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**Lead paper**

## **Agrometeorology and food security**

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**Lead paper**

## **Crop simulation models as tools for agro-advisories for weather and disease effects on production**

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### **ABSTRACT**

Seasonal and daily variations in weather are major determinants of cropping practices, crop yield, diseases, and crop quality. Crop simulation models have capabilities to predict crop growth response to weather, soils, crop management, and genetic factors. We hypothesize that crop growth models can be used as strategic planning tools with historical weather to improve production or as in-season agro-advisories to advise on weather-induced production problems, and disease management. The DSSAT V4.0 crop models were simulated for soybean and maize for 28 years at Patancheru, and for groundnut for 32 years at Anantapur, to hypothesize optimum sowing date, irrigation requirement, cultivar (soybean), and N requirement (maize). Optimum sowing for these crops was generally as soon as monsoon rains allowed. Across all sowing dates, the optimum soybean cultivar was Maturity Group 8 and yield was increased 1500 kg/ha with irrigation. Maize yield increased up to 150 kg N/ha, producing 5800 kg/ha under early sowing. Irrigated maize yield was increased with later sowing dates, but irrigation requirement was high. Optimum sowing window for groundnut at Anantapur was 15 July to 15 Aug and yield was clearly water-limited. Concepts for linking dynamic disease simulation models to the CROPGRO model for predicting consequences of leafspot disease on groundnut production were discussed.

**Keywords:** Crop models, weather, disease, groundnut, maize, soybean

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**Lead paper**

## **Integrated watershed management - A food security approach for SAT rainfed areas**

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### **ABSTRACT**

Vast potential of rain-fed Semi-Arid Tropics (SAT) in terms of increased productivity can substantially contribute to bridge the existing yield gaps between the farmers' yield and the achievable yield for different crops. Small sustainable increase in rainfed areas will help provide a degree of desired stability in the overall agricultural productivity of the country as nearly 60% of the agricultural land area is rainfed. The rainfed areas play a major role in providing the supply of pulses, oilseeds and nutritious cereals to the population. This paper describes the results of recent on-farm research in the SAT rainfed areas that has the capacity to realize the potential of agricultural productivity in the SAT India. In this approach, community watershed management is used as an entry point to implement soil and water conservation practices in concert with integrated nutrient management strategy to surmount the twin major constraints—water shortage and low soil fertility along with improved cultivars, institutional mechanisms and enabling policies to alleviate poverty and achieve inclusive growth in dryland areas. A number of case studies are presented to demonstrate that an integrated watershed management approach indeed can help provide food security by sustainably enhancing agricultural productivity in the SAT rainfed areas.

**Keywords:** integrated watershed management, soil and water conservation, integrated nutrient management, water shortage, multi-nutrient deficiencies, agricultural productivity, rainfed agriculture

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## **Land degradation in coastal areas and its impact: A study using remote sensing and GIS**

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## **Impact of land use pattern and land configurations on surface run-off and soil erosion during south-west Monsoon at Parbhani**

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### **ABSTRACT**

The Parbhani district of Marathwda region comes under the assured rainfall zone having more than 800 mm of rainfall in 40 to 45 rainy days. The impact of land use pattern and land configuration on surface runoff and soil erosion during from 1995-96 to 2001-02 was carried out to quantify the amount of surface run-off and loss of surface soil due to soil erosion under influence of south-west monsoon rain and to identify and suggest the suitable land use pattern for minimizing these losses of natural wealth. This study reveals that sorghum crop sown on ridges recorded lowest runoff followed by cotton in all seven years as where sorghum crop sown on ridges reduced considerable soil loss as compared to other treatments i.e., cotton on ridges and soybean on flat beds. If the fields are sloppy having about 1 % slope it is highly desirable to sow the sorghum and cotton crop on ridges and furrows across the slope

to protect the soil losses from fertile upper soil layer. The land should not be kept fallow during monsoon season.

**Key words:** Monsoon, Runoff, erosion, ridges and furrows, flat beds etc.

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### **Effect of season on morphology of the testis and seminal attributes in Osmanabadi goats**

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#### **ABSTRACT**

Eighteen weaned Osmanabadi goat bucks were selected and randomly distributed into three feeding groups viz. extensive ( $T_1$ ), complete stall-fed ( $T_2$ ) and semi stall-fed ( $T_3$ ). The effect of season on biometricular studies viz. testes length, width, breadth, circumference and volume from the age of four months to fifteen months and for these kids have been studied and also the seminal attributes viz. Semen volume, sperm motility, sperm concentration, live sperm count and dead sperm count from the age of puberty to fifteen months have been recorded. The data on both of these parameters have been classified into three seasons viz.  $S_1$  (winter),  $S_2$  (summer) and  $S_3$  (monsoon). It was observed that season and treatment had significant effect on testicular length, testes width, testes breadth and testes circumference but interaction between these two had non significant effect except testes volume. Among the seminal attributes the season had significant effect.

**Key words :** Season, feeding systems, biometricular parameters and seminal attributes.

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### **Effect of residue recycling on biological soil health indicators and surface CO<sub>2</sub> emissions in rainfed semi-arid tropical Alfisol under minimum tillage conditions**

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#### **ABSTRACT**

The present study was undertaken to assess the impact of surface application of different levels of crop residue on predominant biological soil health indicators and release of CO<sub>2</sub> fluxes from the surface soil as a result of microbial respiration under minimum tillage conditions. The experiment was conducted in a rainfed Semi-Arid Tropical (SAT) Alfisol at Hayathnagar Research Farm of Central Research Institute for Dryland Agriculture, Hyderabad. Studies indicated that an application of 6 t ha<sup>-1</sup> of sorghum stover recorded significantly highest microbial biomass carbon of 177.11 and 167.83 µg g<sup>-1</sup> of soil and highest DHA (Dehydrogenase Assay) of 2.49 and 1.74 µg TPF g<sup>-1</sup> hr<sup>-1</sup> at surface and subsurface layers respectively. Similarly, the activity of arylsulphatase was also significantly influenced by residue application and was highest at 6 t ha<sup>-1</sup> plot (150.755 µg PNP g<sup>-1</sup> hr<sup>-1</sup>) irrespective of soil depth. The activities of other

soil enzymes such as urease, acid phosphatase and alkaline phosphatase were also significantly influenced at both the soil depths by graded levels of residue applications. On an average, quantitatively, biological soil quality indicators attained higher values in surface soil compared to subsurface soils. The CO<sub>2</sub> flux significantly increased with the increasing levels of surface applied sorghum crop residue upto 4t ha<sup>-1</sup> under minimum tillage conditions. Thus, the biological soil quality indicators were significantly influenced with residue application under minimum tillage in these Alfisols.

**Key words :** Soil enzymes, microbial biomass C, DHA, biological soil quality indicators and CO<sub>2</sub> flux

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## **Soil water functional relationships under unsaturated condition for the soils of Central Brahmaputra Valley Zone of Assam**

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### **ABSTRACT**

An investigation was conducted to evaluate  $D(\theta)$ ,  $K(\theta)$  and  $C(\theta)$  for the surface and subsurface soils of Central Brahmaputra Valley Zone of Assam.  $D(\theta)$  values were found to decrease with the increase in fineness of texture.  $D(\theta)$  also decreased with decrease in soil water content.  $D(\theta)$  increased exponentially with increase in  $\theta$  values for all the soils. Prediction of  $D(\theta)$  using Gardeners(1970) approach was unsatisfactory. The experimental  $K(\theta)$  values at 33 kPa were higher in case of medium textured soils. At 1500 kPa, the value of  $K(\theta)$  were sharply reduced compared to 33 kPa and it was more pronounced in case of medium textured soils. The prediction of  $K(\theta)$  using Campbell (1974) model was unsatisfactory for all the soils. At lower suctions the medium textured soils exhibited higher  $C(\theta)$  values, whereas at higher suction lower  $C(\theta)$  values were exhibited by the soils.

