UNIVERSITI TEKNOLOGI MARA

CROP PLANTING STRATEGIES FOR MULTI-YEAR LAND PLANNING USING INTEGER LINEAR PROGRAMMING AND MONTE CARLO SIMULATION

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ABSTRACT

Crop rotation is commonly used to improve soil health and maximize profit especially on cases where optimal planting strategies are hard to determine. The Integer Linear Programming (ILP) and Monte Carlo Simulation (MCS) methods are preferred for their straightforward application and consistent accuracy across a wide range of optimization problems. These methods are widely applied in fields like agriculture, economics, and land resource planning. However, there is not yet research about the crop planting strategies that applied Integer Linear Programming and Monte Carlo Simulation using Malaysian dataset. The crops and environment of each country are different on this topic because agricultural planning involves multiple plots and years with fluctuating market conditions that affect the outcome of sensitive planning decisions. Thus, this research introduces a crop planting optimization model applying Integer Linear Programming integrated with Monte Carlo Simulation in Pahang, Malaysia to review the result. The method was tested alongside actual historical planting data using ten vegetable crop types across ten agricultural plots in Pahang from 2015 to 2024. Accuracy was measured by Percentage Relative Error and efficiency by robustness under market volatility and it is all calculated in Python. These findings suggest that mathematical optimization can significantly enhance agricultural planning decisions and provide an efficient alternative for managing multi-year crop rotation strategies in Malaysia crops and environments.