

GREAT GURUS OF AGROMETEOROLOGY IN INDIA

Assessment of rainfall trends at micro and macro level in Andhra Pradesh

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ABSTRACT

Climate change scenarios generated using GCM models are mostly based on grid data for the entire country or for a given state. Most international organizations use this data in generating the scenarios for India. An attempt has been made to make a comparison of rainfall trends based on 1° X 1° grid data and data collected from a dense network of 1128 raingauge stations in Andhra Pradesh. No decreasing trend is noticed over the entire state with grid data. However, a clear decreasing trend in annual rainfall is found in the tract consisting of Medak, Nalgonda, Krishna, East and West Godavari districts from block level data. On the contrary, increasing trend is noticed with grid data in these districts. In Prakasam district, declining trend in many blocks with block level data was noticed, but increasing trend is seen with grid data. Like-wise in Rayalaseema (Anantapur, Cuddapah, and Chittoor) some blocks are showing increasing or decreasing trend with block level while with grid data, no significant trend was observed.

Key words: Rainfall trends, grid data, block data, Andhra Pradesh

Comparative evaluation of WOFOST and ORYZA2000 models in simulating growth and development of rice (*Oryza sativa* L.) in Punjab

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ABSTRACT

Two simulation models, viz. WOFOST and ORYZA2000 were validated and compared to predict growth and productivity of 2 rice varieties (PR 116 and PR 118), under central plain regions of Punjab, India, during 2006-2008. The simulated values of dry weight of leaves, dry weight of stem, above ground biomass, leaf area index and grain yield did not differ significantly with observed values. Based on statistical evaluation of performance of crop simulation models, ORYZA2000 showed an advantage over WOFOST model in simulating crop growth parameters and grain yield of rice.

Key words: WOFOST, ORYZA2000, crop models, simulation, rice

Validation of PRECIS baseline (1961-1990) simulation for middle Gujarat

agroclimatic zone

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ABSTRACT

The simulated temperature and precipitation by PRECIS model for nearest grid points were compared with the observed data of Anand (22.58 °N, 72.92 °E) during baseline period (1960–1990) to judge the usability of the simulated climate data. It was found that the simulation of rainfall events by model were fairly accurate only for July with overall agreement index value of 0.79 with considerably high values of difference measures. PRECIS showed average performance in simulation of maximum temperature with overall agreement index value of 0.81. The error statistics and difference measures were average except January, February and July months for maximum temperature. The simulation performance of PRECIS for all months of the year and overall performance (with index of agreement 'd'=0.96, r²=0.85, RMSE=2.36 and CV%=11.74%) was found excellent in case of minimum temperature prediction for the baseline period (1961-1990). Though, minimum temperature was slightly overestimated for February to May months.

Key words: Validation, PRECIS, simulation, baseline period

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Impact of climate change on apple crop in Himachal Pradesh

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ABSTRACT

The study examines the impact of climate change in recent years on apple shift to higher altitude in Himachal Pradesh based on climate information and farmers perceptions. It is evident that temperature in apple growing regions of Himachal Pradesh showed increasing trends whereas precipitation showed decreasing trends. The temperature trends in apple growing regions of Kullu and Shimla indicated 1.8 to 4.1 °C rise in past two decades which reflected in decrease of chill units (CU) hours accumulations. The annual snow fall decreasing rate of 36.8 mm with decreasing trends of snowfall during early winters (October & December) and late winters (March and April) clearly indicated the shrinking winter period in high hills. The CU hours showed decreasing trends upto 2400 meter above mean sea level (amsl) from Bajaura in district, Kullu at 1221 m amsl to Sarbo in district Kinnaur at 2400 m amsl. The Dhundi station situated at 2700 m amsl showed increasing trend of chill unit at the rate of 25.0 CUs per year. The increasing trends of chill units at 2700 m amsl suggested that area is becoming suitable for apple cultivation in higher altitude. These findings have also been supported by the farmers' perceptions which clearly reflected that apple cultivation is expanding to higher altitude in Lahaul and Spitti and Kinnaur. The average landuse per farm in Lahaul and Spitti showed more than two percent shift towards apple cultivation but it showed reverse trend in other apple growing regions of Himachal Pradesh. The income of the farmers increased more than 10 percent in district Lahaul and Spitti whereas it showed a decrease of more than 27 percent in Kullu and Shimla districts from fruits in recent decade compared to 1995. The data on area under apple cultivation also compounded statement that apple cultivation is expanding in Lahaul and Spitti in recent decade. The climate change has demonstrated its impact of decreasing productivity of apple crop in recent years.