**Key words:** Soil water diffusivity, hydraulic conductivity, water capacity, soil water content.

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## **Innovative model for forecasting daily trend of monsoon rainfall**

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### **ABSTRACT**

For better and sustainable output, timely and necessary input is the basic requirement. This is also true in case of monsoon rainfall. At present farmers do not know the availability of rainfall either date wise or quantity wise in the forth coming monsoon. Further, the trends of monsoon, onset, dry spell, wet spell, withdrawal, heavy to very heavy rain spells etc. are also completely unknown. Even with the latest developments in meteorological instruments, super computers satellite images, media communication the agricultural community is able to receive weather information 2-3 days in advance only but not well before. In this regard an attempt is made to establish

a model for forecasting daily trend of summer monsoon behavior well in advance in its due course from the onset to withdrawal phases. The model is very unconventional with respect to its input parameters.

**Key words:** Solar system, topography, ephemeris, declination

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### **Energy budget over semi-arid agro-ecosystem using satellite data**

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#### **ABSTRACT**

The crop production system in semi-arid climatic conditions is frequently encountered by water scarcity due to maldistribution of rainfall or lack of irrigation water. It gives low productivity to overall growth in agriculture. The characterization of water stress over large agriculture using thermal regime over crop surface in periodic manner throughout crop growth cycle is extremely important. Though, conventional measurements with Lysimeter keep record of field and soil specific water balances in root zone but cannot be extrapolated to larger area. The combination of optical band data in terms of albedo, NDVI threshold based emissivity and thermal band data in terms of Land Surface Temperature can represent evapotranspiration (ET) through energy balance approach over a spatial domain. The estimation of energy budget over crop field is more complicated than barer field.

Energy balance estimates derived from MODIS AQUA were validated with in situ attended and unattended observations for two wheat seasons, 2005 - 06 and 2006 - 07, within a 5km x 5km wheat growing region of Kheda district in Gujarat. Daily AQUA evapotranspiration estimates in terms of daytime latent heat fluxes were found to have root mean square error (RMSE) 29 Wm<sup>-2</sup> (r = 0.72) and 26 Wm<sup>-2</sup> (r = 0.8), respectively as compared to attended measurements during both the seasons. Correlation was substantially more and RMSE were less when estimates were compared with in situ measurements using Large Aperture Scintillometer (LAS) sensible heat fluxes.

**Key words:** Wheat, semi-arid, ET, MODIS

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### **The performance of SWAT model for generating rainfall from microwatershed**

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## **Land suitability analysis for agricultural crops using GIS and remote sensing techniques**

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### **ABSTRACT**

IRS1D-LISS-III imagery (FCC) was visually interpreted to identify land use categories and land suitability analysis for important crops of the study area, viz., maize and wheat was performed based on the limitation concept of the FAO methodology for land evaluation combined with parametric classification approach and multiple overlaying techniques in a GIS environment. The suitability analysis for wheat crop showed that 37, 13, and 50 per cent of the total area of the watershed is moderately suitable, marginally suitable and permanently unsuitable, respectively. With respect to maize crop, 0.7 per cent is found to be highly suitable, 36.6 per cent is moderately suitable, 13 per cent is currently unsuitable, and 50 per cent is permanently unsuitable. Major limitations of the watershed are found to be low soil fertility, low water holding capacity of soils, erosion hazard on steep slope land units, and inadequate water availability during the intermediate growing period. The study also showed that GIS and Remote sensing techniques are powerful tools to integrate various data layers and to assess the potentials and limitations of physical land resources for scientific land use planning and decision supporting systems in crop specific modeling of agricultural production.

**Key words:** Land suitability, parametric classification approach, GIS and remote sensing

## **Growth - yield dynamics, radiation interception and radiation use efficiency in Brassica carinata**

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### **ABSTRACT**

A field experiment was conducted at Punjab Agricultural University, Ludhiana, to study the crop performance, radiation interception and radiation use efficiency in African sarson (*Brassica carinata*). The relationship of leaf area index and total dry matter with photosynthetically active radiation (PAR) interception indicated that with an increase in leaf area index as well as total dry matter, the photosynthetically active radiation interception increased during both the years. The linear regression equation developed between leaf area index (X) and photosynthetically active radiation interception (Y) was  $Y = 60.01 + 15.02 X - 3.09 X^2$  ( $R^2 = 0.85$ ). The linear regression equation developed between total dry matter (X) and photosynthetically active radiation interception (Y) was  $Y = 67.03 + 1.15X - 0.16 X^2$  ( $R^2 = 0.83$ ). Similarly, radiation use efficiency also increased with increase in leaf area index and dry matter upto certain level and afterwards start declining. The radiation use efficiency was higher for early sown crop as compared to late sown crop. The regression equations were developed

for different dates as well as for the whole season. The results also showed the increase in yield during early date of sowing as compared to late sowings.

**Key words:** Oilseed, Leaf area, Dry matter, PAR interception, Radiation Use Efficiency, Brassica carinata

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## **Heat flux estimation from MODIS TERRA-AQUA and validation over a semi-arid agroecosystem using scintillometry and model simulation**

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### **ABSTRACT**

Sensible heat flux (H) is a critical and crucial energy partitioning component. Its estimation at local and regional scale generally uses surface radiometric temperature from observations in thermal infrared bands as well as aerodynamic resistance determined from ground-based measurements. A study was carried out to compute daily instantaneous sensible heat fluxes from MODerate resolution Imaging Spectroradiometer (MODIS) TERRA and AQUA optical and thermal data at morning (11:00-11:30hrs) and noon (13:00-13:30hrs) hours, respectively. MODIS data were acquired over semi-arid wheat-fallow system at Nawagam, Kheda district of Gujarat during 1 November 2006 to 31 May 2007. A numerical iterative procedure built-in METRIC (Mapping Evapotranspiration at high Resolution and with Internalized Calibration) model that takes inputs from 'dry' and 'cold' pixels, was used to solve stability-instability parameters and aerodynamic resistance in a single source energy balance framework. In addition, Richardson number based bulk approach was also used to derive such parameters. MODIS based estimates from both the approaches were compared with area-integrated half-hourly measured fluxes from Large Aperture Scintillometer (LAS) installed at 10m height with a path length of 1.5km between its transmitter and receiver. Initial analysis showed low root mean square error (RMSE) of METRIC estimates as compared to bulk approach. The RMSE of TERRA and AQUA based 'H' estimates from METRIC were 21Wm<sup>-2</sup> (19%) with R<sup>2</sup> = 0.85 (n = 157) and 22Wm<sup>-2</sup> (14%) with R<sup>2</sup> = 0.9 (n = 133) when compared to coincident area integrated 'H' measurements from LAS, respectively. The RMSE of TERRA-AQUA pooled 'H' estimates was found to be 21.5Wm<sup>-2</sup> (17%) with R<sup>2</sup> = 0.88 (n=278). The simulated half-hourly heat fluxes from a two-source Atmosphere Land Exchange (ALEX) model were also compared with satellite based estimates and LAS measurements after sensitivity analysis. Comparison among model simulation, METRIC estimates and LAS measurements showed that METRIC (satellite based) estimated was better than simulated sensible heat flux.

