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SINTA 2

The Influence of Farmers' Knowledge of the Jajar Legowo Planting System on Rice Production

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ABSTRACT

The Legowo row planting system is a method of rice cultivation with several rows separated by one empty row. This research aims to determine the influence of farmers' knowledge and skills in applying the Legowo row planting system on rice production. A quantitative descriptive method was used with 112 rice farmers who have implemented the system in Landak Regency. Data analysis was performed using the structural equation modeling (SEM) model with SMART PLS 3.0 software. The results show that rice production using the Legowo planting system is significantly influenced by knowledge factors, including training levels and innovation adoption, and skill factors, including procedures and water management. These factors significantly impact rice production for farmers implementing the Legowo system.

Keywords: Rice production, Legowo planting system, farmer knowledge, farmer skills

INTRODUCTION

Rice is one of the primary food commodities for the Indonesian people (Saleh, 2022). Rice cultivation significantly contributes to the national economy and is widely cultivated by the community (Raspati et al., 2020). In 2022, the harvested area for rice reached 10.45 million hectares, an increase of 40.87 thousand hectares (0.39 percent) from 2021, with production reaching 54.75 million tons of dry unhulled rice (BPS, 2022). However, rice production in Indonesia has not yet met the needs of the entire population, leading the government to continue importing rice from other countries (Suprapto, 2021). This is due to an increase in rice consumption that is not matched by an increase in production, potentially leading to a national rice shortage. Therefore, increasing rice production has become a significant priority (Hilalullaily et al., 2021).

Between 1984-1986, Indonesia achieved rice self-sufficiency, but the country has since become a rice importer. Food security to achieve rice self-sufficiency is now the government's main focus in agricultural development policies (Rahayu & Febriaty, 2019). Sustainable food security issues include aspects of independence, availability, and affordability of food, which are inseparable from challenges in agriculture and the disempowerment of farmers as the main actors in farming (Saleh & Suherman, 2021). The success of agricultural enterprises largely depends on the capabilities of farmers as the primary managers (Tanjung et al., 2023), which vary depending on their individual characteristics (Fadhilah et al., 2018).

The government has taken several steps to increase rice production, such as developing irrigation facilities, providing subsidies for seeds, fertilizers, and pesticides, and offering subsidized

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agricultural credit (Swastika et al., 2016). Additionally, the government supports agricultural development through various strategies, including intensification, diversification, rehabilitation, and technical innovations such as balanced fertilization, cropping patterns, and plant protection (Riyadi, 2020).

One of the innovations in cropping patterns is the "jajar legowo" planting system, a method of rice planting that involves several rows separated by one empty row (Nirwan et al., 2019). This system allows the outermost rice plants more space to grow, with good air circulation and optimal sunlight utilization, and facilitates maintenance such as weed control and fertilization (Prasetyono & Kadir, 2019). The "jajar legowo" planting system has been proven to increase rice production compared to conventional systems (Hiola & Indriana, 2018).

However, many farmers still use conventional methods, making it difficult for rice production to increase or even causing a decline (Yalrendra et al., 2022). Therefore, innovation and the enhancement of farmers' knowledge and skills in implementing more efficient farming systems are essential.

This research was conducted in Landak Regency, specifically in Sengah Temila District, one of the key food production centers in the region. Since 2019, this area has adopted the "jajar legowo" planting system, but cultivation practices are still not optimal. The lack of knowledge and skills among farmers in implementing this system, such as insufficient understanding of the effectiveness of the "jajar legowo" planting system, impacts production and harvest quality (Lestari & Sriyono, 2021).

Farmers' knowledge of the "jajar legowo" planting system includes plant spacing arrangements, the selection of appropriate varieties, the use of fertilizers and pesticides, and pest and disease control. Farmers' skills involve the ability to apply cultivation techniques suitable for this system, such as planting, maintenance, and harvesting (Lestari & Sriyono, 2021).

Capacity building for farmers becomes crucial to improve the ability of individuals, groups, or organizations to solve problems and achieve goals (Aghis et al., 2020). Agricultural extension workers play a role as change agents, encouraging farmers to enhance their skills, make independent decisions, and achieve a better quality of life (Fadhilah et al., 2018). According to Rahma et al. (2019), training and mentoring are necessary to address farmers' lack of understanding of innovations, thereby increasing their knowledge and skills.

Moreover, a case study in Kudus Regency showed that factors such as the amount of loans, farming duration, land area, and age significantly affect farmers' ability to repay Food and Energy Security Credit (KKP-E), which is one of the essential instruments in supporting the sustainability of rice farming (Pertiwi et al., 2019).

It is hoped that the results of this research will serve as a source of information and enhance farmers' knowledge and skills in applying the "jajar legowo" planting system with the aim of increasing rice production. Indonesia faces significant challenges in the agricultural sector, one of which is the unfavorable demographic shift in the workforce. More farmers are aging (over 55 years old), while the number of young workers interested in working in agriculture continues to decline. This condition affects the adoption of new technologies, such as the "jajar legowo" planting system, which has proven to increase rice production. This phenomenon has the potential to slow down efforts to increase rice production in Indonesia, particularly in regions like Landak Regency, which has started implementing the "jajar legowo" planting

system since 2019 (Yusnita Arvianti et al., 2019).

