

# Vanilla Production System and Agricultural Extension Needs of Farmers in Bali, Indonesia

Aripranata<sup>1\*</sup> Supat Isarangkool Na Ayutthaya<sup>1</sup> and Sukanlaya Choenkwan<sup>2</sup>

<sup>1</sup> Department of Horticulture, Faculty of Agriculture, Khon Kaen University, Khon Kaen, Thailand, 40002

<sup>2</sup> Department of Agricultural Extension and Development, Faculty of Agriculture, Khon Kaen University, Khon Kaen, Thailand, 40002

## Abstract

Vanilla production in Indonesia has consistently fluctuated, with a downward trend in recent years. This study aims to identify key issues in the vanilla production system and assess farmers' needs for agricultural extension services to improve cultivation sustainability. The study was conducted in Jembrana Regency, Bali, from July to September 2024, involving 93 farmers selected from a population of 1,322 using the Taro Yamane method. Data were collected through structured interviews and analyzed using descriptive statistics.

The results showed that 77.42% of farmers had never received extension visits, a concern because frequent contact with extension workers would strengthen cultivation practices and help farmers address issues such as low mean planting preparation scores, with the majority below 2.50 on a predetermined scale. The majority of farmers reported a lack of training in modern cultivation techniques. Most farmers relied on traditional practices for land preparation, maintenance, and post-harvest handling, resulting in low productivity and product quality. The most pressing needs identified were technical training, pest and disease control, and marketing support for value-added products, with the majority of needs scores above 2.49 and even exceeding 3.49, indicating a high level of needs. These findings underscore the importance of strengthening agricultural extension programs, with a focus on practical, market-oriented training, to enhance farmer capacity and improve the sustainability and competitiveness of vanilla production systems in Bali, Indonesia. These findings underscore the impact of socio-demographic factors on agricultural awareness and recommend curriculum enhancements incorporating hands-on agricultural experiences.

Keywords: vanilla farming, modern cultivation farming, agrotourism, economic

---

\*Corresponding author: [aipranatasp@gmail.com](mailto:aipranatasp@gmail.com)

## Introduction

Indonesia, especially Bali, is one of the world's top vanilla producers. Indonesian vanilla, particularly from Bali, is recognized for its high quality and unique scent (Baharuddin et al., 2023). Vanilla is a valuable spice that requires specific cultivation techniques and careful post-harvest processing. Despite its global popularity in food, beverage, and cosmetic industries, natural vanilla accounts for less than 1% of the global market, creating persistent supply shortages and high prices. Most of Indonesia's vanilla is sold domestically and internationally as a raw commodity, leaving smallholder farmers to face significant production and marketing challenges (Wahyudi et al., 2021).

Vanilla cultivation contributes not only to farmers' income but also to local employment, biodiversity conservation, and the maintenance of agricultural traditions. Its high global price and increasing demand in the food, perfume, and pharmaceutical sectors make it a strategic export commodity. In Bali, the integration of vanilla farming with agrotourism has the potential to strengthen rural economies while maintaining environmental sustainability (Armenta-Montero et al., 2022; Watteyn et al., 2020).

However, despite these advantages, the productivity and quality of Indonesian vanilla remain below potential. Declining vanilla quality, stem rot disease, theft, and price fluctuations are among the main challenges faced by farmers (Wulandari, 2021). To maintain sustainability,

these risks must be mitigated through stronger stakeholder collaboration and institutional support. The central and regional governments, together with private actors, have initiated efforts such as training, capital assistance, and marketing facilitation to develop competitive vanilla products (Setiawan et al., 2023).

Research and professional extension services play a pivotal role in addressing such challenges. They serve as platforms for knowledge exchange and innovation, helping to enhance capacities at both personal and institutional levels (Longley et al., 2007; Kamara et al., 2021). Agricultural extension officers act as key intermediaries linking farmers with new technologies and practices. To be effective, they must possess adequate, updated, and contextual knowledge before educating and training farmers (Wulandari, 2015). However, many extension workers still lack specific information related to the technical and socio-economic problems of vanilla farming, which limits their ability to support farmers effectively.

