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Use of weather and climate information for agricultural planning and decision making

K. J. COUGHLAN and A. K. S. HUDA

School of Natural Sciences, Hawkesbury Campus, University of Western Sydney, Locked Bag 1797, Penrith South DC, NSW 1797, Australia

ABSTRACT

Landholders have long used weather and climate information, based on experience and intuition, for planning and decision making on land or crop management. Over recent times, the availability of data bases of historical climatic information and the development of predictive tools ranging from correlation analysis to computer simulation models have made the climatic information useful to a much wider range of stakeholders. This paper provides an overview of the elements of the decision-making process, and how these elements affect the adoption of, and benefits arising from, the decision. We examine both the technical and social barriers to decision-making. Major technical issues are lack of availability of data and lack of appropriate predictive tools. At the farm scale, the major social issue in decision-making is risk aversion due to personality or capacity to take risk, particularly in the case of resource poor farmers. Large farmers with low risk aversion and significant capital assets can take high risks for high and infrequent returns. At societal and larger scales, social issues and political responses become far more important.

Elements in decision-making are illustrated *via* a number of Case Studies on the use of weather and climate predictions at different geographic scales (farm, region, national, and global) and time scales (days, months, years). The applications of short, medium and long-range forecasts at farm, regional and national levels is demonstrated drawing from our own research. These include applications of Seasonal Climate Forecasting (SCF) based on El Nino Southern Oscillation (ENSO) for irrigation, crop and pasture management as part of a project funded by the Australian Centre for International Agricultural research (ACIAR). Other Case Studies examine the development of systems for forecasting national crop yields, requirements for commodity imports, and crop insurance schemes.

The paper concludes by listing some initiatives that can improve the use of weather and climate data in agricultural planning and decision making in Developing Countries. These include improvements in the collection of meteorological data, development of locally applicable predictive tools, formation of groups and co-operatives that can make participative decisions to spread the risks associated with the decision-making, and greater involvement of Government to integrate the national research and application effort.

Key words: Climate risk, decision-making, agricultural planning

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Climate change and its effect on reference evapotranspiration and crop water requirement in Hebei Province, China during 1965-1999

CHUNQIANG LI^{1*}, BAOGUO LI² and KEQIN HONG¹

¹*Hebei Provincial Key Lab for Meteorology and Eco-Environment, Meteorological Institute of Hebei Province, Shijiazhuang, China, 050021*

²*College of Resource and Environment, China Agricultural University, Beijing, 100094*
E-mail: chunql@sohu.com

ABSTRACT

Long term changes of reference evapotranspiration (ET_o) and crop water requirement (CWR) can have a great effect on agricultural production, hydrological cycle as well as water resources management. The objective of this research is to analyse the effect of climate change and variability on reference evapotranspiration and crop water requirements. Based on the historical meteorological data Penman-Monteith equation and approaches recommended by FAO, reference evapotranspiration and crop water requirements which derived by ET_o times crop coefficients, were calculated, and change trends and causes were analyzed also for winter wheat and summer corn in Hebei Province, China during 1965-1999. The results showed that reference evapotranspiration and crop water requirement had decreased with time. The main reason for the decreasing of ET_o and crop water requirements was the reducing of wind speed and sunshine hours.

Key Words: Climate change, reference evapotranspiration, crop water requirement, change trend, Hebei Province

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Simulated effect of climate change on wheat production and nitrogen management at different sites in Germany

K.C. KERSEBAUM^{a*}, A.S. NAIN^b, C. NENDEL^a, M. GANDORFER^c and M.WEGEHENKEL^a

^a Leibniz-Centre for Agricultural Landscape Research, Inst. of Landscape Systems Analysis, Eberswalder Str. 84, 15374 Müncheberg, Germany; e-mail: ckersebaum@zalf.de

^b G.B.Pant University of Agriculture a. Technology, Dept. Agrometeorology, Pantnagar, India

^c Tech. University Munich, Inst. Agric. Economics a. Farm Management, Freising, Germany

