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Need for and details of a new approach for control of pests, diseases and weeds of crops in a warming atmosphere under climate change

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ABSTRACT

As global warming is due to increase in carbon dioxide (CO₂) concentration in atmosphere, a holistic view of the effects of both elevated CO₂ and higher temperatures on pests, diseases and weeds needs to be taken. Studies on effects of elevated levels of CO₂ on pests, diseases and weeds are of recent origin and confined to laboratories. The indications of effects of elevated CO₂ are for (i) a smothering of C₄ crops by weeds (ii) an increase in severity of pest attacks due to effects on crop metabolism and (ii) possible offsetting of effects of higher temperatures on pests and diseases. The need is for an Integrated Pests and Diseases Management Programme (IPDM), involving a network of insect and spore trapping stations and application of the concepts of biofix, economic pest threshold level and critical disease level to data thereof.

Key words: Spore and insect traps, integrated pest and disease management, biofix, economic pest threshold, critical disease level, holistic approach

Finger millet production in Southern Karnataka - An agroclimatic analysis

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ABSTRACT

Agro meteorological conditions cause wide fluctuations in growth, development and yield of finger millet crop. Crop performance data on the popular finger millet crop variety INDAF-8, collected from field experimentation at Bengaluru during the period 1985-2001 was used to understand the role of the weather on finger millet yields. Among 10 weather variables / indices studied minimum temperature (T_{\min}), diurnal temperature range (DTR) and moisture adequacy index (MAI) were found to influence finger millet yields. T_{\min} during 4th to 8th fortnight after sowing (FAS) and MAI during 8th FAS were found to have a strong positive correlation with yields. DTR at 6th FAS and the frequency of days in a season above a threshold value of 11°C were found to have an impact on the finger millet yields. Step-wise regression technique resulted in identifying T_{\min} and MAI as critical weather parameters influencing the yields. An yield prediction model was developed that uses T_{\min} during 4th to 8th, DTR at 6th FAS and MAI during 8th FAS accounted for 63% variability in yields.

Key words: Finger millet, minimum temperature, moisture adequacy index, agroclimatic analysis, Southern Karnataka

Climate change projections - A District-wise analysis for rainfed regions in India

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ABSTRACT

Rainfed agriculture is practised in arid, semi-arid and dry-sub-humid- regions of the country. The climate projections are reported generally at the all India level or at the resolution of grids of different dimensions. This paper attempted to derive and report the climate projections given by the PRECIS for A1B scenario in the form agriculturally relevant variables for 220 districts where rainfed agriculture is predominant. Districts with an average rainfall of less than 1500 mm and are included either in DPAP or DDP and those with less than 30 per cent of net sown area under irrigation are included in the study. The climate projections provided at a grid size of 50 x 50 km are converted into district level estimates. Annual rainfall is projected to increase by more than five per cent in 173 districts and decrease by more than five per cent in 42 districts during the mid-century compared to the baseline. The later part of the century is likely to be much wetter with 205 districts showing an increase in rainfall by more than five percent and only five districts projected to receive relatively less rainfall. The number of rainy days is projected to not change much in a majority of districts during the both periods. The end-century is likely to witness much variability in the onset of monsoon, which is projected to arrive late by more than five days in 42 districts. Incidence of drought is observed to increase in 62 districts during mid-century and in 134 districts during the end-century. The average maximum temperature is projected to increase by 1.5 to 2°C in a majority of districts during mid-century and by more than 2°C in a few districts. Temperature is likely to be much warmer during the end-century with projections of 3.5 to 4°C in most districts. These projections have implications to planning and targeting technology development and transfer as well as planning for development interventions.

Key words: Rainfed agriculture, climate change, PRECIS, rainfall, drought incidence

Weather based forecasting of Alternaria blight disease on cotton at Dharwad

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ABSTRACT

The paper presents results from a field experiment conducted at Agricultural Research Station, Dharwad Farm, Dharwad from 1997-2004 in order to develop weather based forecast models for Alternaria disease on four cotton genotypes (LRA-5166, Laxmi, DCH-32 and Jayadhar) grown in multiple growing environments. Lead time concept was used to statistically analyse the data to identify sensitive meteorological variables at different lead weeks and develop disease forecast models. Analysis was performed for disease initial, progress and peak stages individually. Minimum temperature during initial and progress stages of disease (August and September months respectively), and afternoon relative humidity during peak stage of disease (October) was identified as critical to forecast the Alternaria blight disease in cotton genotypes.

Key words: Alternaria blight, disease forecasting, cotton, regression models

Seasonal climatic variability and its impact assessment on wheat productivity using crop modeling techniques in Haryana

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ABSTRACT

A study was undertaken to analyze the climate variability and trends to have an idea of the probable impact of future trend scenarios on the productivity of wheat at Hisar and Sirsa representing western agroclimatic zone using CERES-Wheat model. The study revealed a decreasing trend in maximum temperature during 1977-86, 1987-96, and 1997-08 period. The mean solar radiation values at Hisar were found to be higher during the *rabi* season than at Sirsa. However, mean minimum temperature (9.1 °C) observed at Hisar during *rabi* season was lower than that observed at Sirsa (9.9°C). In the recent past (1997-08) period, both maximum and minimum temperatures exhibited increasing trend in *rabi* season both at Hisar and Sirsa. However, the magnitude of increase in maximum (0.188°C) and minimum temperatures (0.053°C) at Hisar was more when compared with (0.102°C) and (0.031°C) at Sirsa, respectively. During *rabi* season, rainfall showed overall increasing trend both at Hisar and Sirsa. However, in the recent past (1997-08), the rainfall activities during *rabi* season decreased @ 5.673 mm and 2.208 mm year⁻¹ at Hisar and Sirsa, respectively. CERES-Wheat model projected 18.27 and 16.31 per cent decrease in grain yield of PBW-343 when both temperatures (maximum and minimum) were increased by 2.5°C at Hisar and Sirsa, respectively.