Key words: Climate change, apple, chill units hours and productivity

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Simulating impact of climate change on mustard (*Brassica juncea*) production in

Himachal Pradesh

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ABSTRACT

The study examines the impact of climate change on mustard crop using Info Crop simulation model after calibration and validation for Sub temperate and sub humid conditions. The IPCC-2004 seasonal climatic scenarios for temperature (0.74°C for 2020 and 1.71°C for 2050) for Himachal Pradesh were used to simulate impact of climate change scenarios. The days to flowering, days to physiological maturity and yield indicated the best fit. Under climate change scenarios, days to flowering and days to maturity showed reduction of 1 to 4 and 4 to 19 days for 2020 and 5 to 13 and 10 to 23 days for 2050 respectively due to elevated temperature and decreasing rainfall. The seed yield also showed decreasing trend ranging between 4 to 16% and 9 to 25% for the crop sown on October 10, October 20 and October 30 during 2020 and 2050 respectively. Late sown crop (November 9) showed an increase in seed yield to the tune of 1 to 12% and 12 to 17% for 2020 and 2050 respectively. Under present climatic scenario (2008-09), October 10 is the best planting window while advantage of increase in yield under late sown (November) conditions was observed during climate change scenarios 2020 and 2050. Hence, delayed sowing windows under elevated temperature proved beneficial under sub-humid and sub temperate climate of Himachal Pradesh.

Key words: Mustard, simulation, climate change, impact, assessment and adaptation

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Comparison of satellite derived water and radiation use efficiency based wheat yield models over semi-arid regions

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ABSTRACT

Water use efficiency (WUE) and radiation use efficiency (RUE) based approaches were attempted to predict wheat yield of major wheat growing districts over semi-arid agro ecosystem of Gujarat. RUE approach through CASA (Carnegie-Ames-Stanford) model was found to produce better yield prediction accuracy (RMSE 17.7 % of reported mean) as compared to the RMSE (18 % of reported mean) from WUE approach. Moreover, the correlation coefficient between predicted and reported district yield was also found to be higher ($r = 0.90$) in RUE based approach than the other one ($r = 0.80$). District mean WUE were computed for three growth stages viz. vegetative, flowering and grain filling of wheat using MODIS AQUA derived evapotranspiration (ET) values. It was found that the WUE were generally higher in vegetative and flowering stages as compared to grain filling. The wheat yield prediction from water use and stage specific WUE were carried out for same seasons. The better correlation found from 0.57 to 0.77 at flowering stage.

Key words: Yield prediction, ET, MODIS, WUE, RUE

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Modeling the impact of anticipated climate change on wheat yields in two different agro-climatic zones of eastern India

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ABSTRACT

Wheat is the major cereal crop of winter season in the Indo-gangetic plains of India. The study is aimed to

analyze impact of climate change on wheat varieties viz. K-9107 and HD-2733, under two different agroclimatic zones using simulation model InfoCrop. Model was calibrated and validated for Patna and Ranchi centres. Sensitivity analysis indicated declining yield trend with increase in temperature. Wheat yields simulated for future climate change scenario HADCM3 A2 for different time periods viz. 2020, 2050 and 2080. Simulated wheat yield showed decline from 3 to 38 percent for Patna and 3 to 28 percent for Ranchi. Due to higher temperature in future scenario the days to anthesis, days to maturity and grain number showed decline for both the locations.