ABSTRACT

The impact of projected climate change for winter wheat production is simulated for 9 sites across Germany using the dynamic agro-ecosystem model HERMES and downscaled climate change scenarios of the GCM ECHAM5 output for SRES emission scenario A1B until 2050. Yield reductions between 2 and 11% were estimated for 8 sites for the period 2031-2050. One site at higher altitude showed an increase in simulated grain yield compared to the reference period 1970-1989. Yield reduction was strongest on sandy sites and the dry eastern part of Germany. Nitrogen response curves were estimated simulating different fertilizer levels. Response curves were altered by climate change, but no unique trend across the sites was observed. Decreasing summer precipitation led to a reduced efficiency of nitrogen fertilizers.

Key words: Wheat, yield, crop model, climate change

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A first assessment of the impact of climate change on discharge and groundwater recharge in a catchment in Northeastern Germany

M. WEGEHENKEL and K.C. KERSEBAUM
Centre of Agricultural Landscape Research, ZALF e.V.
Institute of Landscape Systems Analysis
D-15374 Müncheberg/Germany
Eberswalder Strasse 84
Email: mwegehenkel@zalf.de

ABSTRACT

Future climate changes might have some impacts on the discharge regime regarding e.g. longer low flow periods due a decreased precipitation and higher evapotranspiration in summer months in many countries in Europe. An assessment of such impacts is required to derive adaptation strategies for future water resources management. For that purpose, in a case study, we applied a hydrological catchment model in the Ucker catchment with an area 2415 km² located in the Northeastern German lowlands for a first assessment of the impact of climate change on discharge regime using meteorological time series from 1951-2055. These time series were generated by the Potsdam Institute of Climate Impact Research based on the A1B-Scenario with an increase of 1.4 °C of the mean annual temperature in Europe. After model calibration, the comparison of simulated and observed daily discharge rates from 1989-2003 led to a Nash-Sutcliffe-Index NS = 0.63. The results of this simulation study indicated, that the amount of days with low flow conditions in the Ucker river will increase and groundwater recharge especially at forested areas will decrease in an order of magnitude of 44-94%.

Key words: Climate change, groundwater recharge, discharge, low flow, modeling

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Impacts of climate change on rice and ascertaining adaptation opportunities for Tamil Nadu

V. GEETHALAKSMI, S. KOKILAVANI, R. NAGARAJAN, C. BABU and S. POORNIMA

Agro Climate Research Centre, TNAU, Coimbatore

ABSTRACT

Info Crop model was used to evaluate the impact of climate change on crop productivity for baseline data and daily weather data created for 2020, 2050 and 2080. The CO₂ concentration used in the model for the base line, 2020, 2050 and 2080 runs were 376, 414, 522 and 682 ppm respectively as projected in the IPCC (2001) report. Simulated rice production indicated that generally rice production showed a declining phase in Tamil Nadu by 8.7, 23.6 and 42.2 per cent from the production level of the year 2000 in 2020, 2050 and 2080 respectively.

Key words: Climate change, infocrop model, rice, adaptation

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Climate change and cropping systems over Kerala in the Humid Tropics

G.S.L.H.V PRASADA RAO, H.S RAM MOHAN¹, C.S GOPAKUMAR¹ and K.N RISHNAKUMAR¹

Centre for Climate Change Research,

Kerala Agricultural University, Vellanikkara, Thrissur- 680656

kauagmet@yahoo.co.in

Department of Atmospheric Sciences, CUSAT, Cochin – 682016

ABSTRACT

There was a decline in southwest monsoon and annual rainfall since 1951 onwards at the rate of 5.2mm/year and 5.6 mm/year, respectively. The climate over Kerala also shifted from wetness to dryness within the humid climate (B₄ to B₃) during the study period from 1951 to 2007. There was a shift in cropping systems across the

