**Modelling the Soil-Water-Crop-Atmosphere System to Improve Land and Water Productivity in Stage II of IGNP**

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**ABSTRACT**

The study entitled “Modelling the Soil-Water-Crop-Atmosphere System to Improve Land and Water Productivity in Stage II of IGNP” was carried out at village Amarpura (Bajju), Bikaner, Rajasthan, during *kharif* and *rabi* seasons of 2012-13 and 2013-14. To assess current physical and economic land and water productivity, N–uptake, and water use of different crops, the CropSyst crop simulation model was calibrated using 2012-13 growing season data. After calibration of the model for *kharif* and *rabi* season crops, the calibrated model was validated using 2013-14 growing season data for the site-specific conditions using the calibrated crop model parameter values. CropSyst model was validated for green area index (GAI), aboveground biomass (AGB), seed yield, soil moisture and N-uptake for each crop. Groundnut and clusterbean in *kharif* and wheat, mustard, chickpea, cumin and isabgol in *rabi* were prominent crops; groundnut-wheat, groundnut- cumin, groundnut-isabgol, groundnut- mustard and clusterbean-chickpea were major cropping systems of the study region.

In *kharif* season, groundnut gave higher seed yields than clusterbean and among *rabi* season crops, seed yield of wheat was maximum during both years. The seed yields of various cropping systems varied from 2660-5326 and 2838-5698 kg ha-1 during the both years and were higher for groundnut-wheat, intermediate for groundnut-mustard, groundnut-isabgol, groundnut-cumin and lower for clusterbean-chickpea. The groundnut-wheat system had highest water use during both years of study. Clusterbean-chickpea cropping system recorded highest water productivity followed by groundnut-mustard in terms of yield and monetary returns. On pooled basis among the tested cropping systems groundnut-cumin, groundnut-mustard and groundnut-wheat were more profitable than other cropping systems.

Simulation for GAI, AGB, seed yield, and N-uptake matched closely with the observed values for groundnut and clusterbean during *kharif* season and wheat, mustard, chickpea, cumin and isabgol during *rabi* season. It only be concluded that with fewer input parameters and less complete calibration procedures, CropSyst model can be applied for simulating the effect of N and water management on yield and water productivity of crops under arid condition of IGNP. It was also demonstrated that the model can be used to derive best management options in term of nitrogen and irrigation application. The CropSyst model can be applied to predict the yield and water balance of groundnut and clusterbean in *kharif* and wheat, mustard, chickpea, cumin and isabgol in *rabi* season.

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