Key words: Climate change, scenarios, simulation study, wheat, agroclimatic zones,

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Seasonal ARIMA model for generation and forecasting evapotranspiration of Solapur district of Maharashtra

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ABSTRACT

This paper deals with the stochastic modeling of weekly reference crop evapotranspiration in semi-arid climatic condition by using seasonal Auto Regressive Moving Average (ARIMA) model. The weekly values of reference crop evapotranspiration (ET_r) estimated by Penman Monteith method for 23 years (1984 to 2006) were used to fit the ARIMA models of different orders. ARIMA models up to 1st order were selected based on autocorrelation function (ACF) and partial autocorrelation function (PACF) of the ET_r series. The parameters of the selected models were obtained with the help of maximum likelihood method. The ARIMA models that satisfied the adequacy tests were selected for forecasting. One year ahead forecast (i.e. for 2007) of ET_r values were obtained with the help of these selected models. The root mean square error (RMSE) was computed between forecast and actual values of ET_r of 2007. The lowest RMSE was obtained for ARIMA (1,1,0) (1,0,1)₅₂ and hence is the best stochastic model for generating and forecasting of weekly ET_r values.

Key Words: Stochastic model, reference crop evapotranspiration, seasonal ARIMA Model.

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Water requirement of pomegranate (*Punica granatum L.*) for Ahmednagar district of Maharashtra State, India

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ABSTRACT

The study was carried out to estimate reference crop evapotranspiration, develop crop coefficients and wetted area factors; and estimate crop evapotranspiration of pomegranate for Ahmednagar district of Maharashtra State. The crop coefficient values were estimated on weekly basis from the concept of shaded area that is widely used for the deciduous crops for the pomegranate plantation of 1st year to maturity (5th year) and are presented in the paper. Shaded areas were estimated at solar noon hour with the help of a specially prepared plywood board of different sizes with grid marking of size 20 x 20 cm for 5 randomly selected pomegranate trees each from 2 orchards of different ages. Pomegranate crop evapotranspiration was then determined on weekly basis. The values of water to be applied to pomegranate plantation spaced at 3 x 4.5 m and irrigated by the drip irrigation system of 90% efficiency were estimated and are presented in this paper for Ahmednagar district for 1st, 2nd, 3rd, 4th, and 5th years of pomegranate orchards for *Mrig*, *Ambhe* and *Hast Bahars*. The values of reference crop evapotranspiration, crop coefficient, area factor, water requirement and water to be applied presented in this paper would be useful for the appropriate irrigation water management of pomegranate.

Keywords: Pomegranate reference crop evapotranspiration, crop evapotranspiration, crop coefficient,

wetted area factor, water requirement.

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Evapotranspiration and water-use efficiency of chilli crop (*Capsicum annum* L.) in arid environment

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ABSTRACT

Lysimetric studies on chilli crop *Capsicum annum* L. cv. Haripur and Raipur) were conducted at Jodhpur during three *kharif* seasons viz., 2006, 2007 and 2008 to determine evapotranspiration requirements during different growth stages under three treatments of irrigation (viz., 100% potential evapotranspiration (PET), 50% of PET and control (10 irrigations each of 30 mm depth). The crop coefficients (ratio of evapotranspiration to reference evapotranspiration) were 0.38-0.47 at early growth stage, 0.39-0.69 at vegetative stage, 0.85-1.00 at flowering/ fruit formation stages and 0.34-0.91 at fruit development/maturity stage with an average value of 0.62 for the entire season. The seasonal evapotranspiration for unstressed chilli crop (Irrigated @100%ET) was 620 mm in 2006, 548 mm in 2007 and 552 mm in 2008 with a mean of 573 mm. The highest dry fruit yield was obtained in 2008 due to the favourable weather conditions and least termite attack, resulting in highest water-use-efficiency of 1.84 kg of dry-fruit ha⁻¹ mm⁻¹. The water-use efficiency of chilli was highest (0.295-2.392 kg of dry-fruit ha⁻¹ mm⁻¹) for the crop grown at 50%ET rate of irrigation.