Although Bali holds great potential to meet global demand for natural vanilla, especially as global industry preferences shift from synthetic to natural sources, there is limited empirical research on the specific extension needs of vanilla farmers in this region. Previous studies have highlighted vanilla's economic value and market prospects (Dewi & Marhaeni, 2018), yet little is known about how extension services can be tailored to address farmers' real constraints in cultivation, disease management,

and post-harvest practices. This gap has resulted in fragmented support systems and underutilized potential. Understanding farmers' extension needs is therefore crucial to improving productivity and product quality, while fostering sustainable and environmentally friendly practices. Identifying these needs will also strengthen the accountability and effectiveness of private and public extension systems (Martin, 2023). Moreover, such findings can inform government strategies to enhance farmer empowerment and support the development of agrotourism-based vanilla industries in Bali.

Therefore, this study aims to identify and analyze the specific extension needs of vanilla farmers in Bali. By doing so, it seeks to provide evidence-based insights for improving extension programs, increasing farmer capacity, and promoting sustainable vanilla production that benefits both the local economy and the broader agricultural sector.

## Research Methodology

### Population and Samples

This research was conducted in Jembrana District, Bali, Indonesia, from July to September 2024. The basis for choosing Jembrana as the research location was that Jembrana is the area with the largest population of vanilla farmers in Bali. There are 1,322 farmers in the Jembrana District. The method used was simple random sampling, with the sample size determined using the Taro Yamane formula, with a tolerance level of 10% (Yamane, 1973). The number of respondents selected was 93 farmers.

### Data Collection Methodology

The data collection technique used structured interviews with a questionnaire as the research instrument, with the Likert scale. Several questions were presented that contain the required knowledge about the things used in vanilla production, the format or method of promotion that should be carried out, the needs that farmers have in receiving agricultural extension services from institutions, and suggestions that farmers can be given for developing vanilla production. Other questions include an assessment of good planting practices in vanilla production systems.

This research was analyzed using a quantitative approach. Descriptive statistics were used to describe the characteristics of respondents and the variables of this research. Frequency distribution and summary statistics used mean, percentage, and standard deviation values. Respondent characteristics include gender, age, education, and agricultural problems that are often experienced by farmers, as well as measuring the information needed for agricultural extension.

### Data Analysis

Data processing involved handling all information collected from respondents. This included conducting a thorough examination of the data and organizing it into Microsoft Excel. SPSS software measures validity with a significance value (Sig) of less than 0.05. In terms of reliability, the livelihood variable has a Cronbach's alpha of 0.8, the production system variable has a Cronbach's alpha of 0.7, and the agriculture extension needs variable has a Cronbach's alpha of 0.9. The results of this data processing were carefully examined and

explained to provide insight into the research findings.

The mean score (M) represents the assessment of variables related to extension needs such as knowledge, promotion, and extension services, as well as production systems, including preparation, planting, maintenance, harvesting, and post-harvest. Each variable is

scored on a scale of 1–5, with scores closer to 1 indicating a lower level of extension need and something that is never done for the production system, and scores closer to 5 indicating a higher level of need and something that is always done for the production system. The scoring system is summarized in Table 1

**Table 1** Assessment scale on agricultural extension service needs and vanilla production system for good practice assessment

Agriculture Extension Needs		Vanilla Production System	
Average Score	Information	Average Score	Interpretation
4.50-5.00	Highest	4.50-5.00	Very often
3.50-4.49	High	3.50-4.49	Often
2.50-3.49	Moderate	2.50-3.49	Moderate
1.50-2.49	Low	1.50-2.49	Seldom
1.00-1.49	Lowest	1.00-1.49	Never

## Results and Discussion

### 1 Socio-Economic Characteristics of Respondents

The majority of respondents were men (97.85%), as shown in Table 2, indicating that men are more involved in vanilla production than women in the area. Most farmers belong to older age groups, suggesting that generational renewal in vanilla cultivation remains limited. Older farmers often have greater farming experience but tend to adopt new practices more slowly, highlighting the need for targeted extension strategies that consider age-related learning

preferences. At the same time, the subsistence level of many farmers limits profit potential. Apart from vanilla farming, respondents also earn income from other sectors such as other crops, craftsmanship, livestock, business, and government services. This diversification helps sustain livelihoods but may reduce the time and investment farmers dedicate to vanilla production. Similar findings were reported by Minyiwab et al. (2024) and UNDP (2017), who noted that smallholders often rely on multiple income sources rather than a single agricultural activity.