METHODS

This study uses a quantitative descriptive method to understand changes in phenomena or conditions in the field (Usman, 2008). The research location is in Sengah Temila District, Landak Regency, selected purposively as it is one of the food production centers in Landak Regency and has implemented the legowo row planting system since 2019. The study was conducted in February 2024.

The population of this study consists of 7,800 rice farmers in Sengah Temila District (BPP, 2023). The sample was taken using a non-probability sampling technique with purposive sampling, involving rice farmers who have implemented the legowo row planting system for at least two years. To avoid bias, the sample size was set at 100 farmers (Redreh et al., 2023).

Primary data was obtained through interviews and questionnaires regarding farmers' knowledge and skills related to the legowo row planting system and its connection to rice production. Secondary data was obtained from articles, books, BPS, and previous research related to the legowo row planting system (Sugiyono, 2013).

The research variables include production, knowledge, and skills. Production refers to the process of converting inputs into outputs (Smith, 1869). Knowledge includes understanding of crop varieties, the use of fertilizers and pesticides, and pest and disease control (Bernardin, 1993). Skills encompass technical skills, communication skills, and conceptual skills (Robert, 1974).

Data analysis was carried out in four stages:

1. Identifying the characteristics of rice farmers descriptively and quantitatively, including gender, age, education level, number of dependents, and the duration of rice farming (Sugiyono, 2013).
2. Identifying the characteristics of knowledge and skills with aspects of human, process, technology, technical skills, human relations skills, and conceptual skills using a 4-point Likert scale and 4-point Semantic Differential (Bernardin, 1993; Robert, 1974).
3. Analyzing the relationship between variables using the Maximum Likelihood Estimate (MLE) technique through Structural Equation Modeling (SEM) with the help of SMART PLS 3.0 software. Evaluation of the outer model includes reflective and formative measurements, while evaluation of the inner model includes hypothesis testing and the value of variable correlation (Hair et al., 2021).
4. Describing the influence of farmers' knowledge and skills in implementing the legowo row planting system on rice production.

RESULT AND DISSCUSSION

A. General Overview of the Research Location

Sengah Temila District is located in Landak Regency with geographical coordinates between 00°08'12.88"–00°30'34.16" North Latitude and 109°41'34.88"–109°47'05.88" East Longitude. The district is bordered by Menyuke District to the north, Ngabang District to the east and south, and Mandor District to the west. The area of Sengah Temila District is 1,963 km², or about 19.81% of the total area of Landak Regency, with a population of 66,112 people, consisting of 34,590 males and 31,522 females (BPS Landak, 2020).

Land use in Sengah Temila District is divided into paddy fields, non-paddy fields, and non-agricultural land (BPS Landak, 2022). The leading commodity in this district is rice, with production details per village as listed in Table 3.

Table 3.
Rice Production Per Village in Sengah Temila District

No	Village	Rice Production (tons)
1	Tonang	4,652
2	Senakin	5,368
3	Andeng	5,048
4	Gombang	3,620
5	Aur Sampuk	4,820
6	Paloan	5,500
7	Pahauman	5,628
8	KR. Paidang	5,596
9	Sebatih	5,100
10	Saham	4,064
11	Sidas	2,716
12	KR. Mancal	3,328
13	Banying	2,970
14	Rabak	3,175
Total		**59,585**

Source BPP Sengah Temila, 2023

B. General Overview of Rice Cultivation with the Jajar Legowo Planting System

The rice cultivation process in the research area involves land preparation, planting, maintenance, and harvesting. Land preparation is carried out by plowing, loosening the soil, and clearing weeds. Planting is done using the 4:1 planting pattern with a spacing of 25x12.5 cm using a caplak tool. Fertilization is done three times using various types of fertilizers, according to the stages of rice growth. Harvesting is done manually, and the harvested rice is dried before being stored in sacks.

C. Characteristics of Respondents

The research respondents consist of rice farmers with the following characteristics:

1. **Gender**: 50% male and 50% female
2. **Age**: Dominant in the 36-50 years age group (50.8%)
3. **Formal Education**: Dominant high school level (72.3%)
4. **Farming Experience**: Dominantly >11 years (72.32%)

The dominance of farmers aged 36-50 years indicates maturity and experience in farming, which is important in decision-making and innovation adoption (Arifianto et al., 2018). The dominant high school education level indicates economic and educational facility limitations but is sufficient to increase productivity through knowledge and skills (Bayu Aji et al., 2020). The dominant farming experience of more than 11 years shows the farmers' ability to

manage rice cultivation effectively (Mardani et al., 2017).

