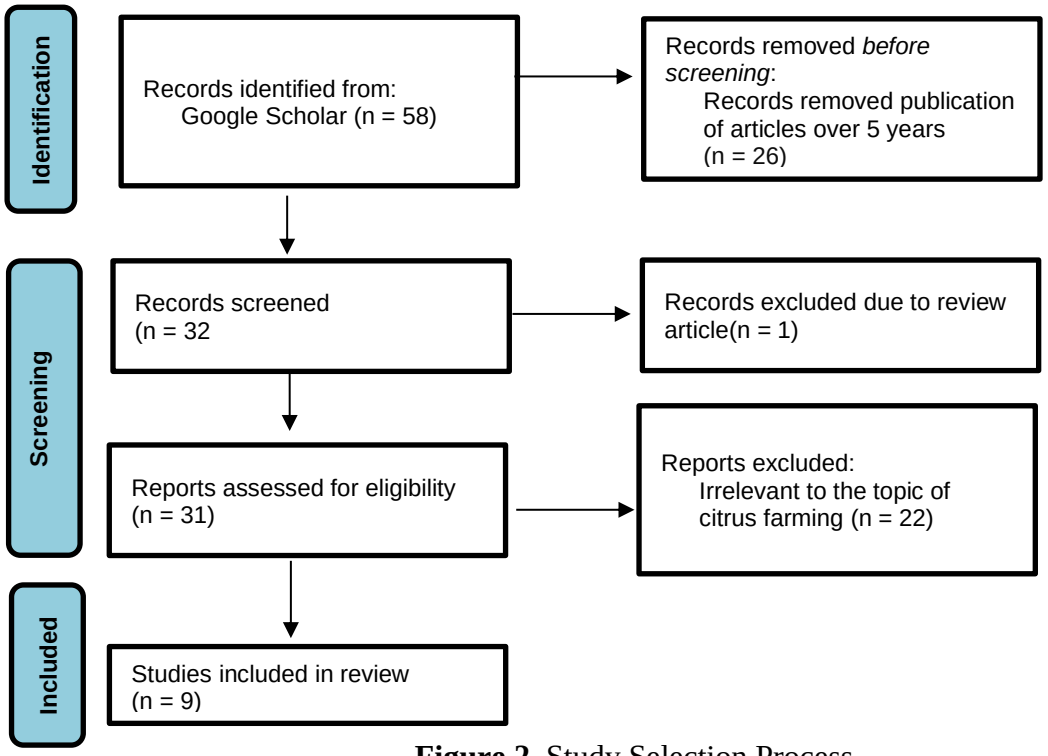

Figure 2. Study Selection Process

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Table 1. Results of Review of Studies Related to the Development of Citrus Agribusiness

Author	Place of Study	Year of Study	Study Design	Method	Results	Relevance to the Development of Kepok Orange Agribusiness, Central Aceh
(Abdushamad et al., 2024)	Selayar Islands Regency, South Sulawesi Province, precisely in Bontomatene District, from three villages that are orange production centers: Bontona Saluk Village, Batangmata Sapo Village, Tamalanrea Village	2023	Quantitative, Explanatory	Binary Logistic Regression through questionnaires from 156 orange farmers selected by random sampling.	Factors that significantly influence orange production in Selayar Islands Regency are: length of education, farmer group membership, land distance, labor, pesticides, herbicides, urea fertilizer, manure, and NPK fertilizer. Land distance and insecticide use have a significant negative effect.	Increasing farmer capacity, managing wider land, using the right fertilizers and pesticides wisely.
(Izhar et al., 2020)	Tanjung Flower Village, Betara District, West Tanjung Jabung Regency, Jambi Province	2017–2019	Descriptive quantitative (field)	- Survey with questionnaire - Random sampling of 40 orange farmers - Tabulation analysis for economic conditions & business feasibility	Orange productivity increased through the application of environmentally friendly cultivation technology. Demonstration land production: 4,960 kg vs non-demonstration: 3,145 kg (an increase of 1,815 kg or 36.59%). R/C ratio demonstration: 2.51 and non-demonstration: 2.20 → the business is economically and institutionally feasible.	Agribusiness development needs to be supported by the application of cultivation technology, strengthening farmer institutions, market access and financing, as well as support for infrastructure and local government policies.
(Triwiratno et al., 2021)	Nunukan Regency, North Kalimantan Province	2017-2018	Participatory -applicative	Development of horticultural areas for 17 farmers, facilitated through 4 farmer groups. Survey, demonstration of Integrated Management of Healthy Citrus Orchard technology, field assistance, program evaluation, and descriptive analysis	The demonstration of the Integrated Management of Healthy Citrus Orchard technology was conducted on 10 ha of new plants and 10 ha of productive plants. The assisted farmers implemented 95% of the technology components, farmers around 80–90%, and less active farmers 55%. High technological understanding with a score between 2.38–3.00.	Implementation of cultivation technologies such as Integrated Management of Healthy Citrus Orchard, increasing farmer capacity through training and mentoring, and strengthening farmer groups.