**Table 2** Distribution of respondents according to socio-economic characteristics (N=93)

Socio-economic characteristics	Frequency	Percentage (%)	Mean (M)
<b>Sex</b>			
Male	91	97.85	
Female	2	2.15	
<b>Age (years)</b>			
17-25	0	0	
26-45	17	18.28	53
46-65	76	81.72	
<b>Level of education</b>			
Not attending school	0	0	
Primary school	22	23.66	
Junior high school	19	20.43	
Senior high school	49	52.69	
University/College	3	3.23	
<b>Vanilla farming is a major occupation</b>			
No	62	66.67	
Yes	31	33.33	
<b>Other occupations apart from Vanilla farming</b>			
Civil service	16	17.20	
Artisan	15	16.13	
Craftsman	15	16.13	
Entrepreneur/Business	33	35.48	
Livestock	17	18.28	
Other farming	75	80.65	
<b>The scale of farming (ha)</b>			
Large scale (>1)	11	11.83	
Moderate scale (0.51-1)	17	18.28	
Small Scale (<0.51)	65	69.89	

About 66.67% of respondents were part-time farmers, while 69.89% were small-scale producers cultivating less than 0.5 ha of land. This aligns with national data showing a continued decline in Indonesia's vanilla production area (FAO, 2023) and reduced farmland in Bali. The limited landholding size constrains production

capacity and investment in improved technologies, emphasizing the importance of extension programs that promote efficient, low-cost management practices suited for small-scale systems.

In this study, vanilla farms were categorized as small ( $\leq 0.50$  ha), medium (0.51–1.00 ha), and

large (>1.00 ha). Assuming a 2-meter spacing, 1 ha can accommodate about 2,500 vanilla plants. Profits from vanilla production at 1 ha can be quite promising; however, plots below 0.5 ha rarely yield significant profit because not all plants survive. This outcome relates to optimal light and air access needed for plant development at 1–3 m spacing between trees (Hänke et al., 2018).

## 2 Production System

### 2.1 Preparation

Table 3 shows that vanilla cultivation in Bali combines traditional and modern practices, with farmers favoring techniques that are familiar and easy to implement. The use of fertile, disease-free land and generative seeds remains uncommon, even though these practices are crucial for plant health. Farmers tend to avoid generative seeds because of biological and economic constraints, preferring vegetative cuttings that are more reliable and commercially efficient. This approach, also practiced in Madagascar and other producing regions, helps accelerate the harvesting period, an important advantage for smallholders (Bory et al., 2008; Medina et al., 2009). However, inadequate soil preparation and poor sanitation often expose cuttings to fungal pathogens such as *Fusarium oxysporum* f. sp. *vanillae* (vanilla stem rot). This condition suppresses productivity and shortens the economic lifespan of vanilla plantations, reflecting similar challenges found in regions with weak disease management systems.

### 2.2 Planting

Table 3 shows that vanilla farmers generally apply techniques related to planting timing and the preparation of support crops. Planting support crops several months before the rainy season and planting vanilla at the beginning of the rainy season are common practices to ensure optimal growth and water availability for the roots. However, soil management practices such as mulching remain rarely adopted, even though mulching is proven to maintain soil moisture, prevent erosion, and improve fertility. The low adoption of mulching among vanilla farmers stems from a conflict between agronomic needs and socio-economic risks, a pattern also observed in Madagascar. Farmers often practice calculated underinvestment, as high vanilla prices increase theft risk, visible investments such as thick mulch layers are avoided to keep plots inconspicuous (Hänke et al., 2018). This neglect exacerbates key technical problems because organic mulch recommended before and after the rainy season is crucial for stimulating actinomycetes, natural antagonists of the soil-borne pathogen *Fusarium oxysporum* f. sp. *vanillae* (vanilla stem rot) (Munshi & Kramer, 2020). Consequently, weak soil management sustains the high prevalence of this disease, directly contributing to Indonesia's persistent vanilla yield gap.

### 2.3 Maintenance

Table 3 shows that vanilla farmers generally perform moderate plant maintenance, including wrapping stems, weeding, pruning, managing drainage, pollinating, and protecting against pests. These practices are essential for healthy growth and good yields. However, organic

and chemical fertilization and mulching are rarely used, indicating that soil fertility and moisture management are not yet a priority. Overall, even

with basic maintenance, increased fertilizer and mulch use can improve vanilla crop quality and productivity.

