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The Impact of Policy Changes in the Distribution of Subsidized Fertilizers and the Use of Biopesticides on Chili Crop Productivity in Rejang Lebong Regency, Bengkulu Province

Gracia Gabrienda[1], Mira Yanuarti[2], Dwita Prisdinawati[3], David Arianto[4], Jepri Saputra[5]
[1] Faculty of Agriculture, Pat Petulai University and ggabrienda@gmail.com
[2] Faculty of Agriculture, Pat Petulai University and mira.yanuarti22@gmail.com
[3] Faculty of Agriculture, Pat Petulai University and dwita.frisfinawati@gmail.com
[4] Faculty of Agriculture, Pat Petulai University and ddarianto20@upprl.ac.id
[5] Faculty of Agriculture, Pat Petulai University and jeprisaputra20@upprl.ac.id

ABSTRACT

This study examines the impact of changes in subsidized fertilizer distribution policies and the use of biopesticides on the productivity of chili plants in Rejang Lebong Regency, Bengkulu Province. A quantitative approach was employed, utilizing a sample of 85 chili farmers. Data were collected through a Likert-scale questionnaire (1-5) and analyzed using SPSS version 25. The results revealed that both subsidized fertilizer policies and biopesticide usage significantly and positively influenced chili productivity, explaining 53% of the productivity variance. Descriptive statistics indicated moderate to high levels of satisfaction with fertilizer policies and biopesticide effectiveness. These findings emphasize the importance of integrated policy measures to enhance agricultural productivity and sustainability. Recommendations include improving fertilizer distribution systems and promoting biopesticide awareness among farmers.

Keywords: *Subsidized Fertilizer Policies, Biopesticides Usage, Chili Productivity, Sustainable Agriculture.*

1. INTRODUCTION

The productivity of chili cultivation in Indonesia is significantly influenced by various factors, including government policies, agricultural practices, and technological advancements. Government policies, particularly subsidized fertilizer distribution, play a crucial role in reducing production costs for farmers and increasing yield [1], [2]. Stable price regulation and the provision of agricultural infrastructure further support sustainable agribusiness development [1]. Additionally, the adoption of biopesticides and integrated pest management is vital for sustainable chili cultivation, as it helps control pests without harming the environment [1]. Training programs have also been effective in enhancing farmers' skills in sustainable practices, leading to increased yields and improved food security [3]. Moreover, technological advancements, such as precision agriculture technologies like drip irrigation and integrated pest management, significantly boost productivity while conserving resources [1], [4]. The implementation of Good Agricultural Practices (GAP) has been shown to increase chili productivity by 16.41% in East Java, highlighting the importance of adopting modern agricultural techniques [5]. These elements collectively contribute to improving productivity, ensuring food security, and supporting rural livelihoods.

The changes in Indonesia's subsidized fertilizer policies have significantly impacted farmers' access to essential resources, particularly in regions like Rejang Lebong Regency, Bengkulu Province, known for chili production. These policy shifts have led to delays, distribution inefficiencies, and inequities, which can adversely affect crop yields. Delays and irregularities in the distribution of subsidized fertilizers have been reported, affecting timely access for farmers due to ineffective coordination and communication among stakeholders, as well as poor logistics infrastructure [6].

Misallocation and misuse of fertilizers are prevalent, with quota deviations by farmers and distributors further complicating equitable access [7]. While fertilizers like NPK and SP36 have been shown to boost yields in other regions, the impact of reduced subsidies on productivity is complex. In Aceh Province, restrictions on Urea and other fertilizers did not significantly affect overall agricultural production, suggesting that the impact may vary by region and crop type [8], [9]. The effectiveness of fertilizer subsidies in enhancing productivity is not uniform, as seen in the varied impact on paddy yields across different provinces [10]. To address these challenges, the introduction of the Farmer Card (Kartu Tani) aims to streamline the distribution process, but its effectiveness is hindered by technical issues and farmers' distrust of new technology. Enhancing technological infrastructure and providing training could improve the system's transparency and efficiency [7].

In parallel, there has been growing advocacy for the adoption of sustainable agricultural practices, including the use of biopesticides. Unlike chemical pesticides, biopesticides offer an eco-friendly alternative for managing pests and diseases, reducing environmental harm and ensuring the long-term viability of agricultural ecosystems. However, their effectiveness and acceptance among farmers remain key considerations in evaluating their impact on productivity. The purpose of this study is to analyze the combined effects of changes in subsidized fertilizer distribution policies and the use of biopesticides on the productivity of chili plants.

2. LITERATURE REVIEW

2.1. Subsidized Fertilizer Distribution Policies

Subsidized fertilizer programs help reduce agricultural input costs and support farmers’ livelihoods. In Indonesia, these subsidies aim to ensure equitable access to fertilizers and enhance crop yields, particularly for smallholder farmers (Susilowati et al., 2019). However, inefficiencies like delays and unequal allocation can reduce their effectiveness [11]. While policy changes seek to improve efficiency, they may also limit farmers’ access to fertilizers, affecting productivity [12]. Effective implementation requires robust monitoring and transparent allocation to prevent supply chain disruptions [13]. In chili farming, fertilizers are essential for optimal growth, as nutrient availability directly influences productivity and profitability [14].