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(Pramuji et al., 2021)	Donowarih Village, Karangploso District, Malang Regency, East Java	2020	Analytical descriptive	The agribusiness strategy approach to 50 farmer respondents was determined by the Slovin formula and random sampling. SWOT analysis, SPACE matrix, and Quantitative Strategic Planning Matrix (QSPM).	Recommended development strategy: establishing a citrus production processing institution and maintaining high production through the use of superior seeds. Batu 55 tangerines have the potential to be further developed to meet market demand.	Establishment of institutions for processing production results and use of superior seeds.
(Hidayat et al., 2022)	Gadingkulon Village, Dau District, Indonesia	During the COVID-19 pandemic	Quantitative Descriptive Evaluative.	Survey of 87 farmers (*random sampling* , Slovin), investment feasibility analysis through Revenue Cost Ratio (R/C Ratio), Benefit Cost Ratio (B/C Ratio), Break Event Point (BEP) Price and Production, Payback Period (PBP), Net Present Value (NPV), and Internal Rate of Return (IRR).	Tangerine and Siamese orange farming is feasible to be developed. PBP < 5 years, NPV positive, IRR > Social Opportunity Cost of Capital (SOCC), BEP < actual price and yield. Farming remains feasible even though prices drop by 10% and production drops by 30%.	1) Land allocation planning, 2) Estimation of the number of productive trees, 3) Profit projection and BEP, 4) Determining superior types of oranges that suit market preferences.
(Fauzi et al., 2021)	Pal 7, Bermani Ulu Raya District, Rejang Lebong Regency, Bengkulu	2020	Financial Feasibility Study	Interview with 10 RGL citrus farmers; data analysis using NPV, Net B/C, IRR, and Payback Period for 6 years of planting cycle	RGL orange farming business is financially feasible: Net B/C = 1.44; NPV = Rp71,599,830; IRR = 20.23%; Payback Period = 5 years 6 months. Sensitivity of 20% cost/production/price is still feasible.	Technical intensification of cultivation and financial management.