Key words: Chilli crop, arid zone, evapotranspiration rates, crop coefficients, water use efficiency

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Thermal sensitivity of mustard (*Brassica juncea* L.) crop in Haryana

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ABSTRACT

A wide gap exists between potential and actual yields of mustard in India. Mustard is highly sensitive to weather variables and thus attempts need to be focused on determining the most yield limiting weather parameter so as to bridge the yield gap. To accomplish this task, mustard (c.v. RH-30) yields recorded for 26 *rabi* seasons (1984-85 to 2009-10) at Hisar, Haryana state were related with weather parameters during crop period. Maximum temperature during 1-6 week after sowing (WAS), minimum temperature during 1-5 WAS and again 16-20 WAS were found to influence mustard yields significantly. The mustard yields were less than 2000 kg ha⁻¹ when maximum temperature was less than 30°C during 1-6 WAS and minimum temperature was less than 12°C during 1-5 WAS. Higher yields (2400 to 3000 kg ha⁻¹) was obtained when minimum temperature during 16-20 WAS was less than 6°C.

Key words: Thermal sensitivity, mustard, north india, critical temperatures, minimum temperature

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Quantification of growth and yield of oilseed *Brassica* using thermal indices

under semi-arid environment

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ABSTARCT

Field experiments were carried out at IARI research farm, New Delhi representing semi-arid climatic condition, to evaluate the growth and yield of oilseed *Brassica* using thermal indices. Two cultivars of *Brassica juncea* viz., Pusa Jaikisan and Varuna, widely grown in north and north-western parts of the country, were sown on ten different dates from 1st October to 3rd December at weekly interval. Three widely used thermal indices viz., growing degree days (GDD), heliothermal units (HTU) and photothermal units (PTU) were computed up to maximum biomass production in both the seasons. It was observed that GDD was able to explain variation in biomass, seed yield and oil content to the tune of 75, 66 and 78 per cent while PTU could explain 73, 66 and 77 per cent variations respectively. The yields and oil content of these two cultivars were highly influenced by the differential thermal environment and delay of sowing; decreased seed yield and oil content significantly.

Key words: Thermal indices, GDD, HTU, PTU, HUE seed yield, oil content and *Brassica*.

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Correlation between weather variables and ascochyta blight disease of chickpea

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ABSTRACT

Relationship of weather variables and chickpea ascochyta blight disease was studied using 24 years (1985-2008) data collected at Ludhiana, Punjab. Coefficients of correlation of ascochyta blight disease index (DI) were worked out with meteorological variables at weekly intervals starting from 5th SMW (standard meteorological weeks) to 17th SMW and utilized to develop regression model in disease forecasting. Minimum temperature (Tmin), morning relative humidity (RHmax), rainy days exhibited positive correlation with DI, however, (maximum temperature (Tmax) and the sunshine hours showed negative correlation. The relationship between DI and Tmin appeared to be exponential; DI sunshine hrs; DI rainfall appeared to be polynomial and regression lines explained 26%, 49% and 22% variation in disease respectively. The relationship between DI and afternoon relative humidity (RHmin); DI and humidity thermal ratio (HTR) appeared to be power function and regression line explained 34% and 35% variation in disease respectively. The favourable range of Tmin and weekly mean RHmin values were 12.5-14.5°C and 45-60%, these two variables were combined as HTR, the values of which ranged from 0.4-0.5 for disease occurrence in central plain region of Punjab. The study concluded for maximum probability of disease from 7th-10th SMW which is also the beginning of reproductive phase of chickpea.

Key words: Chickpea, Ascochyta blight, weather variables, disease index

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Short communication

Development of Hargreaves and Samani shortwave radiation coefficient (Kr) for India

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Short communication

Phenology, heat unit accumulation and dry matter partitioning behavior of two

rice cultivars transplanted on different dates

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Short communication

The influence of canopy architecture on light penetration, soil temperature and fruiting in sub-tropical pear

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Short communication

Effect of weather parameters on moth catches in pheromone trap for *Helicoverpa armigera* (Hübner) Hardwick infesting tomato

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