**Key words:** Sensible heat flux, Large Aperture Scintillometer, METRIC, ALEX

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## **Evaluation of cotton genotypes for their performance during spring summer season**

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## ABSTRACT

A field experiment was conducted at Regional Station, PAU, Bathinda during spring summer season of 2005-06 to evaluate the feasibility of growing cotton genotypes in the spring summer season. The genotypes were tested in term of thermal requirement, monopodial branches, sympodial branches, total number of bolls per plant, boll weight, yield and heat use efficiency. PIL-8 and LH-1995 genotypes took less days (98 to 100) and heat unit (1559.9 day °C and 1606 day °C) up to boll opening stage to attain different phenological stages. The highest number of monopodial branches (2.8 per plant) was observed in PIL-8 where as highest number of sympodial branches (29.4) and total numbers of boll per plant (33.2) was found in LH-2074. The genotypes BH-7 and Pusa 5-8 took comparatively more days (172) and more accumulated heat units (3195.6 day °C each) to complete their life cycle.

**Key words:** cotton genotypes, spring season, heat units, yield and yield attributes

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### **Microclimatic effects in the commercial production of *Anthurium andreanum***

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## ABSTRACT

Four cut flower varieties of *Anthurium andreanum* Tropical (V1), Pistache (V2), Mauritius orange (V3) and Passion (V4) were grown under four growing structure(s). Weather parameters viz., temperature, relative humidity and light intensity were recorded daily both inside and outside the four growing structures. Low cost structure with UV stabilized shade net to divert 75% light intensity and UV stabilized polyethylene film (120 gsm) to provide protection from rainfall on top and sides covered with 25% of shade nets and with irrigation facilities at a cost of construction of Rs. 300/ m<sup>2</sup> was found suitable for growing anthurium in tropical areas. Temperature showed positive correlation with plant characters except in leaf number.increase in plant height, spread, leaf length and breadth was observed with increase in temperature. Leaf number showed significant negative correlation in variety Tropical (V1), Pistache (V2) and V3 (Mauritius Orange) in S1. In S2 and S3 this character did not show any relationship with temperature. In S4 leaf number was positively correlated with temperature in Pistache (V2) and Mauritius Orange (V3).

**Keywords :** Microclimate, cut flowers, weather, correlations

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### **Medium range weather forecast verification for middle Gujarat region**

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## ABSTRACT

Verification of weather forecasts has been a controversial subject amongst meteorologists and others out to lack of agreement on the specification of a scale of goodness for weather forecasts. An effort has been made to verify the weather forecast issued by NCMRWF Various test criteria were used to test the reliability and accuracy of the forecasted weather. Results showed that the accuracy of rainfall forecast was excellent in pre monsoon and winter seasons; above average for post monsoon and year as a whole. But reliability of forecasts in the post monsoon season

was skeptical as evidenced by negative HK score. Rainfall forecast was very good (>90% accuracy) except in monsoon season (75% accuracy). The forecast of cumulative weekly rainfall was excellent in pre monsoon, post monsoon and winter seasons. and was average for monsoon season. Performance was above average for year as a whole. The accuracy of wind speed was most accurate in all the seasons (>95% accuracy). Forecast of temperature (maximum and minimum) and wind direction was average (>60% accuracy) in all the seasons and need further improvements.

**Key words:** Medium Range Weather Forecast, Forecast verification, Ratio score, HK Score, Correlation coefficient

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## **Toposequence based cropping system for enhanced productivity in Nareshwar watershed of Vadodara**

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### **ABSTRACT**

On farm trials were conducted in 30 farmers' fields in upper, middle and lower toposequences to test and evolve the best management practice to enhance the productivity and income of cotton based cropping system in the Nareshwar watershed area of Vadodara district. The highest cotton, greengram, sorghum and sorghum fodder yields were obtained in treatment of in situ moisture conservation with supplemental irrigation in all the toposequences followed by insitu moisture conservation technique, recommended technology and farmers practice in that order. Decreasing trend in all the yield and economic parameters except ICBR was observed from upper to lower toposequence.

**Key words:** Watershed, Toposequence, In situ moisture conservation, Supplemental irrigation, economics, Cotton

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## **Microclimate study under agroforestry system and its impact on performance of tea**

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### **ABSTRACT**

Tea is usually grown in the hills and terai region of West Bengal, India. To evaluate the possibility of growing tea in the lower Gangetic plain of West Bengal, an experiment was conducted during 2001-2002 in the Central Research Farm of Bidhan Chandra Krishi Viswavidyalaya, Gayespur, Nadia. The main objectives of the study

were to identify the favourable environmental factors as well as the suitable shade tree for this region. For evaluating environmental condition specific micro-meteorological parameters viz., net radiation ( $R_n$ ), photosynthetic active radiation (PAR), Atmospheric temperature (AT), relative humidity (RH) and soil temperature (ST) were recorded in the alley of seven shade tree species from an established tea garden along with tea yield data. So far as the data were recorded, both AT and ST were lowered by 2 to 3 °C compared to a non-shaded open condition, where as RH values increased by 3 to 9 per cent within the shade. The result showed that better growth and yield of tea would be possible under the microclimatic conditions where  $R_n$  varied from 108 to 178.94  $Wm^{-2}$  and Incident PAR from 188 to 339  $\frac{1}{4} E m^{-2} s^{-1}$ . The shade provided by *Acacia auriculiformis* and *Dalbergia sisoo* seemed to be beneficial for tea yield.

**Key words:** Tea, Shade tree and Micrometeorological parameters

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### **Crop weather relationship in *Kharif* sunflower**

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### **Performance of CERES and WOFOST models in prediction of phenology and yield of rice in Telangana region of Andhra Pradesh**

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#### **ABSTRACT**

Field experiment was conducted during *Kharif* seasons at RARS, Jagtial in 2004 and 2005 and at Agricultural Research Institute, Rajendranagar in 2006. Two popular cultivars of the region were taken under different dates of planting. The WOFOST and CERES models were tested for phenology and grain yield of rice. CERES model predicted the physiological maturity with an error of -5.7 % and 7.8% during 2004 and 2005, respectively. Whereas grain yield was predicted with an error of 4.1 per cent. During 2005, CERES model has predicted flowering, maturity and yield of MTU 1010 with an error of -3.6%, -4.7 and 0.6%, respectively. During 2006, at Rajendranagar, in JGL 1798, CERES model predicted the yield of 3.4 % and -3.4% compared to WOFOST, which predicted the grain yield with an error of 1.9% and -1.8%, for 31 July and 11 August plantings. Sensitivity analysis revealed that, both the models performed well under delayed planting up to 30 August in prediction of grain yield of both cultivars JGL 1798 and MTU 1010 at RARS, Jagtial.

**Key words:** CERES-Rice, WOFOST, Phenology, grain yield.

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### **Prediction of phenology in aerobic rice using agrometeorological indices**

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### **ABSTRACT**

Field experiment was conducted during kharif seasons of 2003 and 2004 at College farm, College of Agriculture, Rajendranagar, Hyderabad to study the phenology and, heat and radiation use efficiency in aerobic rice. Crop was sown on four different dates viz., 16 June, 26 June, 07 July and 18 July as main plots and two varieties viz., Varaalu and Erramallelu as sub-plots in split plot design and replicated thrice. Results revealed that, from emergence to physiological maturity, Varaalu accumulated mean growing degree days of  $1624 \pm 58$  and heliothermal units of  $8658 \pm 396$  with coefficient of variation of 3% and 5%, respectively. While Erramallelu has accumulated  $1893 \pm 41$  mean growing degree days and  $10700 \pm 815$  heliothermal units from emergence to physiological maturity with coefficient of variation of 2 % and 8%, respectively. In Varaalu higher heat use efficiency (6.36), heliothermal use efficiency (1.24) and radiation use efficiency (6.12) were obtained in crop sown on 26 June, while in Erramallelu, higher heat use efficiency (7.16), heliothermal use efficiency (1.46) and radiation use efficiency (6.88) were obtained in crop sown on 16 June.