Key words: Seasonal climatic variability, wheat productivity, crop modeling, DSSAT, Haryana

Change in climate in India during last few decades

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ABSTRACT

Classification of Indian geography based on climate was done long back. The climate datasets used in such studies were very old from now. Climate change literature about India showed enough evidence of rising mean temperatures during post 1970 period. The rising temperatures would affect potential evapo-transpiration and consequently aridity is expected to increase at least at the macro level though there may be spatial variation at a smaller geographical scale. It is considered important to reassess state-wise extent of area under arid, semi-arid, dry sub-humid climates using more recent climatic data. The present study used 0.5° x 0.5° grid level rainfall data and average potential evapo-transpiration for 144 stations located across India for the time period 1971-2005 to compute moisture index needed for delineation of different climatic zones. The study examined state-wise changes occurred in the area under arid, semi-arid zones over time. Arid region was found to increase in Rajasthan, Gujarat and Karnataka. Semi-arid zone has expanded in Madhya Pradesh, Uttar Pradesh, Andhra Pradesh, Maharashtra and Tamil Nadu. Some of the moist sub-humid pockets in Orissa, Chhattisgarh and Jharkhand turned dry sub-humid. The revisited moisture availability calls for a relook at choice of crops in the states. An attempt was made to estimate state-wise net sown area experiencing moisture stress when climate and irrigation components are considered together. About 40 % of net sown area (56 m ha) of India is under dry climate and constrained irrigation. It is mainly concentrated in Maharashtra, Rajasthan, Karnataka, Gujarat and Andhra Pradesh. Appropriate developmental programmes are to be planned in the regions getting drier.

Key words : Grid level data, rainfall, potential evapo-transpiration, moisture index, climatic classification, drylands

Population dynamics of *Spodoptera litura* outbreak on soybean *vis-a-vis* rainfall events

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ABSTRACT

Spodoptera litura (Fabricius) (Lepidoptera: Noctuidae) is one of the important insect pests on soybean in Maharashtra where frequent outbreaks of this pest have been recorded in recent years. Analysis of pest surveillance data indicated that *S. litura* incidence was early and severe with above the economic threshold levels in 5 districts of Maharashtra during rabi 2009. However, its incidence was low and delayed during 2010, 2011 and 2012 seasons, showing inter-annual variability. Analysis indicated occurrence of widespread and frequent rainfall during June-September as reflected in greater number of rainy days, rainfall events of >20 mm and >40 mm during low incidence years of 2010-12. Studies with rainfall simulator also indicated that high rainfall events of 42.3, 61.7 and 77.7 mm imposed two days prior to moth emergence resulted in significantly lower adult emergence (63.4, 57.2 and 45.3%, respectively) compared to higher adult emergence in control with no rain (87.8%). *S. litura* outbreaks were observed in seasons experiencing delayed planting of soybean due to late onset of monsoon, coupled with fewer than normal rainy days and rainfall events of >20 mm during June to mid-August. Two forecast models developed to estimate *S. litura* population by end of July and by mid-August based on crop age and rainfall variables explained 70 and 80% variation in pest incidence across season. These models can be used to estimate *S. litura* severity on soybean in 15 endemic tehsils across 5 districts in Maharashtra.

Key words: *Spodoptera litura*, pest surveillance, rainfall, moth emergence, forecast

Impact of projected climate change on groundnut in Gujarat

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ABSTRACT

The impact of projected climate change (2071-2100) of A2 scenario and its likely impact on groundnut yield of Saurashtra region of Gujarat using PRECIS output of A2 and Baseline (1960-1990) were studied. Baseline and A2 scenario yields were simulated using DSSAT (v 4.5) model. Experimental data of the Dry Farming Research Station, Rajkot for *kharif* seasons of 2009 and 2010 were used to calibrate and validate the model. The study was extended to the regional level for Rajkot, Bhavanagar, Kesod and Bhuj districts to simulate groundnut yields. Widely cultivated groundnut cv. GG-2 and GG-20 with two dates of sowing (D_1 – Onset of monsoon and D_2 – 15 days after D_1) were considered for the study. Results revealed that the pod yield of groundnut is likely to decrease during the projected period by 20 to 34% in different districts (Rajkot, Bhavanagar, Kesod and Bhuj). Further delay in the sowing (15 days after onset of monsoon) reduces the pod yield by 2 to 7%. The biomass of groundnut may decrease by 20 to 36% and the LAI will decrease even more (42-47%). The duration of anthesis date of groundnut may get reduced by 23 to 36% while maturity date reduced by 7-16% in different districts of Saurashtra under projected period (2071-2100) as compared to the baseline period. Reduction in groundnut phenological duration, growth and development under projected climate might be attributed only because of air and soil temperatures above optimum can cause significant yield loss in peanut. The results of this study call for immediate long and short term adaptation and mitigation action for sustainable groundnut production.