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(Ngongo & Markus, 2020)	The border of Kupang Regency (Indonesia) and Oecusse (Timor Leste), as well as 3 other regencies on Timor Island	2017	Policy and program based descriptive study	Case studies of the implementation of the Agricultural Innovation Support (AIS) program and field observations	Agricultural innovation has been successfully implemented by some farmers (*co-operators*), but its impact is still limited because farmer access and extension are still low. However, community life is maintained because the traditional beekeeping of the Amfoang community has succeeded in maintaining sources of livelihood and nature conservation.	Agricultural innovations must be adapted to local conditions, including household calendars and non-farm activities such as honey harvesting. Similar integration can be developed for citrus plantations by considering the season, farmer access, and integration of conservation activities.
(Purba et al., 2021)	Banyuwangi, East Java	2019-2020	Completely Randomized Design with one radiation dose factor	- Irradiation of Siam Banyuwangi orange (SB) embryos using gamma rays (0, 45, 50, and 55 Gray) - In vitro selection of mutant shoots against Huanglongbing (HLB) disease pathogen suspension	- Gamma ray irradiation has a significant effect on embryo germination and plant morphological characteristics. - Mutation shoots from a dose of 45–55 Gray showed the most optimal resistance to HLB.	Biotechnological approaches to produce more HLB-resistant tangerine varieties. Creating local genetic diversification and improvement based on technological innovation.
(Agussalim et al., 2024)	PT. Al-Fatih Porang Indonesia (Lemon Garden, 80 Ha)	2023	Descriptive (identification of insect diversity)	- Absolute method (direct observation) - Relative method: 20 pitfall traps, 8 yellow traps, 5 methyl eugenol attractants, sweep net - Sampling: 3 days each week for 6 weeks at the diagonal point of the garden	- 19 types of insects were found in the lemon garden - Three types have the potential to be natural enemies of pests: ants (*Tapinoma* sp.), crickets (*Gryllus* sp.), and predatory flies (*Volucella zonaria)* - Other insects include pests such as fruit flies, mealybugs, citrus leaf caterpillars	- Providing ecological references for biological and sustainable citrus pest control. - Identification and prevention of natural enemy populations of pests in citrus cultivation - Promote agroecological approaches rather than dependence on chemical pesticides

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Increased citrus productivity has been proven to increase through the application of environmentally friendly cultivation technology, as in a study conducted by Izhar et al., (2020) showing that demonstration land produced 4,960 kg compared to non-demonstration land which only produced 3,145 kg. The higher R/C ratio in demonstration land (2.51 vs 2.20) indicates that a technology-based approach is also economically feasible. One technological approach that can be applied is the Integrated Management of Healthy Citrus Orchard (IMHCO), which integrates comprehensive and sustainable cultivation management. Its application on 20 hectares of land showed the success of technology adoption by assisted farmers of up to 95%. In addition to technical aspects, strengthening farmer capacity through training, mentoring, and revitalization of farmer institutions is the key to success. Farmers who are members of farmer groups are better able to adopt innovations and access production resources. Cultivation development strategies need to include land allocation planning, estimation of the number of productive trees, profit projections, and break-even points (BEP), and selection of citrus types that suit market preferences.

Integrated agrotechnology approaches need to consider the context of a sustainable environment. The use of biotechnology such as gamma ray irradiation at a dose of 45–55 Gray has been shown to produce mutant shoots that are more resistant to Huanglongbing disease (HLB), one of the main threats to citrus plants (Purba et al., 2021). In addition, the ecological approach also includes pest control based on natural enemies. Surveys in citrus orchards found at least 19 types of insects, with three main types that have the potential to be biological control agents: ants (*Tapinoma* sp.), crickets (*Gryllus* sp.), and predatory flies (*Volucella zonaria*). This approach can reduce dependence on chemical pesticides, reduce production costs, and maintain the balance of the agricultural ecosystem.

Learning from conservation practices such as traditional beekeeping of the Amfoang community, integration of agricultural activities with local calendars, and nature conservation is important. Citrus cultivation can be directed to a pattern that is more adaptive to the seasons, household activities, and sustainable landscape management. The development of citrus agribusiness requires increasing farmer capacity, strengthening institutions, and financial and infrastructure support.

CONCLUSIONS AND SUGGESTIONS

Recommendations for the development of tangerine farming in Central Aceh are the application of environmentally friendly cultivation technologies such as Integrated Management of Healthy Citrus Orchard (IMHCO) which has been proven to increase productivity and efficiency of farming efforts, supported by increasing farmer capacity through continuous training and mentoring. In addition, it is important to strengthen farmer group institutions, expand access to financing and markets, and encourage biological pest control to reduce dependence on chemical pesticides. The integration of technological and ecological approaches needs to be accompanied by support from local government infrastructure and policies, so that tangerine farming in Central Aceh can develop sustainably and competitively in the market.

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