ABSTRACT

Projected changes in weather parameters, mainly temperature and rainfall, have already started to show their effect on agricultural production. To cope with the changing scenarios, adoption of appropriate management strategies is of paramount importance. The reported study was conducted to evaluate the impact of climate variabilities on peanut and rice growth and yield parameters under different management practices namely sowing date and fertilization level for a sub-tropical region of West Bengal state in the eastern India. Field experiments were conducted during the pre-summer and *kharif* (rainfed) seasons of 2012 and 2013 on peanut and rice crops with varying dates of planting and fertilization as treatments, at the experimental farm of the Indian Institute of Technology, Kharagpur to evaluate the optimum combination of sowing date and fertilization levels. The DSSAT v4.5 CROPGRO-Peanut model as well as CERES-Rice model was used to simulate the growth and yield of peanut and rice crops under a wide range of sowing dates and fertilization levels. The models were calibrated with 2012 dataset of growth, phenology and yield for determining the genetic coefficients of the cultivars of peanut (TMV-2) and rice (IR36) and were validated with the 2013 dataset for the same parameters. Moreover, investigation was also done to determine suitable sowing date and corresponding ET estimation method to get maximum water use efficiency for the peanut crop under climate variability. DSSAT v4.5 CROPGRO-Peanut model was used with varying dates of planting and varying levels of maximum allowable depletion (MAD) of available soil water (ASW) such as: 10% (T_1), 30% (T_2), 50% (T_3), and 70% (T_4), along with two ET estimation methods (Penman-Monteith and Priestly-Taylor). For rice, 36 years (1977–2013) of rainfall data were analyzed for Kharagpur for characterization of monsoon season. Weekly rainfall values were computed from daily values and were used for initial and conditional probability analysis as well as consecutive dry and wet spell analysis using Markov chain probability model. The growth and yield of Peanut and rice crops under present weather and ambient CO_2 concentration as well as different future climate variability scenarios of rise in temperature and CO_2 concentration were simulated using DSSAT CROPGRO-Peanut and CERES-Rice models to determine appropriate sowing dates and fertilization levels. Field experiments on peanut revealed that the highest yield was achieved during 2nd fortnight of January to 1st fortnight of February sowing for 40 and 80 kg P_2O_5 ha^{-1} in the sub-tropical climate of Eastern India. For rice, sowing on June 30 to July 15 along with 140-180 kg N ha^{-1} gave the highest grain yield. Sensitivity analysis of CROPGRO-Peanut model and CERES-Rice model indicated that sowing of peanut between second week of January and end of February, using 30-50 kg P_2O_5 ha^{-1} is profitable. Whereas, fertilization of 120 kg N ha^{-1} and July 15 sowing date provided maximum rate of increase in yield for rice crop. The CROPGRO Peanut model with Penman-Monteith approach gave the highest crop water use efficiency for 14 January sowing for irrigation scheduling at 50% (T_3) MAD**.** The elevated CO_2 concentration of 420, 530 and 650 ppm showed gradual increase in yield and biomass yield with delay in sowing dates from normal sowing time for both peanut and rice crop under 2020, 2050 and 2080 scenarios, respectively.

Keywords**:** Climate variabilities, DSSAT v4.5, CROPGRO-Peanut, CERES-Rice, Sensitivity analysis, ET estimation, Markov chain probability model, CO_2 concentration