**Key words:** Aerobic rice, GDD, Phenology, HUE, RUE

*Journal of Agrometeorology (Special issue - Part I): 115- 119 (2008)*

### **Predicting yield and yield attributes of yellow sarson with agrometeorological parameters**

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### **ABSTRACT**

A field experiment, conducted with five sowing dates, viz. 22 October, 29 October, 5 November, 12 November and 19 November, during 2004-05 and 2005-06 winter seasons, indicated that total dry matter, plant height, seed yield, silique plant<sup>-1</sup>, seeds silique<sup>-1</sup> and test weight decreased significantly in sowings beyond 5 November. Greater magnitudes of these parameters were associated with higher mean temperature during vegetative phase and its lower values during reproductive and seed filling phases. Stepwise regression equations were developed for total dry matter with accumulated mean vapour pressure deficit during vegetative and reproductive phases ( $R^2=0.99^{**}$ ), seed yield with accumulated morning vapour pressure deficit during vegetative, reproductive and ripening phases ( $R^2=0.99^{**}$ ), number of silique plant<sup>-1</sup> with heliothermal unit during reproductive phase ( $R^2=0.94^{**}$ ) and test weight with maximum temperature during ripening phase ( $R^2=0.98^{**}$ ). To achieve higher yield, the sowing of yellow sarson needs to be adjusted during October to early November on attainment of mean temperature of 26 to 29 °C, which along with medium range weather forecasts could be useful guide to the farmers for scheduling sowing in the New Alluvial Zone of West Bengal.

**Key words:** Yellow sarson, sowing date, yield components, seed yield, weather parameters, regression equation.

*Journal of Agrometeorology (Special issue - Part I): 120- 121 (2008)*

### **Diurnal variation in the relationship between total solar radiation and photosynthetically active radiation**

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#### **ABSTRACT**

The total solar radiation (TSR) and photosynthetically active radiation (PAR) were measured daily Department starting from 630 h to 1630 h at a frequency of one hour with the help of LICOR 185B Photoradiometer (Pyranometer and quantum sensor), throughout the years for four years (2003 to 2006). Regression equations relating PAR and TSR were generated, Result revealed that at morning, noon and afternoon time respectively 82, 78 and 79 % variation of PAR could be explained by TSR value.

**Key words:** Solar radiation, PAR

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### **Development of predictive models in rapeseed and mustard under the agroclimatic conditions of Jorhat in the UBVZ of Assam**

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#### **ABSTRACT**

Field experiment was conducted at Jorhat (Lat 26°46' & Long 94°13') during the *rabi* seasons from 2000-01 to 2004-05 to investigate the crop-weather relationships in rapeseed-mustard. Correlation and regressions between accumulated agro-climatic indices, and final seed yield revealed that the significant association of agroclimatic indices with the yield of rapeseed mustard. The predictive model was developed with data 2001-02 and validated with the yield data of the remaining four years. Very low (<20%) per cent variations between predicted and actual yields in were the indicative of the fact that the model could be used very successfully in predicting seed yield of rapeseed - mustard well ahead of crop harvest under the agro-climatic conditions prevailing at Jorhat.

**Key words:** Rapeseed and mustard, agroclimatic indices, models.

*Journal of Agrometeorology (Special issue - Part I): 125- 126 (2008)*

### **Simulation modeling of growth parameters of wheat genotypes using CERES wheat model**

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*Journal of Agrometeorology (Special issue - Part I): 127- 130 (2008)*

### **Characterization of energy use by cotton and wheat crops**

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#### **ABSTRACT**

The partitioning of energy towards different components or energy budgeting was studied over cotton and wheat crops in field studies conducted at Central State Farm, Hisar during three consecutive *kharif* (2004, 2005 and 2006) and *rabi* seasons (2004-05, 2005-06 and 2006-07). The radiation observations were recorded over a large homogenous single crop sown on single date with same variety. It was revealed that the LE (latent heat flux) component was major energy utilizing process and it exceeded the other components irrespective of crop growth stage. In cotton crop, 58-69 per cent of  $R_n$  (net radiation) was utilized as LE component at vegetative stage and increased with advancement of crop age and attained peak (80-90 per cent of  $R_n$ ) during reproductive stage coinciding with maximum LAI (leaf area index). Thereafter, a decline set in during the maturity phase. The temporal trends for H (sensible heat flux) and G (soil heat flux) values were reverse to LE and higher values of these components were observed at vegetative and maturity stages when canopy was sparse and lower at reproductive stage of wheat with dense canopy. The LE component varied between 49-63 per cent of  $R_n$  at vegetative stage and increased to 71-79 per cent of  $R_n$  during the reproductive stage. The values of H in wheat at three crop stages varied between 27-33, 15-23 and 27-34 per cent of  $R_n$ , respectively. The results indicated that around 58 per cent of the yield variations in cotton could be explained by LE during reproductive stage whereas in wheat almost 98 per cent of variation could be explained by the LE at vegetative stage.

**Key words:** Energy balance, Bowen's ratio, cotton, wheat.

*Journal of Agrometeorology (Special issue - Part I): 131- 133 (2008)*

### **Canopy temperature variations and its effect on yield of summer green gram under varied hydrothermal regimes**

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#### **ABSTRACT**

The investigation was carried out to study the variations in canopy temperature in green gram (*Vigna radiata* L. Wilczek) cv. SML-134 during summer season 1999 and 2000 under changed hydrothermal regimes at Punjab Agricultural University, Ludhiana. Canopy temperature ( $T_c$ ) based predictive models explained 66% to 72% of the variations in the grain yield. Canopy to air temperature difference (CATD) temperature based predictive models explained 75% to 81% of the variations in the grain yield.

**Key Words :** Canopy temperature, *Vigna radiata* L. Wilczek, sowing dates, irrigation, straw mulching, yield predictive models.

*Journal of Agrometeorology (Special issue - Part I): 134- 136 (2008)*

### **Growth dynamics and yield of okra (*abelmoschus esculentus*, Moench) cultivars as influenced by date of sowing**

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**ABSTRACT**

Field trial was conducted at research farm of vegetables, PAU, Ludhiana with four dates of sowing viz. 5<sup>th</sup> March, 7<sup>th</sup> April, 10<sup>th</sup> May and 10<sup>th</sup> June and four varieties viz. Punjab 7, Punjab 8, Arka Anamika and Shagun replicated thrice in split plot design. Plant height, leaf area and dry matter were recorded periodically. All the biometric parameters increased with delay in sowing. Among different varieties Punjab 8 showed higher plant height, more dry weight and more leaf area index followed by Punjab 7, Arka Anamika and Shagun. Crop growth rate (CGR) was maximum in fourth date of sowing and among different varieties it was maximum in Punjab 8. Total fruit yield was maximum in fourth date of sowing followed by third date of sowing. Among the four varieties Punjab 8 performed best under all the dates of sowing. Regression models were also developed by using dry matter and fruit yield as independent variables and AGDD, AHTU, APTU and LAI as dependent variables. R<sup>2</sup> values were very high in both the models.