Key words: *PRECIS, simulation, DSSAT, climate change, projected climate*

Long term rainfall and temperature analysis through ClimGen model in Ranga Reddy district of Andhra pradesh

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ABSTRACT

Weather generator was evaluated for generation of daily precipitation and air temperature in selected mandals of Hayatnagar, Yacharam and Rajendranagar in Southern Telangana region of Andhra Pradesh. A 31-year (1980-2010) weather data of the selected mandals was used for generating the long term time series from 1980-2050. The model results were validated over the period from 1980-2010. The model generated series has similar characteristics of observed series with respect to weekly and monthly rainfall, daily maximum and minimum temperatures. The long term data were subjected to trend analysis for all three sites. There is projected increase of 10.5, 4.65 and 5 per cent of annual rainfall in Yacharam, Hayatnagar and Rajendranagar mandals respectively by 2050. However, the trend analysis in the seasonal rainfall indicated an increase of 13.8, 7.2 and 6.7 per cent in Yacharam, Hayatnagar and Rajendranagar mandals respectively by 2050. Maximum temperature showed increasing trend and minimum temperature showed decreasing trend by 2050 in all selected mandals.

Key words : ClimGen model, rainfall analysis, weather generator, rainfall-temperature trend analysis.

Response of *Aphis craccivora* Koch to elevated CO₂ on cowpea

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ABSTRACT

Changes in climate and weather could profoundly affect the population dynamics and status of insect pests of crops. Aphids are ubiquitous insect herbivores whose behavior could be influenced by climate change. We studied the impact of elevated CO₂ (eCO₂) on *Aphis craccivora* Koch on cowpea (*Vigna unguiculata* L.). Cowpea plants were grown under ambient (380 ppm) and elevated (550 and 700 ppm) CO₂ conditions in open top chambers (OTCs). Feeding trials were conducted using 'cut leaf' technique and the aphids were cultured individually in the laboratory. Results showed that the host plant and aphid species were significantly and positively influenced by eCO₂. The mean fecundity (number of nymphs per day, 80%), Mean relative growth rate (MRGR, 8%) and adult weight (22%) of aphids increased but the longevity (5 %) and development time (5%) decreased significantly at eCO₂ conditions over ambient CO₂. Bio chemical analysis of cowpea foliage indicated an increased C:N ratio (8%) and decreased nitrogen content (7%) and non-significant variation of carbon and phenol content at eCO₂ conditions.

Key words : *Aphis craccivora*, elevated CO₂, fecundity, MRGR, leaf nitrogen, C:N ratio

Spectral and spatial properties of rice brown plant hopper and groundnut late leaf spot disease infestation under field conditions

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ABSTRACT

A study was conducted to identify spectral wavelengths specific to pests and disease infestation in rice and groundnut crops, and tests the feasibility of using space-borne data for detecting their field incidence. A portable hyperspectral radiometer (ASD Fieldspec) was used to record spectral data from late leaf spot (LLS) infested groundnut leaves and the data revealed 678, 1439 and 1921 nm were sensitive to LLS disease. The wavelengths correspond to response of leaf pigments (678 nm) and water content (1439 and 1921 nm), indicating the damage induced by the invading pathogen in the host tissues. Extensive field surveys in East Godavari (EG) district, Andhra Pradesh (A.P.) during February-March, 2007 revealed a severe incidence of brown plant hopper (BPH) in few villages. Ground based multispectral radiometric studies (CropScan16R) in rice showed spectral reflectance between 760-1100 nm could differentiate healthy and rice BPH infestation. Disease water stress index was found better than several other spectral vegetation indices for the early detection of rice BPH damage. IRS P6- LISS IV Mx satellite data was assessed to detect BPH damage in selected villages of EG district. NDVI values for BPH damaged pixels in the classified image were in the range of 0.1 to 0.2 compared to higher values for the healthy crop.

Key words: Pest, disease, multispectral, hyperspectral, remote sensing, reflectance, satellite image

Solar radiation estimation from limited meteorological parameters in a semi-arid environment

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ABSTRACT

Application of crop-growth models either to understand crop response to climatic variability/change or to estimate regional yields require precise data on solar radiation. Though solar radiation data have many other areas of applicability, seldom it is readily available for many of the Indian locations. Equipment cost and maintenance cost of the instruments become prohibitive for developing countries like India. Empirical methods to estimate global solar radiation from meteorological parameters with reasonable accuracy are promising alternatives. Thus, an attempt was made to estimate global solar radiation at a semi-arid Indian location (Patancheru, Hyderabad) employing 12 models that use readily available meteorological data at most of the Indian sites. The performance of the models was tested using statistical tools like RMSE, D-Index and NOF. Goodin *et. al.*, (1999) model, a modified version of Bristow-Campbell model performed better with high D-Index and low NOF values and resulted in small residuals compared to the other modified models with an overall RMSE of 2.65 MJ m⁻² day⁻¹.