**Table 3** Assessment of farmers for vanilla cultivation

The process for vanilla cultivation	Mean±SD	Interpretation
<b>Preparation</b>		
1. Prepare land that is fertile and free from plant disease	2.33±0.88	Seldom
2. Preparing quality generative vanilla seeds	1.74±1.12	Seldom
3. Preparing quality vegetative vanilla seeds	3.88±1.08	Often
4. Using concentrations of root growth regulatory materials	1.66±0.97	Seldom
5. Using climbing plants to grow vanilla vines	4.32±1.02	Often
6. Using non-plant climbing media to grow vanilla vines	1.85±1.10	Seldom
7. Use a greenhouse	1.78±1.02	Seldom
<b>Planting</b>		
1. Plant climbing trees six months before the rainy season	4.21±1.22	Often
2. Planting vanilla early in the rainy season	4.16±1.22	Often
3. Plant vanilla plants with sufficient mulch	1.98±1.28	Seldom
<b>Maintenance</b>		
1. Twisting tendrils with a length of at least 1.5-2 m	3.17±0.77	Moderate
2. Apply mulch or soil to the bottom of the vanilla stem after turning it	2.81±0.69	Moderate
3. Carry out the scheduled wedding	2.97±1.45	Moderate
4. Fertilize using organic fertilizer	2.26±1.48	Seldom
5. Fertilize using chemical fertilizer	1.60±0.91	Seldom
6. Regularly provide mulch	1.77±1.02	Seldom
7. Carry out regular pruning	2.95±1.54	Moderate
8. Make drainage	2.69±1.37	Moderate
9. Successfully pollinate well and correctly	3.06±0.92	Moderate
10. Able to protect vanilla plants from pest and disease attacks	3.06±0.88	Moderate
<b>Harvest and post-harvest</b>		
1. Harvest within 8-9 months after pollination	2.95±0.89	Moderate
2. Know the characteristics of vanilla fruit that is ready to harvest	4.15±1.14	Often
3. Able to process green vanilla fruit into black	1.95±0.97	Seldom

The process for vanilla cultivation	Mean±SD	Interpretation
vanilla		
4. Selling green vanilla	4.53±0.87	Very often
5. Selling black vanilla	2.56±1.06	Moderate
6. Selling vanilla to collectors	4.35±0.98	Often
7. Selling vanilla direct to customers	2.30±0.88	Seldom
8. Exporting vanilla	1.08±0.28	Never

## 2.4 Harvest and Post-Harvest

Balinese vanilla farmers generally harvest several months after pollination and can identify mature pods, yet most still sell their produce as green vanilla. Processing into black vanilla remains rare due to limited technical skills and the labor-intensive nature of curing, which requires long drying periods and precise chemical handling. Economic pressures, particularly the immediate need for cash, drive farmers to sell unprocessed vanilla at lower prices rather than wait for delayed returns. The high market value of vanilla also heightens theft risks, discouraging farmers from allowing pods to fully ripen or investing in curing facilities. In addition, the absence of communal processing centers and labor constraints, especially among female-headed households, further reinforces dependence on collectors, who provide capital, security, and access to markets. These conditions collectively explain why green vanilla sales dominate, while direct marketing and export opportunities remain limited (Dhillon and Moncur, 2023; Ravier et al., 2024; Afriana & Khoiruman, 2025).

## 3 The Farmer Needs of Extension

### 3.1 Extension Contacts with Vanilla Farmers

Table 4 shows that 77.42% of respondents had no extension contact in the past year, reflecting a severe communication gap in Indonesia's agricultural extension system. The limited and irregular contact often occurring only once every 19 months or more restricts farmers' access to essential information on vanilla cultivation and marketing, even though the crop requires precise seasonal technical interventions. This low contact frequency stems from structural barriers, particularly a high farmer-to-extension ratio that limits field mobility and time allocation. As a result, critical knowledge gaps persist in time-sensitive practices such as vanilla flower pollination, which is receptive for only a short period, and proper pruning techniques are essential for flowering (Rokhani et al., 2021; Nyamweru et al., 2024). Sporadic contact also disrupts the persuasion and confirmation stages in the Diffusion of Innovation theory, hindering sustained adoption of complex practices. Therefore, strengthening change agents' competencies and prioritizing direct field visits and demonstration plots are crucial for effective and experience-based knowledge transfer, especially where digital outreach remains constrained by infrastructure and data costs (Dearing, 2009).