**Key words:** Okra, crop growth rate, fruit yield

*Journal of Agrometeorology (Special issue - Part I): 137- 139 (2008)*

**Correlation with climatic factors and regression models on yield of rabi sunflower (*Helianthus annuus* L.)**

**S.V. KHADTARE, D.D. MOKASHI, J.D. JADHAV, K P PAWAR and J.R. KADAM**

**ABSTRACT**

The field experiment was conducted for five years on sunflower by using four different sowing windows to study the relationship between weather parameters and yield in rabi season. The minimum temperature, relative humidity and BSS had highly significant positive association with grain yield at all the phenological phases. Significant negative association with grain yield by pan evaporation indicated that, at early growth stages rabi sunflower not favoured moisture stress condition. Significant positive association with grain yield at all stages of growth by minimum temperature indicates rabi sunflower responds well to the low temperature condition throughout growth period. The crop sown at MW 36 (first fortnight of September) and hybrid MSFH-17 produced maximum grain yield and total monetary returns. The weather parameter influence their contribution and performance of rabi sunflower crop sown at different dates of sowing were assessed and the model on combined effect was developed using stepwise multiple regression for predicting grain yield

**Key words:** Sunflower, Weather parameter, correlation, stepwise regression

*Journal of Agrometeorology (Special issue - Part I): 140- 142 (2008)*

**Agrometeorological indices for prediction of growth and yield in sweet sorghum under rainfed vertisol**

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**ABSTRACT**

Field experiments conducted at Kovilpatti, TN revealed that the total dry matter production of sweet sorghum was significantly influenced by dates of sowing. The agrometeorological indices viz. accumulated growing degree days, (GDD) helio thermal units (HTU) and heat use efficiency (HUE) of sweet sorghum under different dates of sowing were higher to attain the physiological maturity under early sown crops as compared to late sown crops. Since the sweet sorghum having the duration of 100-110 days, the early sowing of sweet sorghum under rainfed vertisol condition can utilize the available soil moisture due to seasonal rainfall. Whereas the late sown crops met with stress at grain filling and soft dough stage resulting in poor grain filling and early maturity due to terminal stress.

**Key words :** Sweet sorghum, Date of sowing, standard weeks, Agrometeorological indices

*Journal of Agrometeorology (Special issue - Part I): 143- 145 (2008)*

### **Phenological behaviour and heat unit requirement of sunflower (*Helianthus annus* L.) under rainfed condition of southern Tamil Nadu**

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#### **ABSTRACT**

A two year field study was conducted during rabi seasons of 2004-05 to 2006-07 at Black soil research farm of Agricultural Research Station, Kovilpatti under rainfed condition to study the phenological behaviour and heat unit requirement of Sunflower (*Helianthus annus* L.) under rainfed condition of Southern Tamil Nadu. The results of the experiment revealed that among different sowing windows, crop sown at 43<sup>rd</sup> standard week showed significant influence on the growth, yield attributes and yield of the sunflower crop under rainfed condition followed by the crop sown at 42<sup>nd</sup> standard week. The yield attributing character, head diameter was comparable between 42<sup>nd</sup> and 43<sup>rd</sup> standard week sown crops. The heat indices viz, growing degree days, helio thermal units and heat use efficiency of rainfed sunflower was higher and comparable at 42<sup>nd</sup> and 43<sup>rd</sup> standard week sowing. However, the seed yield of sunflower was significantly higher at 43<sup>rd</sup> standard week sowing and 45<sup>th</sup> standard week (Farmers practice) registered lesser seed yield of sunflower than the crop sown at rest of the sowing windows.

**Key words:** Sunflower, Standard week, sowing windows, heat indices

*Journal of Agrometeorology (Special issue - Part I): 146- 149 (2008)*

### **Validation of APSIM and CERES-Sorghum model for prediction of rabi sorghum yields in Solapur region of Maharashtra**

**V. RAVI KUMAR, S. R. KUMAR, M.S. RAUT, G. SREENIVAS and D. RAJI REDDY<sup>2</sup>**

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#### **ABSTRACT**

APSIM and CERES – sorghum models were calibrated by using the data collected from the field experiments conducted at Centre for Rabi sorghum, Solapur, Maharashtra and from the farmer's fields of Solapur district. For APSIM, rabi sorghum data of M35-1 (popularly grown cultivar of the region) under different dates of sowing in different years (2001 – 2004) was used. For CERES data of rabi 2005-06 and rabi

2006-07 on phenology and yield were used. The APSIM model has predicted the grain yield with deviation of 1.3 % to 7.0 % and -0.3% to -1.1% during rabi 2001 and 2002 at CRS, Solapur. Because of late receipt of rains during the years 2003 and 2004, the sowings were delayed and the model over predicted the yields with a deviation of 10.4 % to 23.1 %. CERES model simulation results revealed that for normal sowing, the model predicted the yield with deviation of 6.2 % to 26.7 % and 7.3 % to 9.3 % for the years 2005 and 2006, respectively. CERES model under predicted the flowering of M 35-1 with deviation of -8.8% to 11.8%. Whereas, the maturity was predicted with deviation of -7.1% to 2.7%.

**Key Words:** APSIM, CERES-Sorghum model, validation, calibration.

*Journal of Agrometeorology (Special issue - Part I): 150- 158 (2008)*

## **Cropping systems options in relation to ENSO phase for Nandyal in Andhra Pradesh—A simulation analysis**

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### **ABSTRACT**

In rainfed environments, the productivity of cropping systems is primarily determined by the amount and distribution of rainfall. In southern India, the ENSO condition to some degree determines the potential of the ensuing rainy season in terms of amount of summer monsoon rainfall that is likely to be received in the region. Although it is difficult to predict the distribution of rainfall at a site or region, the prediction of rainfall amount would help farmers to plan cropping strategies to minimize climatic risks to crop production. Using crop simulation models and long-term weather records (1961 to 2006), productivity and net income of three sequential cropping systems (maize-chickpea, soybean-chickpea and groundnut-chickpea) and three intercrop systems (maize/pigeonpea, soybean/pigeonpea and groundnut/pigeonpea) were evaluated for the three ENSO conditions for Nandyal situated in the Kurnool district of Andhra Pradesh. The simulation analysis showed that groundnut-chickpea sequential, groundnut/pigeonpea and soybean/pigeonpea intercrop systems during the La-Niña years, while maize/pigeonpea and groundnut/pigeonpea intercrop systems during the El Niño years gave higher net income at low risk among the cropping systems studied. During Neutral years, groundnut/pigeonpea intercrop systems was the most promising in terms of net income. The study has demonstrated that assessing the potential of seasons based on ENSO condition would help farmers maximize incomes and reduce climatic risks by providing more efficient cropping systems options in the region.

**Key words:** Rainfall prediction, ENSO condition, cropping systems, climatic risk.

*Journal of Agrometeorology (Special issue - Part I): 159- 163 (2008)*

## **Influence of weather parameters on the yield and yield attributes of soybean**

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### **ABSTRACT**

A field experiment was conducted at Regional Agricultural Research Station (RARS), Lam, Guntur, Andhra Pradesh, India, during the kharif and rabi seasons of 2001-02 and 2002-03 with an objective to find out the relationship between the growth and yield attributes of soybean grown in different cropping systems under staggered sowing as influenced by different weather elements. Correlations were developed between weather parameters and the resultant crop growth and yield attribute parameters. Weather variables during various phenophases of soybean, influenced growth, yield and yield attributes. At the end of the vegetative phase of soybean; the rainfall ( $r = 0.44^*$ ), morning relative humidity ( $r = 0.44^*$ ), evening relative humidity ( $r = 0.64^{**}$ ), and soil moisture at 15 cm ( $r = 0.59^{**}$ ) and at 30 cm soil depth ( $r = 0.55^*$ ) had strong significant positive correlation with growth parameters, yield attributes and seed yield at harvest. During the pod set phase of soybean, the mean minimum temperature ( $r = 0.60^{**}$ ), morning relative humidity ( $r = 0.71^{**}$ ) and afternoon relative humidity ( $r = 0.74^{**}$ ) had strong significant positive correlation with seed yield. Similarly, the mean morning and afternoon relative humidity of the seed fill and maturity phases also had significant positive correlation with seed yield of soybean. A regression model was developed taking into consideration those weather parameters that showed significant influence on the seed yield of soybean, which indicated that increase in afternoon relative humidity (51.1-84.0 per cent and 47.4-85.7 per cent) during pod set and seed fill phases respectively, morning relative humidity in the range of 71.6-93.5 per cent at seed fill phase along with soil moisture in the range of 12.5-40.2 per cent and 11.4-37.6 per cent, respectively in the 15 and 30 cm soil depth accounted for 65 per cent variation in soybean seed yield.