Key words: Solar radiation, Hargreaves-Samani, Bristow-Campbell, Goodin model, semi-arid environment

Productivity and physiological responses of sheep exposed to heat stress

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ABSTRACT

A study was conducted to evaluate the effects of solar radiation on some physiological parameters (body temperature, respiration rate, pulse rate and panting score), blood metabolites and average daily gain in two breeds of sheep (Deccani and Nellore). The experiment was conducted at Hayathnagar Research Farm of Central Research Institute for Dryland Agriculture (17°27'N latitude and 78°35'E longitude and about 515m above sea level) during May to July months in the year 2012 and involved 18 ram lambs divided into 2 groups with similar age (152 ± 6.1 d) and body weight (15.1 ± 0.26 kg). The ram lambs were exposed to solar radiation from 0900 to 1500hrs during the study period. Heat load index (HLI) was maximum ($P < 0.05$) in May (93.9 ± 0.85) compared to July (88.7 ± 0.37) month. Significantly ($P < 0.05$) higher body temperature, pulse and respiration rate, panting score was observed in both the breeds as HLI was highest in May, however impact was more pronounced in Deccani than Nellore breed. Exposure of sheep to heat stress evoked a series of radical changes in the biological functions, which include a decrease in feed intake, efficiency and utilization, disturbances in protein, energy and mineral balances, hormonal and blood metabolite levels. Heat stress severely affected body weight gain and resulted in lower average daily gain in ram lambs and a significant ($P < 0.01$) difference was observed among two breeds. The present study confirms breed differences in susceptibility to heat stress as manifested by physiological alterations and subsequent effect on productivity.

Key words : Solar radiation, heat load index, ram lambs, panting score, productivity, blood metabolites

Predictive model for aphid incidence in rapeseed & mustard in relation to crop phenology and weather in the North Bank Plain Zone of Assam

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ABSTRACT

An attempt has been made to develop a forewarning model to predict the development of aphids population on rapeseed crop using data collected from a field experiment conducted at B.N. College of Agriculture, AAU, Biswanath Chariali (26°42' N and 93°15' E) during four *rabi* seasons (2007-08 to 2010-11) with cv TS-36 and M-27. During first two crop seasons both the cultivars were sown on four different dates (D₁ to D₄) at ten days interval starting from 25th October to 25th November, however, during third and fourth crop seasons the cultivars were sown at weekly interval on six dates starting from 15th October to 19th November (D₁ to D₆). The crop was infested by aphid during vegetative to pod development stages in both the cultivars and all seasons. However, aphid incidence increased as sowing was delayed. When the daily minimum and maximum temperatures fell below 12°C and 27°C, respectively, aphid appeared in the crop irrespective of sowing dates and cultivars. Since, average maximum and minimum temperatures and morning relative humidity for five days before day of observation showed significant correlation with aphid population, model equations were developed to forewarn aphid population 5 days in advance on a real time basis for individual cultivars, which can be used in agro advisory.

Key words: Rapeseed, mustard aphid, weather parameter, forewarning model

Assessment of impact of elevated temperature and CO₂ on growth and yield of maize crop using DSSAT model

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ABSTRACT

Crop production is inherently sensitive to variability in climate. Temperature and CO₂ are two important parameters related to climate change, which affect crop yield of a particular region. In this study, an attempt has been made to assess the impact of these two parameters on the productivity of maize crop under sub tropical condition of Jammu. For this purpose CERES-Maize model 4.0 was used in which the experimental results of maize during *kharif*, 2005 used as baseline to assess the maize yield under different climate change scenarios. The CO₂ concentrations used in the model, as projected by IPCC, were 376, 414, 522, 682 and 970 ppm against the years for baseline, 2020, 2050, 2080 and 2100, respectively. However, on the basis of study carried out in the region, the model was run and rerun for temperatures rise by 0.64° C for 2020, 1.60° C for 2050, 2.56° C for 2080 and 3.20° C for 2100 against the year 2005. The deviation in maize productivity from 2005 was estimated and analyzed to assess the effect of elevated temperature and CO₂. Simulated maize productivity revealed the reduction in grain yield by 3.66%, 8.06%, 16.29% and 26.14% in response to temperature rise by 0.64°, 1.60°, 2.56° and 3.20°C, respectively. The enrichment of CO₂ concentration, however, enhanced the grain yield by 0.83, 3.16, 6.98 and 11.97 per cent from the production level of the year 2005 in 2020, 2050, 2080 and 2100, respectively.

Key words: Climate change, CERES Maize model, temperature rise, CO₂ conc., maize

Weather based forewarning models for safflower aphid (*Uroleucon compositae* T.) in the scarcity zone of Maharashtra

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ABSTRACT

Field experiments were carried out with two safflower varieties A-1/Bhima (tolerant) and CO-1 (susceptible) to study the effect of various weather factors on aphid (*Uroleucon compositae* T.) at Solapur during five consecutive *rabi* seasons of 2007-08 to 2011-12. Two varieties were sown at two sowing dates *viz.*, normal (Second fortnight of September to first week of October) and late (Second fortnight of October to first week of November) during each season. Late sown safflower crop with susceptible cultivar CO-1 was found to be infested more by aphids. Equations were developed to forewarn the incidence of safflower aphid by using weekly weather data study. The also revealed that the maximum and minimum temperatures contributed significantly for the aphid incidence and its spread under two sowing situations and on both the cultivars. Further, the aphid population was negatively correlated with maximum and minimum temperatures and rainfall, while it was positively correlated with relative humidity both at morning and evening. Prediction models on the aphid population were proposed which may be used in agro advisories.