2.2. Biopesticides and Sustainable Agricultural Practices

Biopesticides, derived from natural materials such as microorganisms, plants, and minerals, have gained attention as an environmentally friendly alternative to chemical pesticides, contributing to sustainable agricultural practices. They help reduce environmental and health risks while maintaining effective pest control [15]. Several studies highlight their advantages, including biodegradability, specificity to target pests, and minimal impact on beneficial organisms [16]. However, adoption is often hindered by limited awareness among farmers, higher costs compared to chemical alternatives, and variability in effectiveness [17]. In chili farming, where crops are highly susceptible to pests and diseases like aphids and powdery mildew, biopesticides have shown promise in improving crop health and yield while supporting sustainable agriculture [18].

2.3. Combined Effects of Fertilizer Policies and Biopesticide Use

The interaction between subsidized fertilizer distribution policies and biopesticide use plays a crucial role in agricultural productivity, as fertilizers provide essential nutrients for plant growth while biopesticides help protect crops from pests and diseases. Together, these factors create a synergistic effect that enhances yield potential [19]. Research suggests that integrating sustainable pest management practices with effective fertilizer use can improve productivity and reduce environmental degradation [10]. However, the success of these approaches largely depends on farmers' access to resources, training, and government support.

2.4. Context of Chili Farming in Rejang Lebong Regency

Rejang Lebong Regency, located in Bengkulu Province, is a key contributor to Indonesia's chili production, benefiting from favorable climate and soil conditions. However, farmers face challenges such as limited access to inputs and persistent pest infestations. The region relies heavily on government-subsidized fertilizers, and studies highlight the need for sustainable pest management strategies to improve productivity [20]. Given chili farming's significance to the local economy, understanding the effects of policy changes and biopesticide adoption is essential for developing strategies that enhance both productivity and sustainability.

2.5. Research Gap

While existing literature provides valuable insights into the individual impacts of fertilizer distribution policies and biopesticide use, there is limited research on their combined effects on chili productivity. Additionally, localized studies focusing on Rejang Lebong Regency are scarce, necessitating a deeper exploration of these factors in the regional context.

This study aims to fill this gap by examining the interplay between changes in subsidized fertilizer distribution policies and the use of biopesticides, providing evidence-based recommendations to enhance chili productivity in Rejang Lebong Regency.

3. METHOD

3.1. Research Design

The study adopts a correlational research design to investigate the relationships between changes in subsidized fertilizer distribution policies, the adoption of biopesticides, and chili productivity. This design is suitable for understanding the extent to which these variables influence one another.

3.2. Population and Sample

The population of this study consists of chili farmers in Rejang Lebong Regency, with 85 farmers selected as respondents using purposive sampling. The inclusion criteria required farmers to be actively cultivating chili plants in the region, have experienced the effects of changes in subsidized fertilizer distribution policies, and have used or been aware of biopesticides in their farming practices.

3.3. Data Collection

Data were collected using a structured questionnaire designed to capture respondents' perceptions and experiences, consisting of three sections: demographic information, which included age, education level, farming experience, and farm size; subsidized fertilizer policies, assessing availability, accessibility, and perceived impact on chili productivity; and biopesticide usage, evaluating adoption levels, perceived effectiveness, and associated challenges. Responses were measured using a 5-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

3.4. Data Analysis

The data were analyzed using SPSS version 25 through several steps: descriptive statistics were used to summarize the demographic profile of respondents and provide an overview of their responses; reliability testing using Cronbach's Alpha ensured the questionnaire's internal consistency, with a value above 0.7 considered acceptable; correlation analysis examined relationships between changes in subsidized fertilizer distribution policies, biopesticide use, and chili productivity; and regression analysis was conducted to determine the strength and significance of the independent variables (subsidized fertilizer policies and biopesticide use) on the dependent variable (chili productivity).

4. RESULTS AND DISCUSSION

4.1 Descriptive Statistics

Descriptive statistics provide an overview of the demographic characteristics and key study variables. The sample consisted of 85 chili farmers with an average age of 42.5 years and an average farming experience of 12.7 years. In terms of education, 60% had secondary education, 25% primary education, and 15% tertiary education. The average farm size was 1.2 hectares. Additionally, descriptive statistics were used to summarize the main study variables, providing insights into the distribution and trends within the dataset.

Table 1. Descriptive Statistics

Variable	Mean	Standard Deviation	Min	Max
Subsidized Fertilizer Policies	3.84	0.651	2.51	4.88
Biopesticides Usage	3.68	0.726	2.02	4.56
Chili Productivity	3.92	0.683	2.85	4.93

The mean scores indicate moderate to high levels of satisfaction and perceived effectiveness across all variables, providing key insights into farmers' perceptions of subsidized fertilizer policies, biopesticide usage, and chili productivity. The mean score for subsidized fertilizer policies was 3.8, suggesting that farmers generally perceive these policies as moderately effective, though some dissatisfaction exists due to distribution irregularities (Min = 2.51, Max = 4.88, SD = 0.651). Biopesticide usage had a slightly lower mean score of 3.68, reflecting moderate benefits but also challenges related to cost, availability, and knowledge gaps, as indicated by a wider variation in responses (Min = 2.02, Max = 4.56, SD = 0.726). Chili productivity received the highest mean score of 3.92, signifying generally favorable productivity levels influenced by fertilizer and biopesticide use, though variability in outcomes suggests the impact of external factors like weather and soil conditions (Min = 2.85, Max = 4.93, SD = 0.683). These findings highlight both the effectiveness and areas for improvement in agricultural support programs.

