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Optimizing Rice Production: Innovative Cultivation Practices at the Farmer Level

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Abstract

The success of lowland rice cultivation is supported by the application of appropriate cultivation technology. The application of this technology is important to ensure optimal production achievement. The increasing population of Indonesia every year increases the demand for rice. To meet this need, the rice cultivation techniques applied by farmers need to be considered. Production factors are related to the application of cultivation techniques, including variety selection, fertilization, irrigation, and control of plant pests, all of which affect the results of lowland rice production. The research was conducted through a survey, by collecting data from farmer groups who own rice fields in South Bolaang Mongondow Regency, which includes Bolaang Uki District, Popodu and Salongo Villages and Pinolosian District, Kombot Village. The application of agricultural technology in South Bolaang Mongondow Regency is still not optimal, mainly due to the financial limitations of farmers. In general, 40% of farmers achieve production of 2-2.5 tons/ha and this shows that increasing access to technology and financial support is very important to increase productivity among farmers.

Keywords: *Cultivation; Production; Rice; Technology*

Introduction

South Bolaang Mongondow Regency is one of the rice-producing areas with a fairly large area of 2,002 hectares with a total production of 8,368 tons in North Sulawesi Province (BPS, 2024), so the application of rice cultivation techniques related to rice production needs special attention. One strategy to maintain rice self-sufficiency is to implement a targeted program, namely farmers as the main actors in the application of rice cultivation technology. The application of this cultivation technology greatly determines rice productivity. However, farmers have diverse characteristics, which affect how they accept and apply technology. These characteristics differentiate the behavior of each farmer in certain situations. One important factor that influences the communication process in the dissemination of information and the adoption of technological innovation is the characteristics of the farmers themselves (Bancin et al., 2019; Managanta et al., 2021; Porong et al., 2023).

Characteristics refer to the natural traits inherent in a person, such as age, education level, land area, and experience in farming. Farmer characteristics and farming competencies reflect the ability to manage farming effectively and efficiently, by appropriate cultivation techniques. These characteristics, together with farming competencies, indicate the performance and responsibility of farmers in running farming sustainably. This factor is very important in determining the level of innovation adoption by farmers (Managanta et al., 2021; Arita et al., 2022). Social characteristics of farmers, such as productivity and experience, can still show positive results even though the level of education is low. Meanwhile, in terms of economy, farmer characteristics often involve narrow land, small capital, and labor from within the family (Datta, 1981; Kurniati & Sisca, 2020).

Bolaang Uki District, Popodu and Salongo Villages and Pinolosian District, Kombot Village in North Sulawesi Province, Indonesia are some of the villages that provide rice. Rice production needs special attention to meet rice needs and reduce dependence on imports. Production factors that include the application of cultivation techniques such as variety selection, fertilization, irrigation, and control of plant pests are very important to know and apply optimally. The application of these factors is crucial to achieve maximum rice production.

Differences in perception in the application of rice cultivation technology among farmers are thought to be caused by differences in farmers' perspectives and responses to technological innovations, which are influenced by their respective characteristics. These characteristics include age, level of formal education, area of cultivated land, and farming experience with the level of adoption of rice cultivation innovations (Managanta, 2020; Wijaya & Astuti, 2023). In addition, farmers' economic factors also play a major role in determining the extent to which rice cultivation technology can be applied. This study aims to study the characteristics of farmers in the application of cultivation technology to increase rice production in South Bolaang Mongondow Regency, North Sulawesi Province, Indonesia.

Method

The research was conducted in South Bolaang Mongondow Regency, precisely in Bolaang Uki District, Popodu and Salongo Villages, and Pinolosian District, Kombot Village in 2024. The method used was through a survey and the data collected consisted of primary and secondary data. Primary data was obtained directly through observation and interviews with respondents, namely owners and cultivators of rice fields, using questionnaires. Secondary data included the content of N, P, K, pH, and organic C from rice fields, which were analyzed in the laboratory. The research data were analyzed descriptively by displaying tables and images.

Results and Discussion

Farmers' education levels show variations ranging from elementary school to senior high school. In Figure 1, the distribution of the percentage of farmers based on education level explains the level of literacy and potential ability to adopt more modern agricultural technologies or practices. Farmers with a higher educational background, such as high school graduates, tend to be more open to innovation and are better able to understand information related to more complex agricultural techniques. Meanwhile, farmers with basic or low education face challenges in accepting changes and innovations due to limitations in understanding technical concepts. However, experience in the field remains an important factor that can complement the limitations of formal education.