State of Kerala as the index of foodgrain crops was declining while increasing the index of non-foodgrain crops. Unlike in seasonal crops, the effects of climate change on long term basis in terms of global warming may not be seen on crops like coconut, rubber and arecanut as they are grown under tolerable limits of surface air temperature. However, the occurrence of floods and droughts as evident in 2007 (floods due to excess monsoon rainfall by 41% against normal) and summer 2004 (drought due to no significant rainfall from November, 2003 to April 2004), is likely to increase in ensuing decades as projected and crop losses are expected. The unusual summer rains in 2008 devastated the paddy crop in Kuttanad and Kole lands of Thrissur. In contrast, it was beneficial to crops like cardamom, coconut and arecanut. The thermosensitive crops like cocoa, black pepper, coffee, cardamom and tea may need attention as temperature range is likely to increase and rainfall is likely to decline in addition to deforestation as these crops are grown under the influence of typical forest -agro-ecosystems. Deforestation, shift in cropping systems, decline in wetlands and depletion of surface and groundwater resources may aggravate the ill effects of floods and droughts on all the crops. Hence, there is an urgent need for pro-active measures on short-term and long- term basis against the climate change risks for sustenance of crop production both in terms of quantity and quality.

Key words: Climate change, climate projection, change in cropping systems, thermosensitive crops, food security

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Impact assessment of climate change on maize cultivars in middle Gujarat agro-climatic region using CERES-maize model

H.R.PATEL, V.J.PATEL and VYAS PANDEY

*Department of Agricultural Meteorology, B. A. College of Agriculture
Anand Agricultural University, Anand- 388 110 (Guj., India)*

ABSTRACT

The CERES-maize model was evaluated to simulate the maize seed yield due to changes in environmental factors such as daily air temperatures, solar radiation and carbon dioxide concentration individually as well as in combination. Results showed that higher maximum temperature in the range of 1 and 2 ° C did not show any significant effect on seed yield of both the cultivars. Significant yield reduction was noted at 3.0 ° C increase of maximum temperature, this is because of reduce crop duration, while in case of -2.0 and -3.0 °C decrease of maximum temperature there was significant yield increment in the range of 5.3, 3 and 6.9, 4.9 % as compared to their base yield for cv. Ganga Safed-2 and GM-3 respectively. Yield increment magnitude was found higher in cv. Ganga Safed-2 as compared to cv. GM-3. The gradual increase of minimum temperature showed gradual yield reduction for cv. Ganga Safed-2, while cv. GM-3 did not show any specific trend. Gradual increase of daily solar radiation showed yield increase of (8.2, 3.2, and 5.1 %) at 1 to 3 MJm²day⁻¹ respectively for cv. Ganga Safed-2. Similar trend was observed for cv. GM-3. In case of gradual decrease of solar radiation (-1 to -3 MJm² day⁻¹) totally reverse trend was observed. Increased CO₂ concentration in the level of 440, 550 and 660 ppm showed gradual yield increase with similar magnitude under both the cultivars. Nearly 9 % yield increment was observed at 660 ppm CO₂ concentration for both the cultivars.

Key words: Climate change, maize yield, DSSAT 3.5

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Climate and its variability over the Western Himalaya

N.S. MURTY, SHACHI SHAH and R.K. SINGH
G.B. Pant University of Agriculture & Technology, Pantnagar

ABSTRACT

The moving averages for 3-year, 5-year and 10-year interval for minimum and maximum temperatures of Ranichauri were calculated during 1982-2002,. Results revealed a decreasing trend in all the three cases. The 5 year and 10 year moving averages were closely followed the trend line. The seasonal analysis indicated that the minimum temperature had an increasing trend during summer, winter and post rainy seasons while a sharp decline was observed during rainy season. The temperature variations were more in rainy season and less in post rainy season. The maximum temperature trend was found to be negative which is 0.13°C/year. The moving averages also indicated decreases in maximum temperature.