**Key words :** Soybean, weather parameters, yield, model

*Journal of Agrometeorology (Special issue - Part I): 164- 168 (2008)*

## **Geomatics-based agroclimatic characterization of Meghalaya**

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### **ABSTRACT**

Long term monthly and annual averages of mean temperature regressed against corresponding elevation data. A good correlation was observed between annual mean temperature and elevation. These monthly spatial variation of mean temperatures is used for computation of spatial Potential Evapotranspiration(PET) by Thornthwaite method(1948), and Available Water Capacity of soil (AWC) based on Thornthwaite and Mather method(1957). Different agroclimatic indices were worked out using climatic parameters. The values refer to the agroclimatic indices which express the relationship between climate and agricultural production in quantitative terms. The information collected on the climatic characteristics has been integrated with information on present land use practices and AWC and soil information to characterize the climate. This paper tries to demonstrate the use of new tools to characterize the agroclimate in hilly areas of North Eastern Region. The work can be extended to characterize climatic zones of other north eastern states.

**Key words :** Agroclimatic zone, Agroclimatic Indices, Remote sensing, GIS, Potential Evapotranspiration, Available Water Capacity.

*Journal of Agrometeorology (Special issue - Part I): 169- 173 (2008)*

## **Markov zero order model for dry and wet spells for Sabarkantha district, Gujarat, India**

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### **ABSTRACT**

In rainfed areas crop planning is solely dependent on the distribution pattern and amount of rainfall. In such conditions knowledge of average annual rainfall is not useful in predicting the start of rains, wet and dry spells for deciding cropping pattern. Probabilities of a particular day being wet or dry assist in planning agricultural activities for a region. For the present study Markov models of zero order are utilized to predict the probabilities of wet and dry days using Instat climatic guide. The analysis is based on rainfall data of 45 years (1961-2005) of rainfall data from 42 raingauge stations in Sabarkantha district of Gujarat, India. Daily probabilities of wet and dry days is calculated and models are prepared to predict the length of dry spell for specified period of the month. The model fitted to the data set consists of 8 terms plus constant with coefficient of correlation of 0.95. From the results it can be concluded that for the present study area the suggested successful sowing date for pearl millet crop is 15<sup>th</sup> May in case of 7, 6<sup>th</sup> June in case of 10 days and 20<sup>th</sup> June in case of 14 days dry spell length.

**Key words :** Markov zero order model, rainfall data, dry and wet spell, Pearl millet

*Journal of Agrometeorology (Special issue - Part I): 174- 182 (2008)*

## **Evaluation of different methods to estimate incoming solar radiation**

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### **ABSTRACT**

Unavailability of daily solar radiation data leads to use alternate ways for estimation of this most important weather variable. The present study was carried out to evaluate the methods of estimating incoming solar radiation using two alternate data sources i.e. ground observatory data (sunshine hours based Ångström-PreScott model; temperature based Bristow-Campbell model and Hargreaves model and both temperature and cloud amount based Supit model) and satellite based Earth Radiation Budget Experiment (ERBE) data.

Ångström-PreScott model was found to be the best among different empirical models tried, with highest  $R^2$  (0.72) and lowest RMSE (2.86 MJ m<sup>-2</sup>) followed by Supit ( $R^2=0.44$  and RMSE=3.97 MJ m<sup>-2</sup>). Two methods based only on temperature viz., Hargreaves and Bristow-Campbell remained at par with  $R^2$  value of 0.36 and 0.34, respectively. Validation was done using the station-wise empirical coefficients and found that all the models viz. temperature based Hargreaves' and Bristow-Campbell models, the temperature and cloud amount based Supit's model resulted with similar  $R^2$  (0.64, 0.65 and 0.66 respectively) and RMSE (2.86, 2.82 and 2.80 MJ m<sup>-2</sup>, respectively). Satellite derived solar radiation showed  $R^2$  of 0.63 with lowest RMSE of 2.08 MJ m<sup>-2</sup>.

**Key words :** Solar radiation, ERBE, Ångström-Prescott model, Bristow–Campbell model, Hargreaves model, Supit model

*Journal of Agrometeorology (Special issue - Part I): 183- 185 (2008)*

## **Rainfall probability analysis for crop planning in Gujarat State**

**V.B. VAIDYA, B.I. KARANDE, VYAS PANDEY, M.M. LUNAGARIA and A.M. SHEKH**

*Department of Agricultural Meteorology, BACA,  
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### **ABSTRACT**

The daily rainfall data of different districts of Gujarat were analyzed to study the rainfall characteristics, onset and withdrawal of monsoon rains and also the duration of getting assured rainfall. The mean annual rainfall analysis on agroclimatic zone basis revealed that the highest rainfall (1651 mm) was received in South Gujarat region while, lowest rainfall (442.3 mm) was observed in North-west zone. The contribution of south- west monsoon rainfall (June to September) was more than 90% in all regions of Gujarat state. The coefficient of variation was found to increase with decrease in rainfall. The onset of monsoon rains took place in 23 to 26 standard meteorological week while, withdrawal took place in 38 to 42 standard meteorological week. The frequency analysis (at j 50% probability) of weeks getting assured rainfall of either j 10 mm or j 20 mm rainfall revealed that in Kutch district there was not a single week while, it was maximum (16 weeks) in Valsad and Dangs districts.

**Key words :** Initial and conditional probability, Coefficient of variation, crop growing period

*Journal of Agrometeorology (Special issue - Part I): 183- 185 (2008)*

## **Rainfall probability analysis for crop planning in Gujarat State**

**V.B. VAIDYA, B.I. KARANDE, VYAS PANDEY, M.M. LUNAGARIA and A.M. SHEKH**

*Department of Agricultural Meteorology, BACA,  
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### **ABSTRACT**

The daily rainfall data of different districts of Gujarat were analyzed to study the rainfall characteristics, onset and withdrawal of monsoon rains and also the duration of getting assured rainfall. The mean annual rainfall analysis on agroclimatic zone basis revealed that the highest rainfall (1651 mm) was received in South Gujarat region while, lowest rainfall (442.3 mm) was observed in North-west zone. The contribution of south- west monsoon rainfall (June to September) was more than 90% in all regions of Gujarat state. The coefficient of variation was found to increase with decrease in rainfall. The onset of monsoon rains took place in 23 to 26 standard meteorological week while, withdrawal took place in 38 to 42 standard meteorological week. The frequency analysis (at j 50% probability) of weeks getting assured rainfall of either j 10 mm or j 20 mm rainfall revealed that in Kutch district there was not a single week while, it was maximum (16 weeks) in Valsad and Dangs districts.