**Table 4** Distribution of respondents according to socio-economic characteristics

Variables	Frequency	Percentage (%)	Mean (M)
<b>Extension contact (n=93)</b>			
No	72	77.42	
Yes	21	22.58	
<b>Reception of useful information (n=21)</b>			
No	0	0	
Yes	21	100	
<b>Frequency of reception (n=21)</b>			
Once every 1-6 months	4	19.05	
Once every 7-12 months	6	28.57	
Once every 13-18 months	3	14.29	5.25
Once every 19 months or above	8	38.10	
<b>Specific areas farmers received extension services (n=21)</b>			
Management practices	21	100	
Planting and post-planting techniques	21	100	
Sourcing appropriate marketing channel	21	100	

### 3.2 Knowledge Needs for Farmers

Despite limited consulting services, some farmers seek advice through informal networks, though the information obtained is often inaccurate and can lead to ineffective innovations (Koutsouris and Zarokosta, 2022). Therefore, agricultural extension services are essential to provide farmers with accurate and sustainable knowledge. Recognizing farmers' local knowledge alongside researchers' expertise supports more interactive agricultural models (Cruz et al., 2022). As shown in Table 5, farmers generally need adequate knowledge for sustainable vanilla farming, with only the indicator of water provision scoring low (2.44). This supports the need for continuous extension services to ensure reliable information and adaptability to future challenges

### 3.3 Promotion Needs for Farmers

Dynamic price changes and promotions can have long-term impacts, as repeated discounts lower the reference price and discourage consumers from purchasing at the regular price (Kim et al., 2018). Promotion is an important strategy for attracting customers and facilitating the sale of agricultural products (Mishra et al., 2024). Promotion can be conducted in person, in groups, or through mass media; farmers tend to prefer personal promotions, while group promotions allow for the exchange of ideas and collaborative learning (Hailemichael and Haug, 2020). Mass media, particularly government and social media, are effective in building brands and increasing revenue, although radio usage is declining (Hoken and Su, 2018; Laradi et al., 2023). Without effective marketing,

farmers' bargaining power weakens, necessitating the improvement of marketing systems, including e-marketing, to increase income (Setiadi et al., 2020; Al Zarlani et al., 2023). Overall, various forms of promotion are essential for farmers to increase agricultural productivity.

Effective promotion is crucial for connecting farmers with markets and strengthening their bargaining power. While direct and group-based promotion remain crucial for sharing cultivation knowledge, social media has become an increasingly powerful tool for marketing vanilla products. Through digital platforms, farmers can expand market access, build brand identity, and attract premium buyers. Therefore, combining traditional extension approaches with digital promotion can increase the visibility and competitiveness of the Balinese vanilla sector.

Information from extension services is frequently hampered by farmers' low level of literacy and their lack of time for the quantity and complexity of the courses given (Nazarzadehzare & Dorrani, 2012). However, with comprehensive management of the time and knowledge needed by farmers, providing agricultural training will be easier (Elliott-Engel, 2024). Promotional services from agricultural extension workers held in groups or individually will certainly have several obstacles. One additional promotion that is currently effective, according to Laradi et al. (2023), is a social media promotion. Other research reveals that social media is very effective in influencing sales and services (Kalra et al.,

2023). Apart from being the main thing that farmers need, other promotional media fulfill moderate needs that farmers still want to need because they are inseparable in terms of complementing each other.

## Conclusion

Vanilla production in Bali has been declining due to challenges in the production system, limited farmer knowledge, inadequate post-harvest marketing, and irregular extension contact. Farmers demonstrate moderate to high needs for support in technical knowledge, marketing facilitation, and regular extension services, yet current extension practices remain sporadic and insufficient for addressing time-sensitive and labor-intensive tasks critical to productivity. To improve outcomes, extension programs should prioritize structured and continuous training on practical activities such as planting methods, pollination, pruning, and post-harvest handling. In addition, facilitating access to marketing channels and promotional media can help farmers achieve competitive pricing and reduce dependence on intermediaries. Local governments and extension offices are encouraged to strengthen field visits, demonstration plots, and targeted capacity-building initiatives, which collectively can enhance both vanilla productivity and farmer welfare, ultimately contributing positively to Bali's agricultural sector and regional economy.