Key words : Climate, temperature trend, Himalaya

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Rainfall variability in coastal region of Karaikal in relation to crop planning

R. KARTHIKEYAN, AL. NARAYANAN AND V. CHELLAMUTHU

*Department of Agronomy
Pandit Jawaharlal Nehru College of Agriculture and Research Institute
Karaikal – 609 603 (Puducherry U.T), India.*

ABSTRACT

The historical rainfall data of 30 years (1976 to 2005) of Karaikal (Puducherry U.T) were used to analyse monthly, seasonal and annual variability of rainfall. The average annual rainfall of the region was 1412 mm and was more or less stable over the years. The inter year probability revealed that the chances of receiving rainfall in normal range (1144 mm to 1681 mm) were 54 per cent and the chances of aberrant rainfall were 46 per cent. In case of seasonal rainfall, the percent contribution to the total rainfall was 76, 18 and 6 per cent for *Rabi*, *Kharif* and summer seasons, respectively with the lowest CV in *Rabi* (27.5%) followed by *Kharif* (47.5%) and summer (95.6%) seasons. The rainfall receipt during *Rabi* season indicated that a successful rice crop (whose average water requirement is 1240 mm) could be cultivated during *Rabi* season without any supplemental irrigation.

Keywords: Rainfall analysis, cropping pattern.

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Variability in rainfall and temperature regimes of the Brahmaputra Valley of Assam

R. L. DEKA, K. K. NATH and R. HUSSAIN

*Department of Agrometeorology
Assam Agricultural University
Jorhat-785013, Assam, INDIA*

ABSTRACT

Data from seven stations of the Brahmaputra Valley of Assam were analysed for evaluation of variability in rainfall and temperature regimes. Long term data on annual and seasonal rainfall, annual maximum, minimum and average temperatures of these stations were included in the analysis. The analysis showed that except Dibrugarh, Nagaon and Dhubri, total annual rainfall is on the declining trend in all the stations. Mann-Kendall rank statistics revealed that this decreasing trend rate in the annual rainfall at Jorhat is significant at 5 per cent level. The annual maximum, minimum and mean temperatures showed an increasing trend at Dibrugarh, Lakhimpur, Jorhat and Guwahati and a decreasing trend at Tezpur and Nagaon. The increasing trend of temperatures was found to be significant at Dibrugarh, Lakhimpur and Guwahati.

Key words: Rainfall, temperature, Mann-Kendall rank statistics, variability, Assam

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Irrigation scheduling for summer groundnut considering agrometeorological parameters and dual crop coefficient approach

F. P. PAREKH and D. T. SHETE

*Water Resources Engineering and Management Institute
Faculty of Technology and Engineering, The Maharaja Sayajirao University of Baroda,
Samiala-391410. Gujarat, India*

E mail: fpparekh@gmail.com, dtshete@yahoo.com

ABSTRACT

Crop water requirement depends on agro meteorological parameters which are to be analyzed at micro-regional level for better planning of agriculture. This research work aims to achieve daily water balance of the crop and to prepare irrigation scheduling as per daily crop water requirement of the crop. Reference crop evapotranspiration was calculated using meteorological data and daily crop water requirement was calculated considering dual crop coefficient approach. Crop coefficient varies at various growth stages of the crop and also as per climatic condition of the area. Irrigation scheduling is prepared to avoid soil water stress. Total available water (TAW) and Readily Available Water (RAW) were computed on daily basis. A computer program prepared in EXCEL was used to carryout irrigation scheduling.

Key words: Irrigation scheduling, dual crop coefficient, evapotranspiration, daily water balance, TAW, RAW

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Irrigation water requirement and production potentials of major crops over Narmada canal command area in Gujarat

V. PANDEY, V. J. PATEL, R. P. VADODARIA, H. R. PATEL and A. M. SHEKH

*Department of Agricultural Meteorology
Anand Agricultural University, Anand 388 110*

ABSTRACT

Field experiments were conducted at Agronomy farm, Anand during 2004 to 2006 to generate crop specific data for different crops required for testing and validating the various crop models incorporated under DSSAT 3.5. The crops selected were maize (GM-3 and Ganga Safed-2), chickpea (Dahod Yellow), wheat (GW-496), and pearl millet (MH-179). The validated models were used to simulate the yield components of these crop cultivars over 11 locations spread across the Narmada

canal command area using mean weather condition and soil characteristics of those stations. The maize (GM-3) yield varied between 3519 to 4717 kg ha⁻¹ while that of cultivar Ganga Safed -2 varied between 3595 to 4825 kg ha⁻¹ across the locations. The chickpea yield was found to vary between 1100 to 1800 kg ha⁻¹. The potential yield of wheat was highest (5807 kg ha⁻¹) at Vijapur. The functional relationship developed between water use and yield of crops revealed that the linear relationship had given higher R² values in comparison to all others tried (curvilinear, logarithmic, or exponential).