Key words: Weather parameters, forewarning models, safflower aphid, Maharashtra

Evaluation of pan coefficient methods for estimating FAO-56 reference crop evapotranspiration in a semi-arid environment

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ABSTRACT

Five empirical methods (*viz.* Cuenca, 1989; Snyder, 1992; Orang, 1998; Pereira, 1995 and Allen and Pruitt, 1991) were evaluated to find out K_p using daily weather data (temperature, relative humidity and wind speed) of Indian Agricultural Research Institute station over the years 1997 to 2011. It was observed that the measured K_p values showed bi-modal variation during the year with values ranging between 0.72 to 0.93, being lower in the summer months and higher in rainy and winter months. Out of the five methods, Snyder method was found to be the best for estimating K_p with RMSE of 0.05, and MAD of 0.04. The E_T estimated with K_p of Snyder method also showed lowest RMSE of 0.19, and MAD about 0.16. It is recommended that temporal variation in K_p should be computed for each station for estimation of E_T and Snyder method is recommended for estimating K_p in semi-arid environments.

Key words: Pan coefficient, pan evaporation, reference crop evapotranspiration, FAO-56

Surface energy balance and its closure in arid grassland ecosystems: A case study over Thar desert

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ABSTRACT

A complete annual cycle of micrometeorological measurements were carried out to characterize the dynamics of radiation and energy balance over a grassland ecosystem at Central Arid Zone Research Institute experimental area at Chandan, Jaisalmer, India from INSAT-linked ISRO-AMS (Agro-Met Station). The daytime average dekadal latent flux for actual evapotranspiration (AET) showed substantially lower magnitude ($15-115 \text{ Wm}^{-2}$) (AET: 0.3 mmd^{-1} to 2.5 mmd^{-1}) with prominent peak coincident to south-west monsoon and peak growth stage. Sensible heat fluxes showed a large variation from 54 to 340 Wm^{-2} with peak during summer and minimum during winter and monsoon seasons. More than 70% energy balance closure (EBC) was observed. The non-closure of energy balance periods were characterized by strong local advections in summer. The daytime average net radiation showed bimodal behavior (195 to 420 Wm^{-2}) with primary peak in spring-summer and secondary peak coincident to the start of the withdrawal of south-west monsoon. Significant complementary exponential relation ($Y=0.045 e^{12.13X}$, $R^2 = 0.65$) was found between dekadal albedo and Bowen ratio which was generally high (1.5 to 5.3) with intermittent dips (0.3 to 1.3) coincident to wet spells. Similarly, the dekadal albedo showed a higher magnitude (0.15 to 0.39), recording the highest (0.39) in the month of April and the lowest (0.15) in the month of September post-monsoon period when green grass growth was maximum.

Key words: Micrometeorology, grassland, Thar desert

Energy and water dynamics over young pine forest as influenced by climatic variability and land management practices

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ABSTRACT

A study was conducted using half-an-hourly micrometeorological data to construct energy and water budget over a young pine plantation in a different rainfall regime year, without (2010) and with (2011) understorey species through 13 m Forest Meteorological Station (FMS) tower at the experimental area of Forest Research Institute, Dehradun. Dekadal (10-day) daytime average net radiation (R_{net}) data showed bimodal behavior with primary peak during summer ($440-520 \text{ Wm}^{-2}$) and secondary peak ($340-370 \text{ Wm}^{-2}$) during post-monsoon. Bowen ratio was high (0.85 - 1.5) during drier months with dips (0.08 - 0.66) during wet spells. The dynamism of surface characteristics was characterized by two types of contrasting relationship between Bowen ratio and albedo during the annual growth cycle. Latent heat (LE) flux ranged between 47 and 284 Wm^{-2} with prominent peak coincident to peak growth stage. Sensible heat flux showed a large variation with a peak during the summer and minima during winter and monsoon. The relative evapotranspiration, showed a peak (0.9) during monsoon and a low range (0.38 to 0.6) during the rest of the period indicating soil dryness. Annual ET / precipitation ratio varied between 0.39 and 0.44 in these two years of the study period, whereas ET/PET ratio varied less and remained between 0.84 to 0.87. This study found that the clearance of understorey species has reduced the latent heat fluxes to about 50% and their removal disturbed all aspects of energy-water balance, energy partitioning behavior in the pine ecosystem of the western Himalayas.

Key words: Pine plantation, water dynamics, understorey species, Western Himalayas.

Growing degree days and reproductive phenology of four oil palm hybrids in India under irrigated conditions

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ABSTRACT

Variations in reproductive phenology, moisture content, oil content and growing degree days (GDD) of four adult oil palm tenera hybrids viz., Malaysia, Palode, Deli x Ghana and Deli X Nigeria grown under irrigated conditions were investigated by evaluating nine production cycles during April to December 2011. The results revealed that large variations in duration of the reproductive phenology and GDD during different production cycles among the oil palm hybrids. The Palode hybrid which had anthesis during the month of October recorded the shortest reproductive duration, while Malaysian hybrid, which had anthesis during July recorded the longest duration. Oil Palm hybrids which had anthesis during December had longer reproductive durations compared to that of other months. The Malaysian hybrid which started anthesis during December also accumulated the highest GDD. Similarly, large variations existed in parameters like average fruit weight, oil and moisture percent in the oil palm hybrids which started anthesis from April to December. Thus, differences in GDD during the different production cycles indicated that this bio-meteorological index is not sufficient to distinguish the reproductive phenology in oil palm hybrids under irrigated conditions.