Table 5 Identified extension needs of vanilla farmers

Extension needs in vanilla farming	Mean±SD	Information
<b>Knowledge</b>		
1. Soil preparation	3.47±0.68	Moderate
2. Selection of varieties to be planted	3.77±0.57	High
3. How to plant	3.44±0.80	Moderate
4. The process of multiplying plants	3.43±0.61	Moderate
5. Planting cuttings seeds	4.11±0.58	High
6. Pruning climbing plants	4.30±0.46	High
7. Pruning vanilla plants	4.29±0.46	High
8. The good and correct way to twist the tendrils	4.01±0.50	High
9. The good and correct way to pollinate	3.90±0.63	High
10. Determining fruit that is ready to be harvested	3.40±0.72	Moderate
11. Prevention and eradication of disease	3.80±0.95	High
12. Prevention and eradication of pests	3.60±0.92	High
13. Weed prevention and eradication	3.82±0.78	High
14. Use of chemical fertilizers	2.57±0.88	Moderate
15. Giving water	2.44±0.83	Low
16. How to store harvested vanilla pods	2.74±0.94	Moderate
17. How to wither and ferment harvested vanilla fruit	2.73±1.07	Moderate
18. How to choose packaging and package black beans vanilla	2.65±1.13	Moderate
19. Distribution channel	3.40±1.34	Moderate
20. Marketing news source	3.37±1.39	Moderate
21. Credit sources	3±1.17	Moderate
<b>Promotion needs for farmers</b>		
<i>Individual promotion</i>		
1. Visit and provide advice in the area	3.32±1.15	Moderate
2. Using services and broadcast centers	3.43±0.71	Moderate
3. Transmitted through agricultural figures in the community	3.35±0.56	Moderate
<i>Group promotion</i>		
4. Training	3.88±1.14	High
5. Field visit to see the work	3.81±1.12	High
6. Organize all farmer groups in the area	3.60±1.03	High
7. Providing advice to farming units in the region	3.42±1.09	Moderate
<i>Promotion through mass media</i>		
8. On television	3.32±0.78	Moderate
9. On Radio	2.77±0.94	Moderate

Extension needs in vanilla farming	Mean±SD	Information
10. On the government website	3.46±0.72	Moderate
11. On social media	3.68±0.92	High
12. Academic articles	3.19±1.07	Moderate

### Recommendations

This research recommends targeted extension programs addressing key needs of vanilla farmers, including cultivation techniques, pest control, and post-harvest management.

For Extension Workers: Conduct regular field visits, farmer field schools, and demonstration plots for practical training.

For Government and Institutions: Develop training modules, allocate budgets for extension, and improve market access.

For Farmer Groups: Encourage collective processing and shared marketing to increase efficiency and bargaining power.

For Researchers: Focus on simple curing technologies and effective disease management strategies.

Additionally, continuous training supported by mobile applications can update farmers' knowledge, while regular monitoring and evaluation ensure program effectiveness. Implementation may be influenced by local conditions, limited resources, and the study's constraints, including sample size, research duration, and secondary data availability.

### Ethical Approval

This research was approved by the Human Research Ethics Committee of Khon Kaen University, HE673178, and by the Ethics Research

Committee of State University of Malang, 2.4.5/UN32.14.2.8/LT/2024.

### Conflict of Interest

No potential conflict of interest was reported by the authors.

### Acknowledgment

This work comes from the hard and smart work of various parties, including my advisor and my co-advisor, who always provide input, ideas, and direction. This article is also one of the requirements for a master's graduation, and thanks also to Khon Kaen University and the Faculty of Agriculture for providing the ASEAN & GMS Scholarship to the first author.

### References

- Afriana, L., & Khoiruman, A. M. (2025). Perbanyak Tanaman Vanili (*Vanilla Planifolia*) secara Konvensional dengan Variasi Waktu Perendaman Auksin (*Rootone-F*). *Jurnal Agrokomples Tolis*, 5(2), 138-143.  
<https://doi.org/10.56630/jago.v5i2.793>
- Al Zarlani, W. O., Muzuna, & Sugianto, S. (2023). Behavior and marketing analysis of pepper (*Piper nigrum* L.): A comparative study of farmers, trading districts and