D. Characteristics of Production, Knowledge, and Skills

Production Characteristics

1. **Production Efficiency**: 83.92%
2. **Total Output**: 71.43%
3. **Output Growth**: 82.14%
4. **Farmers' Income**: 68.75%

Knowledge Characteristics

1. **Training Level**: 81.25%
2. **Understanding of Rice Varieties**: 80.36%
3. **Experience**: 82.14%
4. **Innovation Adoption Rate**: 80.36%
5. **Technology Availability**: 80.36%
6. **Technology Mastery Level**: 75.89%
7. **Technology Support Level**: 28.57%

Skills Characteristics

1. **Technical Skill**: 78.57%
2. **Human Skill**: 82.14%
3. **Conceptual Skill**: 82.14%

E. Analysis of the Influence of Knowledge and Skills in Implementing the Jajar Legowo Planting System on Rice Production

Data analysis using SEM-PLS with the SmartPLS 3.0 application shows the following results:

Evaluation of Measurement Model (Outer Model)

Reflective Measurement Model

Table 6
CR (Composite Reliability) and AVE (Average Variance Extracted)

Variable	CR	AVE
Production (Y)	0.870	0.625
Knowledge (X1)	0.906	0.579
Skills (X2)	0.920	0.623

Formative Measurement Model

Table 7
R^2, R-Adj, and Q^2

Variable	R^2	R-Adj	Q^2
Production (Y)	0.774	0.769	0.451

Table 8
VIF (Variance Inflation Factor)

Indicator	VIF
Efficiency Level	2.393
Total Output	1.526
Output Growth	2.545
Income	1.464
Training Level	2.446
Understanding of Rice Varieties	2.039
Experience	2.220
Understanding	2.344
Innovation Adoption Rate	2.369
Technology Availability	1.906

Indicator	VIF
Technology Mastery Level	1.738
Procedures	2.523
Ability and Expertise	2.218
Communication Skills	2.134
Collaboration Skills	1.917
Planning Skills	1.767
Problem Understanding and Solution Selection	2.083
Water Management	2.397

Table 9
t-statistics and p-value

Variable Relationship	t-statistic	p-value
Knowledge (X1) -> Production (Y)	4.759	0.000
Skills (X2) -> Production (Y)	3.146	0.001

Structural Model Evaluation (Inner Model)

The structural model is used to test hypotheses and variable relationships. Hypothesis testing is shown through t-statistics and p-value.

1. The analysis results show that knowledge (X1) and skills (X2) have a significant influence on production (Y). The level of farmers' knowledge and skills positively contributes to production efficiency, total output, output growth, and farmers' income. Farmers' knowledge about suitable rice varieties and skills in applying the Jajar Legowo planting system support the increase in rice production in Sengah Temila District.
2. This research finding indicates that the Jajar Legowo planting system positively impacts rice production in Sengah Temila District. Farmers who participated in training and had more than 11 years of experience showed better abilities in managing rice cultivation. Knowledge and skills factors play an essential role in increasing rice production. The availability of technology, such as the caplak tool, helps farmers in the planting process, although the level of technology support remains low.
3. These findings are consistent with the research of Arifianto et al. (2018), which states that farmers' age and experience influence the effectiveness of rice cultivation. The dominant high school education level among farmers also supports the findings of Bayu Aji et al. (2020) that education increases productivity through knowledge and skills. This research also supports the findings of Mardani et al. (2017), which show that farming experience contributes to increasing farmers' knowledge and skills.
4. However, this research has limitations regarding the low level of technology support, which can be a focus for future research. Higher technology support can enhance the adoption of agricultural innovations and support the increase in rice production.
5. This research shows that farmers' knowledge and skills play an important role in increasing rice production using the Jajar Legowo

planting system. Therefore, continuous training and extension, along with adequate technology support, are crucial to supporting farmers in increasing rice production. The government and related institutions need to enhance training programs and provide agricultural technology that is easily accessible to farmers.

6. Recommendations for future research include exploring other factors that may influence rice production, such as environmental conditions, fertilizer use, and water management practices.

CONCLUSION

The implementation of the Jajar Legowo planting system in rice cultivation significantly influences rice production through several key factors, namely farmers' knowledge and skills. This study shows that the variables of production (Y), knowledge (X1), and skills (X2) have a strong relationship, with significant indicators on each variable.

Output growth is the main factor in rice production, and the reflective implementation of the Jajar Legowo planting system significantly affects this output growth. Knowledge plays a crucial role as the foundation for applying innovations like the Jajar Legowo planting system, influenced by factors such as training, innovation adoption, experience, and understanding. Farmers' knowledge has a significant impact, with a value of 0.535, while skills have an impact of 0.368. Better knowledge is obtained through training, innovation adoption, experience, and deep understanding, all of which contribute to increased rice production.

In terms of skills, the procedures applied, water management abilities, communication skills, and problem understanding and solution selection play an important role. Good procedures, water management skills, and reflective communication and planning skills strongly support the success of this system's implementation.

To increase rice production through the Jajar Legowo planting system, the following steps are recommended:

a. Strengthening the role of agricultural extension workers in providing training on the proper application of the Jajar Legowo planting system, starting from land preparation to post-harvest activities.

b. Providing technical support such as technology provision and resources for farmers to ensure the correct implementation of the Jajar Legowo planting system.

c. Encouraging collaboration between the government, agricultural research institutions, and farmers for the adoption of appropriate and reflective innovations in increasing rice production, such as the implementation of the Jajar Legowo planting system.

Future research can develop more specific indicators related to the application of the Jajar Legowo planting system.

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