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Short communication

Calibration and validation of CERES-rice model for different rice cultivars at Navsari

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Crop growth simulation models, properly validated against data have the potential for tactical and strategic decision making in agriculture. Such validated model can also take the information generated through site specific experiment and trial to other sites years (Ritchie *et al.* 1988). CERES-Rice model was used to simulate the growth and development of rice as affected by varying levels of nitrogen. However, before using model for any purpose, it needs to be calibrated and validated for the location/ crop/ variety. To generate required crop management data, a field experiment was conducted at College Farm of N. M. College of Agriculture, Navsari Agricultural University, Navsari, (20º 57' N latitude, 72º 54' E longitude and 10 m above mean sea level), Gujarat, India, during *kharif* season of the year 2012. The treatment consisted of three cultivars viz., V_1 (Jaya), V_2 (Gurjari) & V_3 (GNR-2) with three dates of sowing viz., D_1 (12 July 2012), D_2 (27 July 2012) and D_3 (11 August 2012) and two nitrogen levels viz., N_1 (75 kg ha^{-1}) and N_2 (100 kg ha^{-1}). For the present study CERES-Rice model was calibrated based on past three years experimental crop data (2009, 2010 and 2011) and subsequently validated with crop data of the year 2012. The genetic coefficients were developed through interactive process for rice genotypes are presented in (Table 1). The different test criteria viz., mean of observed and simulated values, root mean square error (RMSE), mean bias error (MBE) and mean percent error (PE) were used to evaluate the performance of model for simulation of yield and yield attributes characters of all three rice cultivars.

Grain yield

The observed and simulated grain and biomass yield of rice as influenced by different treatments are presented in (Table 2). Among three different dates of transplanting, the per cent error of simulated grain yield over observed were found very low (-7.4) in second date (27/07/2012) of transplanting. Among all the cultivars simulated grain yield for cv. GNR-2 was found closest with observed values with per cent error (-7.7) as compared to other cultivars. In case of nitrogen levels the simulated yield at 100 kg nitrogen level was having lower per cent error (-14.8), than that of 75kg ha^{-1}N level. The average errors as computed by RMSE, MBE, PE were 5.3, -4.1 and 15.8 respectively. Similar results are found to be in association with Sreenivas and Reddy (2013).

Biomass production

The observed biomass was found to decrease with delay in transplanting and simulated yield also decreased, however, the per cent error was lowest (2.1) in D_1 transplanting. In case of cultivar simulated value for cv. GNR-2 was found closest with observed values with per cent error (-4.3) as compared with rest of cultivars. The simulated yield under nitrogen treatment had low error per cent (-3.4) in N_2 treatment (Table 2). The average errors as computed by RMSE, MBE, PE were 7.4, -5.9 and 9.8 respectively. The results are in good agreement with the finding of Shamim *et al.* (2012).

Table 1: Genetic coefficients for three cultivars of rice at Navsari

Cultivars	P1	P2R	P2O	P5	G1	G2	G3	G4
Jaya	740.0	100.0	550.0	11.5	58.0	0.0240	1.00	1.00
Gurjari	710.0	150.0	550.0	11.0	55.0	0.0250	1.00	1.00
GNR-2	700.0	150.0	550.0	11.5	55.0	0.0280	1.00	1.00

Table 2: Observed with simulated value for grain yield and biomass at different dates of transplanting and nitrogen levels

Treatments	Grain yield (q ha^{-1})			Biomass (q ha^{-1})		
	Observed	Simulated	Error %	Observed	Simulated	Error %
Transplanting dates						
D_1 -(12/07/2012)	36.5	40.0	9.7	81.1	82.8	2.1
D_2 -(27/07/2012)	34.0	31.5	-7.4	76.0	69.7	8.1
D_3 -(11/08/2012)	31.6	24.3	-23.1	70.2	57.0	-18.8
Varieties						
V_1-Jaya	34.0	27.5	-19.1	76.1	72.1	-5.1
V_2-Gurjari	35.0	27.8	-20.5	77.8	67.2	-13.6
V_3-GNR-2	33.0	30.5	-7.7	73.4	70.2	-4.3
Nitrogen levels						
N_1-(75 kg ha^{-1})	33.2	27.6	-17.0	74.0	64.9	-12.3
N_2-(100 kg ha^{-1})	34.8	29.6	-14.8	77.5	74.9	-3.4
RMSE	5.3	7.4				
MBE	-4.1	-5.9				
PE	15.8	9.8				

RMSE: Root mean square error, MBE: Mean bias error, PE: Percent error.

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