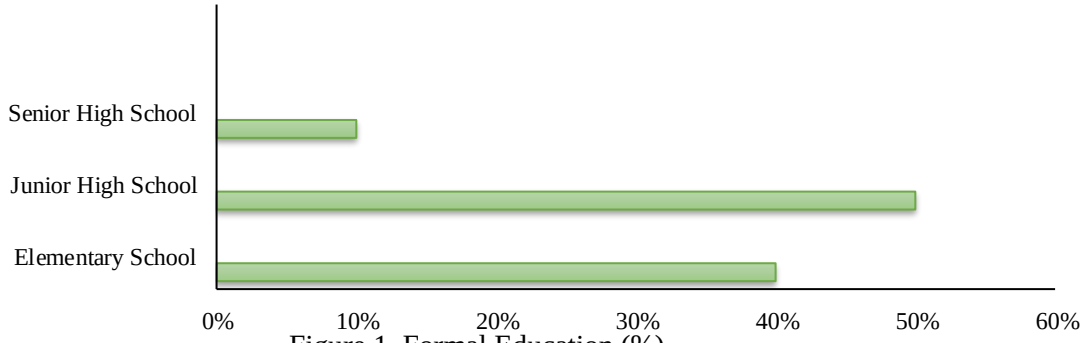

Figure 1. Formal Education (%)

The results of the study showed that 80% of the workforce was in the age range of 40 to 55 years, which was considered productive because they had skills, coupled with farming experience between 17 and 40 years (Figure 1). The age category was divided into three groups, young age 15-24 years, prime age group 25-59 years, and old age group over 60 years (Ministry of Agriculture, 2023). The data showed that most farmers were in the prime age group, which made it possible to apply optimal cultivation techniques. Samun et al., (2011) stated that farmers aged 30-59 years had a physique that supported farming activities and were dynamic, creative, and quick to accept new technological innovations. This is in line with the results of Novita et al., (2016); Managanta et al., (2021); and Arita et al., (2022) research, which showed that farmers in productive age find it easier to understand new things in farming, so they can increase their rice production.

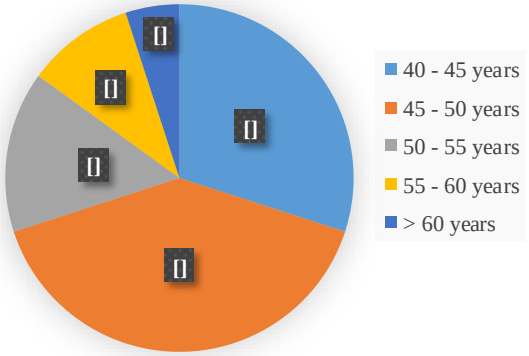

Figure 2. Average age of farmers (years)

Fertilization carried out by farmers generally does not follow the recommended dosage for lowland rice cultivation. Farmers also rarely use rice straw as a source of organic material to restore nutrients lost during the harvest process. Most farmers do not use organic fertilizer. This can be seen from the results of laboratory analysis of samples of rice field soil taken (Table 1), which shows that the content of organic matter nutrients in rice fields is relatively low. The use of fertilizer doses often depends on the financial condition of farmers, so production does not always meet expectations. In addition, pest and disease attacks that occur can cause crop failure. Lack of attention from agricultural extension workers also causes farmers to lack adequate information to deal with pest and disease attacks effectively.

Table 1. Content of N, P, K, pH and C-Organic

Village	pH H2O	pH KCl	C-Organic (%)	N (%)	P (ppm)	K (%)
Salongo	5,95	5,62	1,89	0,22	281	0,24
Popodu	6,05	5,39	2,23	0,06	176	0,14
Kombot	5,52	5,38	1,65	0,20	172	0,19

Note: Palm Plant Instrument Standard Testing Center Testing Laboratory, 2024 (International Organization of Standardization 17025 Accreditation)

The results of the study showed variations in the achievement of lowland rice production among farmers. The data indicated significant differences in productivity levels, which can be linked to various factors such as the application of cultivation technology, land conditions, and the availability of agricultural inputs. As many as 20% of farmers managed to achieve production between 1.5 to 2 tons per hectare, while 40% of farmers produced between 2 to 2.5 tons per hectare, and another 40% achieved higher production, namely 3 to 4 tons per hectare (Figure 3).

