

Optimizing Nitrogen Fertilizer Application in Rice Cultivation: A Decision Model for Top and Ear Dressing Dosages

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Abstract : Nitrogen is a vital element crucial for crop growth, significantly influencing crop yield. In rice cultivation, farmers often apply substantial nitrogen fertilizer to maximize yields. However, excessive nitrogen application increases the risk of lodging and pest infestation, leading to yield losses. Additionally, conventional flooded irrigation methods consume significant water resources, necessitating precise agricultural and intelligent water management systems. In this study, it leveraged physiological data and field images captured by unmanned aerial vehicles, considering fertilizer treatment and irrigation as key factors. Statistical models incorporating rice physiological data, yield, and vegetation indices from image data were developed. Missing physiological data were addressed using multiple imputation and regression methods, and regression models were established using principal component analysis and stepwise regression. Target nitrogen accumulation at key growth stages was identified to optimize fertilizer application, with the difference between actual and target nitrogen accumulation guiding recommendations for ear dressing dosage. Field experiments conducted in 2022 validated the recommended ear dressing dosage, demonstrating no significant difference in final yield compared to traditional fertilizer levels under alternate wetting and drying irrigation. These findings highlight the efficacy of applying recommended dosages based on fertilizer decision models, offering the potential for reduced fertilizer use while maintaining yield in rice cultivation.

Keywords : intelligent fertilizer management, nitrogen top and ear dressing fertilizer, rice, yield optimization

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