Forecasting Rice Yields Based of Markov Chain theory

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Abstract.

The study explores the application of Markov Chain theory for rice yield forecasting. Yield forecasts are based on the eco-physiological process of rice growth given measurable rice crop characteristics and weather data at intermediate times in the growing season of the rice crop. The ORYZA1 model is used to simulate a database containing rice yields and rice crop conditions at specified times during the growing season. The model was ran on 32 years of historical weather data (1959 - 1990) from the meteorological station at the International Rice Research Institute (IRRI), Los Baños(121 15 E Latitude: 14 11 N Altitude: 21.0m), Laguna, Philippines. As input to the model, the study adopted the parameters on one of the representative yield potential field experiments at IRRI during the 1992 dry season for the IR72 variety planted on a 15x15 m2 plot. Based on the output of ORYZA1, a Markov Chain (matrix of transition probabilities) was constructed to provide forecast distributions of rice yield for various rice condition classes at different rice phenological stages prior to harvest. This Markov Chain can provide several statistics of interests. This ranges from mean, percentile (median) and standard error of the forecasts to probability interval forecasts and predicted probabilities of exceeding (or falling bellow) target yields. The simulated rice yield obtained from ORYZA1 model for 32 years ranged from 8.33 to 10.88 ton ha-1 with an average of 9.57 ton ha-1 and a standard deviation of 0.60 ton ha-1. Forecasted yields from the matrix of transition probabilities ranged from 8.58 to 9.45 ton ha-1 and standard deviations ranging from 0.39 to 0.60 ton ha-1. Results also showed that forecasted yields are more consistent when forecasting starts when the rice plants are more mature.