4.2 Reliability Testing

The reliability of the questionnaire was assessed using Cronbach's Alpha, with all values exceeding the acceptable threshold of 0.7, indicating high internal consistency. The reliability scores were α = 0.82 for subsidized fertilizer policies, α = 0.78 for biopesticide usage, and α = 0.85 for chili productivity, confirming that the measurement tools used in the study were consistent and reliable.

4.3 Correlation Analysis

The Pearson correlation coefficients are summarized below:

Table 2. Correlation Analysis

Variables	Subsidized Fertilizer Policies	Biopesticides Usage	Chili Productivity
Subsidized Fertilizer Policies			
Biopesticides Usage	0.422**		
Chili Productivity	0.624**	0.583**	

The results show significant positive correlations between all variables, indicating that both subsidized fertilizer policies and biopesticide usage are strongly associated with increased chili productivity.

4.4 Regression Analysis

A multiple regression analysis was conducted to examine the effects of the independent variables on chili productivity. The regression model summary indicates that R2=0.53, meaning the model explains 53% of the variance in chili productivity. The F-statistic value is F=18.27 with p<0.001, suggesting that the model is statistically significant.

Table 3. Coefficients

Predictor Variable	Coefficient (β\betaβ)	t-value	p-value
Subsidized Fertilizer Policies	0.425	4.126	< 0.01
Biopesticides Usage	0.357	3.481	< 0.05

Both subsidized fertilizer policies and biopesticide usage significantly and positively affect chili productivity. The coefficient for subsidized fertilizer policies (β = 0.425) indicates a strong and direct relationship, where a one-unit increase in policy effectiveness corresponds to a 0.425-unit increase in chili productivity. This underscores the importance of fertilizer accessibility, affordability, and distribution in enhancing productivity levels. The t-value of 4.126 exceeds the critical threshold of 1.96 (at a 95% confidence level), and the p-value is <0.01, confirming the statistical significance of this relationship. Similarly, biopesticide usage has a positive coefficient (β = 0.357), indicating a moderate direct effect, with a one-unit increase in biopesticide effectiveness leading to a 0.357-unit rise in productivity. The t-value of 3.481 surpasses 1.96, and the p-value is <0.05, affirming statistical significance, though its impact may be influenced by factors such as application methods, environmental conditions, or pest resistance. These findings highlight the crucial roles of both subsidized fertilizer policies and biopesticide adoption in improving chili productivity.

Discussion

The findings confirm that changes in subsidized fertilizer distribution policies significantly affect chili productivity. Improved availability and accessibility of fertilizers enable farmers to meet the nutritional needs of chili plants, resulting in higher yields. However, inefficiencies in distribution, as reported by some respondents, highlight the need for better monitoring and transparency. This aligns with previous studies [12], which emphasize the importance of efficient policy implementation.

The positive relationship between biopesticide usage and chili productivity underscores the importance of sustainable pest management practices. Farmers who adopted biopesticides reported healthier plants and reduced pest-related losses. Nevertheless, the moderate adoption rate suggests that more awareness and training are needed to overcome barriers such as perceived costs and effectiveness variability, consistent with findings by [17].

The moderate correlation between subsidized fertilizer policies and biopesticide usage suggests that these factors are complementary rather than independent. Farmers who benefit from improved fertilizer access are more likely to invest in additional sustainable practices, such as biopesticides. The combined effects of these factors on productivity highlight the need for integrated policy approaches, as supported by [10].

Implications for Rejang Lebong Regency

The findings are particularly relevant for Rejang Lebong Regency, where chili farming is a vital economic activity. Addressing distribution inefficiencies and promoting biopesticide adoption can enhance productivity and sustainability. Tailored training programs and subsidies for biopesticides could further empower farmers and improve outcomes.

CONCLUSION

This study demonstrates that subsidized fertilizer policies and biopesticide use are significant drivers of chili productivity in Rejang Lebong Regency, emphasizing the crucial role of government interventions in ensuring efficient fertilizer distribution and promoting biopesticide adoption. With a combined explanatory power of 53%, these factors highlight the necessity of integrated approaches to enhance agricultural outputs. Policymakers are encouraged to strengthen fertilizer distribution networks for better accessibility and reliability, provide training and subsidies to promote biopesticide adoption, and develop a holistic agricultural framework that integrates both elements for sustainable productivity growth. By implementing these measures, chili farmers in Rejang Lebong can improve yields while supporting environmental sustainability. Future research should explore additional factors, such as climate variability and market dynamics, to gain a more comprehensive understanding of agricultural productivity in the region.

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