- retailers in southeast Sulawesi, Indonesia. *Caraka Tani: Journal of Sustainable Agriculture*, 38(1), 14-25.  
<https://doi.org/10.20961/carakatani.v38i1.59193>
- Armenta-Montero, S., Menchaca-García, R., Pérez-Silva, A., & Velázquez-Rosas, N. (2022). Changes in the potential distribution of *Vanilla planifolia* Andrews under different climate change projections in Mexico. *Sustainability*, 14(5), 1-13.  
<https://doi.org/https://doi.org/10.3390/su14052881>
- Baharuddin, A., Dzaki, M., Erlangga, R., & Ernah, D. (2023). Kajian potensi komoditas vanilla Indonesia di pasar internasional. *Prosiding Hasil Penelitian Sosial Ekonomi Pertanian*, 2(2023), 108-121.
- Bory, S., Lubinsky, P., Risterucci, A., Noyer, J., Grisoni, M., Duval, M., & Besse, P. (2008). Patterns of introduction and diversification of *Vanilla planifolia* (Orchidaceae) in Reunion Island (Indian Ocean). *American Journal of Botany*, 95(7), 805-815.  
<https://doi.org/10.3732/ajb.2007332>
- Cruz, J. L., Albisu, L. M., Zamorano, J. P., & Sayadi, S. (2022). Agricultural interactive knowledge models: researchers' perceptions about farmers' knowledges and information sources in Spain. *The Journal of Agricultural Education and Extension*, 28(3), 325-340.  
<https://doi.org/10.1080/1389224X.2021.1932537>
- Dearing, J. W. (2009). Applying diffusion of innovation theory to intervention development. *Research on Social Work Practice*, 19(5), 503-518.  
<https://doi.org/10.1177/1049731509335569>
- Dewi, N. M. K., & Marhaeni, A. A. I. N. (2018). Factors affecting vanilla farm productivity in Bali. *Quantitative Economics Research*, 1(1), 32-38.
- Dhillon, R., & Moncur, Q. (2023). Small-scale farming: A review of challenges and potential opportunities offered by technological advancements. *Sustainability*, 15(21), 15478.  
<https://doi.org/10.3390/su152115478>
- Elliott-Engel, J. (2024). A writing retreat for extension professional development capacity building: A case study of Arizona cooperative extension's 4-H youth development program. *Journal of Extension*, 62(1).  
<https://doi.org/10.34068/joe.62.01.10>
- FAO. (2023). *FAOSTAT*. Food and Agriculture Organization of the United Nations  
<https://www.fao.org/faostat/en/#compare>
- Hailemichael, S., & Haug, R. (2020). The use and abuse of the 'model farmer' approach in agricultural extension in Ethiopia. *The Journal of Agricultural Education and Extension*, 26(5), 465-484.  
<https://doi.org/10.1080/1389224X.2020.1757475>
- Hänke, H., Barkmann, J., Blum, L., Franke, Y., Martin, D. A., Niens, J., Osen, K., Uruena, V., Witherspoon, S. A., & Wurz, A. (2018). *Socio-economic, land use and value chain perspectives on vanilla farming in the SAVA Region (north-eastern*

- Madagascar: The Diversity Turn Baseline Study (DTBS)*. Department of Agricultural Economics and Rural Development, University of Goettingen.
- Hoken, H., & Su, Q. (2018). Measuring the effect of agricultural cooperatives on household income: Case study of a rice-producing cooperative in China. *Agribusiness*, 34(4), 831-846. <https://doi.org/10.1002/agr.21554>
- Kalra, A., Itani, O. S., & Rostami, A. (2023). Can salespeople use social media to enhance brand awareness and sales performance? The role of manager empowerment and creativity. *Journal of Business and Industrial Marketing*, 38(8), 1738-1753. <https://doi.org/10.1108/JBIM-01-2022-0056>
- Kamara, L. I., Van Hulst, F., & Dorward, P. (2021). Using improved understanding of research and extension professionals' attitudes and beliefs to inform design of AIS approaches. *Journal of Agricultural Education and Extension*, 27(2), 175-192. <https://doi.org/10.1080/1389224X.2020.1828114>
- Kim, H., Zansler, M., & House, L. A. (2018). Retail promotion with price cut and the imperfect price responses of orange juice demand in the U.S. *Agribusiness*, 34(2), 363-376. <https://doi.org/10.1002/agr.21523>
- Koutsouris, A., & Zarokosta, E. (2022). Farmers' networks and the quest for reliable advice: Innovating in Greece. *Journal of Agricultural Education and Extension*, 28(5), 625-651. <https://doi.org/10.1080/1389224X.2021.2012215>
- Laradi, S., Berber, N., Rehman, H. M., Hossain, M. B., Hiew, L., & Illés, C. B. (2023). Unlocking the power of social media marketing: Investigating the role of posting, interaction, and monitoring capabilities in building brand equity. *Cogent Business & Management*, 10(3), 2273601. <https://doi.org/10.1080/23311975.2023.2273601>
- Longley, C., Christoplos, I., Slaymaker, T. & Meseka, S. (2007). *Rural recovery in fragile states: Agricultural Support in Countries Emerging from Conflict*. Overseas Development Institute. <https://media.odi.org/documents/10.pdf>
- Martin, R. (2023). Reconsidering home or farm visits extension method for improving impact of agricultural extension in Tanzania. *Journal of Agricultural Extension*, 27(4), 41-52. <https://doi.org/10.4314/jae.v27i4.5>
- Medina, J. D. L. C., Jiménez, G. C. R. & Garcia, H. S. (2009). *Vanilla: Post-harvest Operations*. FAO. [https://www.fao.org/fileadmin/user\\_upload/inpho/docs/Post\\_Harvest\\_Compendium\\_-\\_Vanilla.pdf](https://www.fao.org/fileadmin/user_upload/inpho/docs/Post_Harvest_Compendium_-_Vanilla.pdf)
- Minyiwab, A. D., Mengistu, Y. A., & Tefera, T. D. (2024). The effect of livelihood diversification on food security: evidence from Ethiopia. *Cogent Economics and Finance*, 12(1), 1-12. <https://doi.org/10.1080/23322039.2024.2345304>
- Mishra, M., Kushwaha, R., & Gupta, N. (2024). Impact of sales promotion on consumer