**Key words :** Initial and conditional probability, Coefficient of variation, crop growing period

*Journal of Agrometeorology (Special issue - Part I): 186- 188 (2008)*

## **Influence of weather parameters on zonate leaf spot (*Gloeocercospora sorghi*) development on sorghum**

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#### **ABSTRACT**

Zonate leaf spot in sorghum incited by *Gloeocercospora sorghi* is an important disease in Indian region. The field studies on three varieties of forage sorghum viz., MP - chari, SSG 59-3 and HC 171 were carried out during SWM 2004 and 2005 at Jhansi, India. The results revealed that zonate leaf spot started appearing during first week of August when the maximum temperature (31.4 to 34.7° C), morning relative humidity (>90%) and evening relative humidity (54%) prevailed. Weather-disease interaction study revealed that preceding one week maximum temperature ( $r= 0.52$ ), evening relative humidity ( $r= 0.54$ ) and sunshine hours ( $r= 0.67$ ) contribute positively, for the diseases incidence whereas, minimum temperature ( $r= -0.79$ ) contribute negatively towards disease development. Step-wise linear multiple regression analysis was done to derive disease prediction equation. The multiple regression equation developed between disease severity and meteorological parameters explained 76 per cent variation of the zonate leaf spot disease during the crop growth period.

**Key words:** Zonate leaf spot, weather variables, forage sorghum

*Journal of Agrometeorology (Special issue - Part I): 189- 192 (2008)*

### **Effect of meteorological parameters on phenology and yellow rust of wheat**

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#### **ABSTRACT**

Field experiments were conducted during *rabi* seasons of 2004-05 and 2005-06 at the Research Farm, Department of Agricultural Meteorology, Punjab Agricultural University, Ludhiana. Wheat variety HD - 2329 was sown on 20<sup>th</sup> November during both *rabi* seasons with four replications in randomized block design. The phenological stages were recorded visually. Disease spread and intensity was recorded at weekly interval. Disease spread was recorded from inoculated plants in eight radial directions (N, S, E, W, NE, SE, SW and NW). Correlation coefficients between disease incidence and meteorological parameters were worked out. The disease was negatively correlated with maximum temperature and sunshine hours and was positively correlated with relative humidity during both the years. Multiple regression analysis indicated that the highest *r*-value was obtained when more number of meteorological parameters were combined. Grain yield was maximum in fourth spread (P4) as it was in SE direction and disease spread was least in this direction.

**Key Words:** Wheat, grain yield, yellow rust and disease spread.

*Journal of Agrometeorology (Special issue - Part I): 193- 196 (2008)*

### **Role of meteorological factors on the incidence of mulberry diseases**

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#### **ABSTRACT**

Mulberry (*Morus* sp), the host plant to silkworm (*Bombyx mori*) is affected by foliar diseases viz. powdery mildew, *Myrothecium* leaf spot, *Pseudocercospora* leaf

spot and bacterial leaf spot. To find out critical weather factors influencing these diseases, weekly disease severity data of the ruling cultivar S1 and daily meteorological data were recorded for three years. Simple correlation coefficient ( $r$ ) between disease severity and meteorological factors revealed that bacterial leaf spot has significant correlation with minimum relative humidity, minimum temperature and number of rainy days. Powdery mildew was found to have positive correlation with maximum relative humidity and negative with minimum temperature. However *Myrothecium* and *Pseudocercospora* leaf spot did not show significant correlation with any of the meteorological factors studied. Stepdown multiple regression analysis revealed that prediction of bacterial leaf spot could best be done from minimum relative humidity ( $R^2=0.36$ ). In case of powdery mildew, minimum relative humidity, maximum and minimum temperatures and number of rainy days were found to be the most influencing combination ( $R^2=0.28$ ). Maximum relative humidity, minimum temperature and rainfall were found to be the factors influencing *Myrothecium* leaf spot disease severity ( $R^2=0.20$ ).

**Key words :** Mulberry, disease, meteorological factors, forecasting

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### **Forecasting population of brown plant hopper, *Nilaparvata lugens*(Stal.)**

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#### **ABSTRACT**

The light trap data and weather data collected from Andhra Pradesh Rice Research Institute (APRRI), Maruteru from 1993-2002 were analyzed. Results revealed that among the weather parameters, rainfall of preceding month has shown significant positive influence on BPH light trap population viz., rainfall of August vs BPH of September, rainfall of September vs BPH of October, rainfall of October vs BPH of November. Maximum temperature of June had significant negative correlation with BPH of August and Maximum temperature of May had significant positive correlation with BPH of September. Morning relative humidity (RH I) of June had significant negative correlation with BPH of October and November. The linear and non linear regression equations were fitted for predicting the populations of BPH using significant weather data of preceding months. Results of the regression equation revealed that, percent accuracy in prediction of population was less when linear regression was fitted (55-70%), and accuracy increased to 60-75 per cent when non-linear regressions were fitted. Since first peak of BPH in kharif is noticed during September, attempt was made to forecast BPH light trap population (1993-2006) of September. Cumulative August rainfall was identified as the most significant factor responsible for increase in BPH population during September. Using cumulative August rainfall, BPH population in September as a whole, September 3<sup>rd</sup> and 4<sup>th</sup> weeks were predicted with an accuracy of 80, 83 and 67 per cent, respectively.

**Key words :** Rice, *Nilaparvata*, BPH, weather factors, forecast

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### **Agroclimatic regression model for forecasting of *Ascochyta* blight of chickpea in Punjab, India.**

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**ABSTRACT**

Ascochyta blight disease of chickpea, which is generally more prevalent in mid-latitude area showed more correlation with maximum temperature, evening relative humidity, rainfall and number of rainy days in a study conducted at the Department of Agricultural Meteorology, Punjab Agricultural University, Ludhiana. These variables provided consistently significant correlations with disease severity (DS) from 4<sup>th</sup> - 5<sup>th</sup> and 9<sup>th</sup> - 12<sup>th</sup> Meteorological Standard Weeks (MSWs). The significant correlation from 4<sup>th</sup> - 5<sup>th</sup> and 9<sup>th</sup> - 12<sup>th</sup> MSWs is due to existence of favourable weather conditions for the growth and development of the pathogens. The functional models developed by conducting step wise regression methods relating different weather parameters with the disease severity could be used in Ludhiana conditions as per the availability of meteorological data and extent of variations explained by different models. Two sets of models were developed using weather data of 4<sup>th</sup>-5<sup>th</sup> MSWs and DS and weather variables of 9<sup>th</sup>-12<sup>th</sup> MSWs and DS. Predictions of disease over 10 years period showed better agreement between predicted and observed values. The first set of models could be used from the end of 5<sup>th</sup> MSWs as a basis for preliminary forewarn for several days advance of symptom appearance and second set of models can be used after 12<sup>th</sup> MSWs as the final forewarn for the prediction of disease appearance.

**Key words :** Ascochyta blight, regression model, chickpea, disease forewarning

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**Degree days based model for predicting the occurrence of *Erysiphe polygoni* DC in *Vigna mungo* L.**

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**ABSTRACT**

Powdery mildew caused by *Erysiphe polygoni* DC is one of the most important diseases of *Vigna mungo*. Field experiments and laboratory studies were carried out to study the effect of degree-days on powdery mildew in *V. mungo*. In the correlation analysis, degree-days were found to influence the disease initiation positively during four days prior to initial disease appearance in all four years. Where as morning RH and leaf wetness hours influenced the initiation positively. A stepwise regression analysis shows that, degree-days had strong significant negative influence on the initiation as well as development of the disease. Where as morning RH was found to influence only disease initiation positively along with degree-days. The regression analysis suggested that a quadratic model best explains the relationship of degree days to disease development in all years when compared to other models like., Logistic, Linear, Richards and Gompertz. The developed model was validated during 2006 in three locations and it proved its efficiency and has  $\pm 6$  % variation in the predicted disease index.