Key words: Oil palm, phenology, growing degree days, cumulative heat units

Development of predictive model for karnal bunt of wheat

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ABSTRACT

Average infection (%) of karnal bunt of wheat and meteorological parameters of 6th to 12th SMW (5th February to 25th March) from 1981-82 to 2006-07 for 26 crop seasons of Karnal station were analyzed for most sensitive stage between ear emergence and maturity. Rainfall and number of rainy days during the 6th SMW were the most important weather parameters favourable for the development of karnal bunt. Wind speed was also important during this week for the transfer of primary sporidia from soil to leaf. Rainfall, number of rainy days along with morning and evening relative humidity during 9th SMW were favourable for further multiplication of secondary sporidia. Rainfall and rainy days during 10th, 11th and 12th meteorological weeks helped in multiplication of karnal bunt in wheat. A multiple regression model was developed that explained 76% variability in occurrence of karnal bunt disease for Karnal zone.

Key words: *Karnal bunt, meteorological parameters, regression model*

Detection of site specific climate resilient nutrient management practice for rice-wheat system – An empirical approach

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ABSTRACT

Identification of suitable climate resilient nutrient management practices will reduce the ill-effects of extreme climate variability on agricultural production. Rice (*Oryza sativa* L.)-wheat (*Triticum aestivum* L.) rotation is one of the major cropping system traditionally followed in the Indo-Gangetic Plains, which are responsible for the food security of the country. The relation between rice yield variability and rainfall under different nutrient management practices and the relation between wheat yield variability and maximum temperature using the yield data from the long term Integrated Nutrient Management experiment on the rice-wheat system for the last 27 years at 9 sites representing different agro-ecological zones of India were analyzed. The application of 50% recommended NPK through chemical fertilizers and 50% N through green manure resulted in an overall average higher increase of 1.5% system productivity under both excess (>750 mm) and deficit (<481 mm) rainfall years and also during the years having seasonal mean maximum temperature $\geq 25.6^{\circ}\text{C}$ at Ludhiana. Thus this treatment has the adaptive capacity to withstand extreme climates and we can say this treatment is the primary climate resilient integrated nutrient management practice for rice-wheat system in Ludhiana. Application of 50% N through crop residue and 25% N through green manure along with inorganic fertilizers were found to be the secondary and tertiary climate resilient integrated nutrient management practices at Ludhiana. The primary, secondary and tertiary climate resilient integrated nutrient management practice for other sites included in the study were also identified.

Key words: Site specific, climate resilient, integrated nutrient management, Indo-gangetic plains

Probable rainfall and contingent crop planning for scarce rainfall zone of Maharashtra

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ABSTRACT

Rainfall analysis comprising of north, central and southern parts of the Scarcity Zone of Maharashtra was carried out. Dhule station representing northern part is *kharif* oriented as evidenced by the high initial rainfall probabilities in *kharif* during MW 25 and 26 (<55%) and less variability. Rainfall analysis of the central part, represented by Kopergaon, Rahuri and Chas indicated that sowing of *rabi* crops in MW 39 has a high probability (>60%) and less variability (CV 95%). Rainfall analysis of southern part represented by Jeur, Mohol, Pandharpur, Padegaon and Solapur revealed that the highest probability (>50%) of receiving >20 mm rainfall was observed during MW 38 to 40 with less variability (CV 86 to 110%). Sowing of crops viz., pearl millet, sunflower, pigeon pea are recommended for the *kharif* period. Mid season correction crop like sunflower is recommended as a contingent crop under late onset of monsoon (July and early August). *Rabi* crops like winter sorghum, safflower and chickpea are recommended for this period which can be grown on residual soil moisture.

Key words: Rainfall, probability, cropping pattern, scarce rainfall zone, Maharashtra

Impact of planting methods and irrigation levels on microclimate of wheat

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ABSTRACT

The microclimate and energy balance in wheat crop was studied under different planting methods (flat sowing (F) with row to row spacing of 22 cm and sowing on raised beds (B) 37.5 cm wide with two crop rows 20 cm apart and 30 cm wide furrows between two beds) and irrigation levels (with 0, 1, 2, 3, and 4 post-sowing irrigations denoted as I_0 , I_1 , I_2 , I_3 and I_4 , respectively). Soil temperature was slightly on the higher side on flat as compared to bed planting, which might be due to more energy losses from loose soil in case of beds. Canopy temperature was found relatively higher in the rain-fed (I_0) treatment as compared to the maximum water application treatment (I_4). During 2006-07, canopy temperature was slightly higher for flat planting as compared to bed planting under I_4 irrigation level, whereas these were almost same during 2007-08. The data indicated that canopy temperature depression increased with increase in irrigation application. $T_c - T_a$ values were found positive for most of the growing period for the rainfed treatment and negative for I_4 treatment for both the years. The rainfed treatments under both the planting methods (BI_0 and FI_0) experienced the highest Bowen ratio, whereas the well-watered treatments (BI_4 and FI_4) experienced the lowest Bowen ratio, which reveals that much of the available energy was partitioned towards sensible heat under rainfed treatment and towards latent heat for well-watered treatment.