- buying behavior in the apparel industry. *Cogent Business and Management*, 11(1), 2310552.  
<https://doi.org/10.1080/23311975.2024.2310552>
- Munshi, E., & Kramer, R. (2020). *Framework for sustainable vanilla cultivation in Madagascar*. Duke University.
- Nazarzadehzare, M., & Dorrani, K. (2012). Study obstacles and problems of agriculture extension training courses from extension workers points of view participating in the extension training courses dezful city. *Procedia - Social and Behavioral Sciences*, 46, 5707-5713.  
<https://doi.org/10.1016/j.sbspro.2012.06.502>
- Nyamweru, J. C., Ndayitwayeko, W. M., Kessler, A., & Biemans, H. (2024). Fostering sustainable agriculture in Burundi: Which competencies for change-agents should vocational agriculture education prioritize? *Journal of Agricultural Education and Extension*, 30(3), 341-361.  
<https://doi.org/10.1080/1389224X.2023.205395>
- Ravier, A., Chalut, P., Belarbi, S., Santerre, C., Vallet, N., & Nhouchi, Z. (2024). Impact of the post-harvest period on the chemical and sensorial properties of *planifolia* and *pompona* Vanillas. *Molecules*, 29(4), 839.  
<https://doi.org/10.3390/molecules29040839>
- Rokhani, R., Asrofi, A., Adi, A. H., Khasan, A. F., & Rondhi, M. (2021). The effect of agricultural extension access on the performance of smallholder sugarcane farmers in Indonesia. *AGRARIS: Journal of Agribusiness and Rural Development Research*, 7(2), 142-159.  
<https://doi.org/10.18196/AGRARIS.V7I2.11224>
- Setiadi, A., Santoso, S. I., Nurfadillah, S., Prayoga, K., & Prasetyo, E. (2020). Production and marketing system of kampung chicken in Batang Regency, Central Java, Indonesia. *Caraka Tani: Journal of Sustainable Agriculture*, 35(2), 326-336.  
<https://doi.org/10.20961/carakatani.v35i2.40907>
- Setiawan, D., Setiawan, I., & Wulandari, E. (2023). Keberlanjutan agribisnis vanili di Kabupaten Sumedang, Jawa Barat. *Analisis Kebijakan Pertanian*, 21(1), 97-110.  
<https://doi.org/10.21082/akp.v21i1.97-110>
- UNDP. (2017). *Guidance note: application of the sustainable livelihoods framework in development projects*. United Nations Development Programme (UNDP).
- Wahyudi, A., Sujianto, S., & Kurniasari, I. (2021). Strategy for developing Indonesian vanilla products to improve the added value. *IOP Conference Series Earth and Environmental Science*, 892(1), 012042.  
<https://doi.org/10.1088/1755-1315/892/1/012042>
- Watteyn, C., Fremout, T., Karremans, A. P., Huarcaya, R. P., Azofeifa Bolaños, J. B., Reubens, B., & Muys, B. (2020). Vanilla distribution modeling for conservation and sustainable cultivation in a joint land sparing/sharing concept. *Ecosphere*, 11(3), 1-18.  
<https://doi.org/10.1002/ecs2.3056>

- Wulandari, R. (2015). Information needs and source information of agricultural extension workers in DIY. *AGRARIS. Journal of Agribusiness and Rural Development Research*, 1(2), 85-87. <https://doi.org/10.18196/agr.1212>
- Wulandari, S. (2021). Investment risk management for vanilla agribusiness development in Indonesia. *E3S Web of Conferences*, 232, 1-9. <https://doi.org/10.1051/e3sconf/202123202022>
- Yamane, T. (1973). *Statistics: An introductory analysis* (3rd ed.). Harper and Row.