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Validation of CERES-RICE model for simulation of growth stages, nitrogen uptake and yield of rice

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ABSTRACT
CERES-RICE model runs on a Personal Computer and is based on management programs for climate, soil and cultural practices. Development and validation of this model can improve understanding of the underlying processes, pinpoint the inadequate understanding, and hence, supports strategic agricultural research. The simulated values for Panicle Initiation, Flowering and Physiological Maturity dates were overestimated in all the treatments. The simulated values of grain nitrogen content grain nitrogen uptake and grain yield were underestimated for most of the treatments Considering the values for simulated grain yield and measured grain yield, this model may be used with fair accuracy. Though there is still large scope of fine tuning this model after which it may be adopted for prediction of growth and yield parameters. The simulation control and several other parameters may also be adjusted to reach a better prediction.

Key words : Ceres - rice model, Simlation, Nitrogen uptake.

INTRODUCTION

Water and nitrogen are the primary factors in increasing the grain yield of rice. A rice crop may need 1000-4000 mm of water during the growing season. A major part of irrigation water in Asia goes to rice production but the efficiency on-farm may average as low as 30% in areas that are well supplied with water (Kampen, 1970).

Use of computer simulation models offer a convenient tool to evaluate different management options for optimizing N management in rice-wheat. In the most satisfactory crop growth models, current knowledge of plant growth and development from various disciplines, such as crop physiology, agrometeorology, soil science and agronomy, is integrated in a consistent, quantitative and process-oriented manner. After proper validation, the models are used to predict crop responses to different environments that are either result of global change or induced by agricultural management and to test alternative crop management options.

CERES-RICE model runs on a PC and is based on management programs for climate, soil and cultural practices. Development and validation of this model can improve understanding of the underlying processes, pinpoint the inadequate understanding, and hence, supports strategic agricultural research. Hence the current study was undertaken with the objective to study and understand the application of DSSAT model for simulation of growth, nitrogen uptake and yield of rice.

MATERIALS AND METHODS

A field experiment was conducted during kharif season of the year 2000 with rice crop cv Pant Dhan-4 at Crop Research Center of G.B.P.U.A & T, Pantnagar in RBD with four nitrogen levels and three water regimes replicated three times. The water regimes included continuous submergence with 5 ± 2.5 c.m water (W_o), 7.5 cm water one day after disappearance of ponded water (W_1) and 7.5 cm water three days after its disappearance (W_3). The 4 nitrogen levels were 0 (N_0), 90 (N_1), 120 (N_2) and 150 (N_3) kg N per hectare. Observations on growth stages, grain nitrogen content, grain nitrogen uptake and yield of grain were recorded. The data pertaining to treatments, soil initial values, planting, irrigation, fertilizers and required weather parameters for the year 2000 were used for running the model.

RESULTS AND DISCUSSION

The measured and simulated results on Panicle Initiation dates (DAT), Flowering dates(DAT) and Physiological Maturity dates (DAT) and their percent accuracy are given in table 1. The percent accuracy

Table 1: Performance of CERES – RICE model for Panicle Initiation, Flowering and Physiological Maturity dates.

Treatments	Panicle Initiation (DAT)		% Accuracy	Flowering(DAT)		% Accuracy	Physiological Maturity(DAT)		% Accuracy
	Simulated	Measured		Simulated	Measured		Simulated	Measured	
N_0W_0	70	58	82.9	101	92	91.1	128	117	91.4
N_0W_1	70	60	85.7	105	90	85.7	131	115	87.8
N_0W_3	70	61	87.1	105	89	84.8	131	114	87.0
N_1W_0	70	65	92.9	105	93	88.6	131	118	90.1
N_1W_1	70	63	90.0	101	91	90.1	128	116	90.6
N_1W_3	70	66	94.3	105	92	87.6	131	117	89.3
N_2W_0	70	69	98.6	105	93	88.6	131	118	90.1
N_2W_1	70	70	100	105	92	87.6	131	117	89.3
N_2W_3	70	67	95.7	101	90	89.1	128	115	89.8
N_3W_0	70	65	92.9	105	94	89.5	131	119	90.8
N_3W_1	70	62	88.6	105	93	88.6	131	118	90.1
N_3W_3	70	66	94.3	105	92	87.6	131	117	89.3

*DAP: Days After Transplanting

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