Key words: Canopy temperature, wheat, irrigation, planting methods, Bowen ratio

Management of tillage and crop residue under maize for enhancing soil resilience to climate change

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ABSTRACT

Development of appropriate coping strategies to adapt to the adverse impacts of climate variability should be a part of research activity in dryland agriculture. Therefore, a field study was established in semi-arid Alfisols to study the effect of conservation tillage practices, which influences the soil - water - plant ecosystem, thereby affecting crop yield. Surface residue cover, soil moisture, bulk density and penetration resistance were measured at different depths in the study composed of three tillage practices in combination with *in-situ* residue recycling. Tillage methods in combination with residue management significantly influenced biomass and grain yield with maize stalk slashing and spreading + tillage twice with offset disc harrow giving highest average stover and grain yield of 3726 and 2402 kg ha⁻¹ respectively. Reduced till or No till slightly recorded more soil moisture than that of conventional tillage. Differences in soil bulk density between tillage practices were temporally dependent and were largest at the depth of 0-100 mm immediately after tillage events. In crop stubbles + No till practice plots, bulk density mean yearly values were highest, 1.53 and 1.6 g cm⁻³ at 0-100 mm and 100-200 mm depths. The penetration resistance was higher in No-till practice than that under conventional tillage at 0 - 25 cm depth. It is concluded that, under semi-arid Alfisols, reduced tillage, even in combination with in-situ crop residue management, gives small yield benefits in the short run. Crop residue mulching helped significantly to conserve soil and water from off-season rainfall events. If adopted on long term basis, the practice could favourably improve other soil physical properties also. Therefore, reduced till and zero tillage practices in conjunction with biomass recycling could be of high significance in making the soil resilient towards climate variability.

Key words: Climate variability, conservation agriculture, tillage practices, soil resilience, soil moisture, penetration resistance, maize yield

Effect of micro-environmental variations on biomolecular profile and performance of pig

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ABSTRACT

The present study was conducted round the year at the Pig Farm Complex of National Research Centre on Pig (ICAR), Guwahati, Assam to study the effect of micro-environmental variations on biomolecular profile and performance of indigenous and crossbred pigs. Round the year, Temperature-Humidity Index (THI) was highest during 12:00 to 18:00 hrs and it crossed 80.0 in May, June, July and August, when most of the animals showed panting, increased respiratory rate and increased rectal temperature. During the winter months (December, January and February), THI was found below 60.0 and the animals showed adaptive behavioural manifestation in terms of hudding and using the closed area of the housing. The Effect of THI on pre-weaning production performance (litter size at birth and at weaning; litter weight at birth and weaning, mortality rate) of Ghungroo, Niang Megha and crossbred pigs revealed no influence of THI on Ghungroo pigs. However, THI had significant ($p < 0.01$) effect on Niang Megha and crossbred pigs. The effect of THI on post-weaning production performance, i.e., weaning weight at various monthly intervals was found significantly higher ($p < 0.01$) at average THI 76.1 as compared to 63.3. Similarly, biomolecular parameters like T_3 , T_4 , cortisol, blood SGOT, sodium, and potassium were significantly ($p < 0.01$) different in different seasons. However, the blood SGPT, total protein, calcium, phosphorus and magnesium levels remained unchanged in different seasons. Immediate observable indicators of stress, i.e., respiration rate and rectal temperature varied significantly ($p < 0.01$) in both the seasons. Adaptive behaviour of pig suggested that Ghungroo are climatic resilient as compared to Niang Megha and Crossbred pigs.

Key words: Stress hormones, biomolecular marker, temperature-humidity index, haematology, production, heat stress, reproduction

Conservation agriculture in maize (*Zea mays* L.)-horsegram (*Macrotyloma uniflorum* L.) system in rainfed Alfisols for carbon sequestration and climate change mitigation

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ABSTRACT

Conservation agriculture (CA) is a new paradigm to achieve higher production by mitigating water and nutrient stress in rainfed regions through adoption of reduced tillage, crop rotations and residue retention and also to address the global warming problem. A field experiment was conducted during 2010 and 2011 in sandy loam soil of Gunegal Research Farm at Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad to study the effect of CA practices and balanced fertilization on performance of maize (DHM 117)-horsegram (CRIDA 18R) cropping sequence, the impact of CA on nutrient use efficiency, profitability, soil health improvement and climate change mitigation. Pooled data showed that seed (3.0 t ha^{-1}) and stover (5.5 t ha^{-1}) yields in maize in CA was on par with conventional system. Significantly higher grain (4.7 t ha^{-1}) and stover (7.9 t ha^{-1}) yields were realized with balanced fertilization. In case of horsegram, significantly higher yields (kg ha^{-1}) were obtained in CA (572) compared to conventional (389). Status of soil organic carbon, other labile pools of carbon and major nutrients (N, P, K) was improved in CA. There was an increase in use efficiency of N, P, K, S and Zn to the extent of 11, 16, 14, 13 and 21% respectively through adoption of CA practices. Higher net returns (Rs. 26571 ha^{-1}) and B:C ratio (2.1) was obtained in CA compared to Rs. 22529 ha^{-1} and 1.9, respectively in the conventional system. Maize yields increased with adoption of CA and balanced fertilization in deficit rainfall year. Thus, CA with improved nutrient management can improve nutrient use efficiency and increase net primary productivity in semiarid tropics.