**Key words :** Weather variables, Degree-days, *Erysiphe polygoni*, *Vigna mungo*

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**Seasonal abundance of sesbania thrips, *Caliothrips indicus* Bagnall in groundnut**

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### **ABSTRACT**

*Caliothrips indicus* Bagnall (Thysanoptera: Thripidae) commonly known as *sesbania thrips* is one of the serious pests of groundnut in Saurashtra region of Gujarat India causing extensive losses. Field studies were conducted for seven years (1999 to 2005) to study the influence of weather factors on the activity of *C. indicus* during different seasons such as summer, kharif and rabi. Multiple regression and correlation analyses were used to determine the most influential variables affecting population development. *C. indicus* population was present through out the year on groundnut and fluctuated from season to season. However, the intensity was greater during summer followed by rabi and kharif. Correlation studies between weather parameters and *C. indicus* population revealed that, maximum and minimum temperature showed significant positive correlation morning and evening relative humidity showed significant negative correlation during rabi. In summer, morning and evening relative humidity showed significant negative correlation. During kharif, only morning relative humidity showed significant negative correlation while the remaining parameters fail to show any significant correlation with the thrips population. The coefficient of determination ( $R^2$ ) between weather parameters and thrips population during rabi, summer and kharif seasons was found to be 11.97%, 9.05 % and 8.03 % respectively over seven years of study suggesting the importance of these parameters in influencing the abundance of *C. indicus*.

**Key words** : *Caliothrips indicus*, groundnut, seasonal abundance, *sesbania thrips*.

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### **Influence of agromet advisory services on economic impact of crops**

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### **ABSTARCT**

A study has been conducted between 2004-05 and 2006-07 at Bangalore rural district of Eastern dry zone of Karnataka to find out the economic impact of Agro met Advisories using weather forecast from NCMRNF. Two groups of farmers namely a group adopting the Agromet Advisories regularly in their operation and the other group of farmers not aware of Agromet Advisories were comparee. For this purpose about 80 farmers from four villages have been identified and Agromet Advisories have been issued only to forty farmers in two villages during *Kharif* and *rabi* seasons and care was taken to implement the advisories by this group. Expenditure incurred by the farmers from land preparation till the harvest at every stage has been worked out and crop growth and yields were monitored regularly in the farmer's field belonging to both the groups. Three years study indicated that the farmers who adopted the Agromet Advisories have realized grain yield of 2323 kg $ha^{-1}$  in Finger millet (ragi) and 1289 kg $ha^{-1}$  of redgram. The farmers who were not aware of Agro met advisories is grain yield of 2148 kg $ha^{-1}$  in finger millet and 1118 kg $ha^{-1}$  in red gram. Similarly it was observed that, in the case of field bean and tomato crops, the productivity of 2178 kg $ha^{-1}$  (pod yield) and 8837 kg $ha^{-1}$  (fruit yield) was realized by the farmers who adopted the Agromet Advisories and that on non-Agromet advisory farmers is 1951 kg $ha^{-1}$  and 8276 kg $ha^{-1}$  respectively. The farmers who have adopted the Agromet Advisories in their day to day operation have realized an average additional benefit of 31.45%, 24.65%, 16.20% and 20.56%, in Finger millet, Red gram, Field bean and Tomato respectively indicating the benefit of Agromet advisory.

**Key words:** Forecasting, Agromet advisories, Productivity,

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## **Capitalising on agro-advisory services for higher productivity in rainfed agro-ecosystem – A case study**

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### **ABSTRACT**

This paper draws on experiences with several participatory research activities carried out during 2005 and 2006 in the context of an Operational Research Project of All India Coordinated Research Project for Dryland areas carried out at the village Pathliyas situated in Mangarope watershed. Data about the climatic constraints, drought and use of agro-advisory services from 45 households were collected to identify key track indicators for measuring community progress. Yield gap analysis of different crops in the watershed region presented indicate that technology gap existing between the potential and demonstrable yields was not substantial. Thus, it was possible to replicate the results obtained in research experiments in on-farm situation. Technology index varied from 20 to 47 percent which gave evidence that there was scope for further improvement in the productivity. Adoption of contingency plan for mitigating aberrant weather situation reveal that adoption of different dryland technologies varied from 10 to 88 per cent. During 2006-07, there was 30 days early onset of monsoon so sowing of maize and groundnut was forbidden based on land topography. Village survey result indicate that out of total cropped area (100 ha), maize & groundnut crops were sown on 35 and 10% of area upto the second week of June. Only 5% area was sown with the recommended agro-advisory services. However, the success rate of such farmers was not more than 10 per cent. Thus, for higher sustainability, equality and stability of production, agro-advisory services must be a vital component of action research and more emphasis should be given to capitalize on them.

**Key words :** Agro-advisory, rainfed maize, yield gap, technology gap, impact assessment.

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## **Economic evaluation of weather based agro advisories in semi-arid region in India**

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## **Economic impact of agrometeorological advisory services over the central zone of Kerala**

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**ABSTRACT**

Weekly agrometeorological advisory bulletins based on medium range weather forecasting were effectively disseminated to assess the economic impact, involving 40 AAS farmers and 40 non-AAS farmers. The study comprises of four Panchayats viz., Panancherry and Madakkathara (AAS) and Puthur and Ollukkara (non-AAS). Crops covered were paddy, banana and coconut. The study was taken up from *rabi* 2003-04 to *rabi* 2006-07. The weekly agromet advisory bulletin contains information on past weather, weather forecast for 3-4 days ahead, state and stage of crops that are grown in the region and advisory to be followed on crop management and crop protection measures based on weather forecast. The results revealed that AAS farmers got 6.3 to 9 per cent and 7.3 and 19.2 per cent increase in yield in *kharif* and *rabi* paddy, respectively over non-AAS farmers. Rainfed banana farmers reaped 10.3 – 12.2 per cent increase in yield while *rabi* banana farmers 6.4 – 12.1 per cent when compared to non-AAS farmers. The increase in coconut yield varied from 7.3 to 8% in the case of AAS farmers during the following years. In the case of extreme weather events, AAS farmers could get advantage of agro-advisory bulletins while non-AAS farmers got less crop yields. As a whole, the percentage increase in yield varied from 6.3 to 19.2% depending upon the season and crop due to agromet advisory services based on weather forewarning. The benefit in terms of crop yield varied from 6.3 to 19.2%, 6.4-12.2% and 7.3-8% in rice, banana and coconut, respectively. Paddy appears to be relatively more sensitive to weather aberrations as the variability in percentage yield was much larger while stable in coconut. It was intermediary in the case of banana.

**Key words:** Agromet advisory service, medium range weather forecasting, crop yields in rice, banana and coconut

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**Economic impact of MRWF based agromet advisory services on farmer's field of humid sub-tropics of uttarakhand, India**

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**Weather based agromet advisory services and farm level economic efficiency**

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**ABSTRACT**

This paper try to see whether farms under Agro-advisory services have better economic efficiency in resource use, compared to their counter parts. The data for the paper is drawn from the project "Economic Impact Assessment of Agrometeorological Advisory Services on Different Crops". The Cobb Douglas functions were fitted taking output and income from rice crop during the Kharif and Rabi seasons as dependent variable and various input levels as the independent variables. The results showed that AAS exerts a significant positive influence on farm income in both the seasons. The resources like area under the crop, investment on plant protection and labour exerts

significant positive impact on farm income during Kharif season. In Rabi, apart from area, investments in farm yard manure and plant protection were found to have significant impact. AAS facilitates the management of labour and plant protection effectively through forewarning of pests and diseases as well as regulating the cultural operations based on weather forewarning. The results also suggested a reorganization of resources for realizing better allocative efficiency for reaping maximum profit. This suggests the inclusion of management suggestions on efficient input use level considering the farm specific physical efficiency and prices of inputs and output. Hence, AAS may be strengthened to include all aspects of farm management

***Key words*** : Agrometeorological advisory service, weather forewarning, economic efficiency, rice