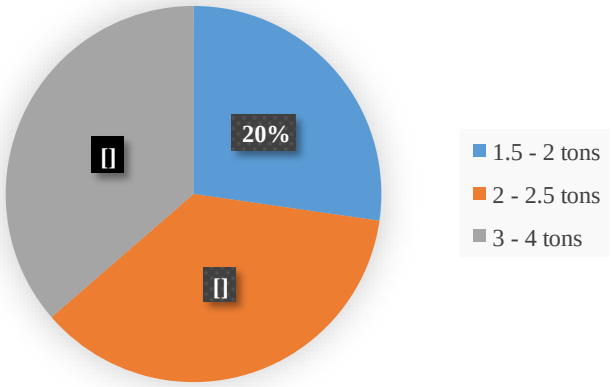

Figure 3. Rice Production (tons)

Discussion

The success of the application of cultivation techniques is not only influenced by age and education level, but also by the availability of seeds, irrigation, fertilizers, and production factors. These factors play a significant role in determining crop yields and land productivity. In terms of seeds, farmers generally obtain seeds from previous harvests, where part of the harvest is set aside to be used as seeds in the next planting season. In addition, farmers also often obtain seeds from fellow farmers, a resource-sharing system in the farming community. The most commonly planted rice varieties are Ciherang, H2M (Herson Mayulu), and Inpari, which are chosen because of their resistance to pests and weather and their relatively high productivity.

The results of the study showed that there were two planting systems applied by farmers. The first method is through seeding and transplanting seedlings, where the seedlings are sown first and then transferred to the field at the age of 3 to 4 weeks. The second method is a direct seed planting system, where the seeds are directly sown in the field without a seeding process. These two methods were chosen based on land conditions, labor availability, and farmer preferences regarding time and efficiency. Irrigation is carried out by relying on pump machines and irrigation from Pinolosian and Salongo dams. The irrigation system is very important to maintain water success during the planting season, especially during the dry season or when rainfall is low. The combination of proper cultivation techniques and adequate irrigation infrastructure support allows farmers to optimize land productivity and achieve better yields.

These differences in productivity explain the variation in the use of cultivation technology and agricultural practices. Farmers who achieve higher production are more likely to have implemented more efficient cultivation techniques, such as the use of superior varieties, good air management, and more precise application of fertilizer doses. In addition, the experience and knowledge of farmers in managing their farms also play an important role in achieving higher yields. Farmers who are only able to produce 1.5 to 2 tons per hectare face obstacles in implementing cultivation technology. Factors such as limited capital, lack of access to quality fertilizers and seeds, and lack of technical support from agricultural extension workers can be the causes of low rice productivity. In addition, less fertile land conditions and minimal use of organic materials such as rice straw can also hurt production results.

This variation in production achievement shows the importance of more intensive interventions, both in terms of extension, access to agricultural inputs, and improving farmer skills. With the right support, rice production in South Bolaang Mongondow Regency has the potential to be increased, especially for farmers who are currently in the low productivity group. This is important to ensure food security in the area and reduce dependence on rice imports.

Conclusion

The application of cultivation technology in South Bolaang Mongondow Regency, North Sulawesi Province, Indonesia is not yet optimal. The main obstacles faced by farmers are financial constraints, and weak extension processes at the farmer level, which have an impact on the low skills of farmers in accessing the necessary agricultural inputs, such as fertilizers, superior seeds, and irrigation technology. Variations in rice production achievement starting from 1 to 4 tons/ha among farmers indicate a gap in the application of technology. There are differences in production and this indicates that not all farmers have the same access to cultivation technology or sufficient skills to implement it effectively. The government needs to develop a credit program or financial assistance that is specifically targeted at subsidized farmers. Fertilizer and superior seed subsidies, as well as soft loan schemes, can help farmers overcome capital constraints and increase the adoption of more efficient cultivation technologies. More incentivized and sustainable extension programs are needed, especially for farmers with low productivity. Extension should focus more on the application of modern cultivation technologies, land management, and more efficient fertilization and irrigation techniques. Local governments and agricultural institutions need to ensure the availability of agricultural inputs such as superior seeds, organic fertilizers, and irrigation technologies throughout the South Bolaang Mongondow Regency. This distribution will reduce the gap in rice production among farmers.

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