Key words : Zero tillage, residue retention, nutrient use efficiency, carbon buildup, water retention, climate change

Impact of climate on oilseed production in Andhra Pradesh: A case study to understand regional level influences

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ABSTRACT

Oilseeds play an important role next to food grains in the Indian agricultural economy both in terms of area and production and India holds a significant share in world production too. The influence of climate change on oilseed production was not understood properly to devise resilience strategies in order to uphold the production and productivity. An attempt was made in this paper to understand the influence of climate change on oilseed production at a regional level using Andhra Pradesh as a case study through regression analysis as well as artificial neural networks (ANN). The results indicated that the predicted changes of climate on oilseed crops varied greatly by crop and region. The implications of regression and ANN models in predicting the climate change impact on different oilseed crops in Andhra Pradesh is discussed in detail.

Key words: Oilseeds, regional climate change, abiotic variables, ANN

Quantification of canopy spread of tree systems through fractional vegetation cover

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ABSTRACT

Quantifying the spread of the tree canopy has assumed importance in the context of afforestation and reforestation activities of the Kyoto protocol as only those areas with <15% canopy covers are eligible for the project activity under Clean Development Mechanism (CDM). Identification of the eligible area for CDM project activity using Fractional Vegetation Cover (FVC) is one of the methods to measure the horizontal spread of Canopy Cover (CC) occupying the ground in vertical projection per unit area. Two different methods viz., Normalised Difference Vegetation Index (NDVI) and Soil-Adjusted Vegetation Index (SAVI) derived method and a Spectral Mixture Analysis (SMA) method with Linear Mixture Model (LMM) were used for the determination of fractional vegetation cover (FVC) and compared with the observed ground data using a medium resolution imagery. The proposed methods for FVC retrieval were applied to Resourcesat LISS-3 (23m) image and were tested against *in situ* measurements of four different tree species at the Hayatnagar experimental farm of CRIDA. The correlation between field-based CC and image-based FVC using the LMM was found to be significant. Hence, it can be concluded that percentage canopy cover can be described in terms of FVC and classification of the pixel elements in to EndMembers (EMs) and then determining the FVC values enhances the accuracy.

Key words : Clean development mechanism, endmembers, fractional vegetation cover, linear mixture model, normalised difference vegetation index

Yield prediction of winter rice employing meteorological variables in central and upper Brahmaputra valley zone of Assam

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ABSTRACT

A study was carried out to forecast the yield of winter rice in seven districts of two agro-climatic zones of Assam. The daily weather data viz. maximum temperature, minimum temperature, morning relative humidity, afternoon relative humidity and rainfall were arranged week-wise from sowing to flowering and the relation between weather parameters and yield was determined using statistical tools like correlation and regression. The models for each district were selected based on higher R^2 and lower model error values. The models developed were validated for independent data set. The R^2 varied from 0.85 to 0.95 with error less than 1% for accepted models. The comparison between observed and forecast yield over different district exhibited a close agreement. Thus, the model could be used for forecasting the yield of winter rice for seven districts of Upper and Central Brahmaputra Valley Zone of Assam. The results also showed that climatic parameters and technological factors influenced the yield of winter rice differently in different districts. In Jorhat and Tinisukia district of Upper Brahmaputra Valley Zone, yield fluctuation was due to variations of climatic parameters whereas in Dibrugarh, Sibsagar and Golaghat district of the zone, and both the districts (Nagaon and Morigaon) of Central Brahmaputra Valley Zone, yields were influenced by both climatic variables and adoption of new technologies.

Key words : Long-term weather data, stepwise regression technique, validation, yield forecast

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Short Communication

**Effect of soil temperature on seedling establishment of Okra
[*Abelmoschus esculentus* (L) Moench]**

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Short Communication

**Efficient crop planning in rainfed areas of sub tropical zone of J&K
through weather based forecasting**

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Short Communication

**Agrometeorological indices for predicting growth and yield of chickpea for use in
agromet advisory services**

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Short Communication

Impact of elevated carbon dioxide and temperature on rice productivity in the mid altitude Meghalaya, Northeast India - Results from a simulation study

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Short Communication

**Effect of rainfall distribution on the productivity of groundnut in
Jamnagar district of Gujarat state**

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Short Communication

Rainfall trend, distribution and its role on crop yields in rainfed areas of Prakasam district of Andhra Pradesh - A Case study

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Short Communication

Phenophase prediction in safflower

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Short Communication

Climate change and rice crop duration

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Short Communication

**Assessing the length of growing season and drought
incidence in Bihar**

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Short Communication

Effect of radiation on floral biology of mustard grown under wheat-mustard intercropping system

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Short Communication

Effect of different sowing environments on dry matter accumulation, thermal indices at different growth stages and yield of fenugreek (*Trigonella foenum-graecum* L)

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Short Communication

PAR interception and dry matter accumulation in groundnut (*Arachis hypogaea* L.) cultivars sown at different time periods in the Gangetic Plains of West Bengal

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Short Communication

Interactive digital database on coral biodiversity of Andaman – An ICT initiative to digitize and manage an ecologically sensitive resource due to climate change

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Short Communication

**Moisture regime variability in selected mandals of Warangal district,
Andhra Pradesh**

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Short Communication

Use of probability models for prediction of rainfall at Solapur, Maharashtra

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Short Communication

Web based initiatives for climate resilient farming

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Short Communication

Drought characterization for crop planning in Nilgiris

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