

RANKING PADDY FERTILIZER FOR RICE PRODUCTION USING FUZZY TOPSIS: A CASE STUDY OF KG PERMATANG TOK JAYA, PENANG

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Abstract

Paddy fertilizer plays a crucial role in enhancing rice production, but farmers often face challenges in selecting the most suitable option. The objective of this study is to identify and rank seven types of paddy fertilizers for rice production using the Fuzzy TOPSIS method. A total of 53 respondents, including farmers and MARDI officers, evaluated the fertilizers based on affordability, nutrient quality, environmental friendliness, and ease of use. Results show that from the farmers' perspective, NPK 17:20:10 (CC = 1.000), Urea (CC = 0.9249), and NPK 17.5:15.5:10 (CC = 0.8452) were the top choices. MARDI officers preferred Urea (CC = 1.000), NPK 17:20:10 (CC = 0.8285), NPK 15:15:15, and Realstrong N Bio-Booster require improvement. Differences in results reflect varying priorities, farmers emphasize practicality and ease of use, while MARDI officers focus on technical performance and long-term impacts. The findings offer valuable guidance for farmers, manufacturers, and policymakers to improve fertilizer use and rice yields. The study gives useful guidance to improve rice production and support food supply goals (Firdaus et al., 2020).

Keywords: *Topsis, fertilizer, rice production, MCDM, Urea*

1. Introduction

Rice is a major food for Malaysians, but many small farmers lack knowledge about the best fertilizers to use, leading to low yields and soil problems. This study aims to rank different paddy fertilizers for rice production in Kg Permatang Tok Jaya, Penang, using the Fuzzy TOPSIS method. The main goals are to rank the important criteria, compare different fertilizers, and find the best option to help farmers choose wisely. The scope of this research focuses on seven types of fertilizers and four main factors: affordable price, good nutrient quality, environmental friendliness, and convenience of use. The study collects data from local farmers and MARDI officers to give useful guidance for better rice production.

2. Methodology

This research employs the TOPSIS multi-criteria decision-making (MCDM) (Tscheikner-Gratl et al., 2017) approach to find the best paddy fertilizer for rice production. The TOPSIS process includes establishing criteria, normalizing decision matrices, applying weights, and identifying the ideal and finding the best and worst solutions. This study focuses on four key criteria: affordable price, good quality of nutrients, environmental friendliness, and convenience of use, to rank the fertilizers clearly and fairly. Seven paddy fertilizers were compared using data collected from 50 farmers and three MARDI officers. The answers were changed into fuzzy numbers to handle different opinions. The results were calculated to find the closeness of each fertilizer to the ideal solution. This process helps farmers see which fertilizer is the best choice. This method gives clear, useful results to help farmers improve rice production and use fertilizers more wisely.

3. Results / Findings

The implementation of the Fuzzy TOPSIS method showed its ability to rank paddy fertilizers based on farmers' and experts' preferences. The results identified NPK 17:20:10 as the best fertilizer as highest closeness coefficient (CCi) of 1.000, followed by Urea of and NPK 17.5:15.5:10 of 0.8285. Other fertilizer like PowerGro, Don-K3, and RealStrong N Bio-Booster ranked lower due to lower scores in key factors. Farmers confirmed that affordable price and good quality of nutrient are the most important when choosing fertilizers. This ranking process proves that the Fuzzy TOPSIS can help farmers choose fertilizers wisely and improve rice yields. The result highlights this method's potential to support better decisions, reduce costs, and help Malaysia's goal of stronger food security.

4. Novelty of Research

The study is special because it uses the Fuzzy TOPSIS method to help small paddy farmers choose the best fertilizer in Kg Permatang Tok Jaya, Penang. Many farmers still use traditional ways to pick fertilizers without proper knowledge, which can lead to low yields and soil problems. By using Fuzzy TOPSIS, this project combines expert opinions and farmers' views in a fair way. It also changes complex ideas into simple numbers that are easier to understand. This study provides a clear ranking of fertilizers based on important factors like price, nutrients, and the environment. The result help farmers make better decisions, save money, and support Malaysia's goal for better rice production and food security.

5. Conclusion or Future Work

This study helps farmers choose the best fertilizer to grow more paddy and save money. In the future, more farmers and places can be included to get better results. This method can also be used for other crops to help more farmers in Malaysia.

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