Key words: DSSAT 3.5, crop models, potential yield, Narmada, water production function

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Effect of date of planting on performance and water use pattern of potato in new alluvial zone of West Bengal

ASIS MUKHERJEE¹, SAON BANERJEE, S.A.KHAN and G .SAHA

Department Agricultural Meteorology

Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, 741252. INDIA

¹*Email ID : aas_kalyani@yahoo.com*

ABSTRACT

To evaluate the overall performance and water use pattern of potato, a field experiment was conducted during the winter season of 2006 considering five dates of planting as treatments. Irrigations with 3cm depth were given at an interval of fifteen days. Soil water content were measured thermo-gravimetrically. Result revealed that date of planting showed significant influence on total tuber yield among different treatments. The highest tuber yield (38.6 t ha⁻¹) was recorded under D₃, which was declined by 27.2 percent under D₁ treatment producing lowest yield. The highest (247.5mm) and lowest (192.9mm) seasonal ET values were noted respectively under D₃ and D₅ treatment. The magnitude of water use efficiency (WUE) value was at its highest tune (82.5 kg m⁻³) under D₃ treatment and the same was at its lowest magnitude (11.4 kg m⁻³) under D₁ treatment.

Key words: Potato, yield and water use efficiency

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Rainfall effectiveness for different crops in canal command areas

B. KRISHNA RAO and T.B.S RAJPUT²

1 Central Tobacco Research Institute, Rajahmundry-533105

E-mail; b_krishnarao@rediffmail.com

2 Water Technology Centre, IARI, New Delhi-110012.

ABSTRACT

Rainfall effectiveness for different crops growing in the command area of Guvvalagudem major distributary of the Nagarjunasagar Left Canal, Andhra Pradesh were estimated by using USDA-SCS method. The effective rainfall during crop period for the crops viz. paddy, maize, sunflower during *kharif* season were found to be 451, 344, 308 mm and during rabi season as, 40, 67, 85 mm respectively. The effective rainfall for cotton and chillies were 290 and 146 mm respectively. Results of the study revealed that in canal command areas, among all the crops paddy crop had the highest percent of rainfall effectiveness, on average effectiveness being 74 per cent in the *Kharif* and 80 per cent in *rabi* season.

Key word : Effective rainfall, water requirement, USDA-SCS

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Estimation of water requirement of cotton and tur grown in the command area of Waghodia Branch of Deo irrigation Project, Gujarat

M. R. KHATRI and T. M. V. SURYANARAYANA

*Water Resources Engineering and Management Institute(WREMI),
Faculty of Tech. & Engg., The Maharaja Sayajirao University of Baroda, Samiala – 391 410
e-mail : wremimsu@gmail.com, tmvkiran@yahoo.com, dtshete@yahoo.com*

ABSTRACT

The study is carried out for Waghodia Branch of Deo Irrigation Project for the year 1997-1998. The gross command area and culturable command area are 11,017 ha. and 7,207 ha. respectively. The objective of present study was to estimate the crop water requirement for cotton and tur crops grown in command area. Water requirement for each crop was calculated on the basis of weekly evapotranspiration, i.e. period: I, II, III and IV week. The water requirement of cotton was found out to be 60.20 mm, 123.98 mm, 82.81 mm and 15.33 mm in the months of September, October, November and December respectively. Similarly, the water requirement of tur was found out to be 51.74 mm, 31.68 mm in the months of September, October respectively.

Key words : Crop period, crop calendar, effective rainfall, crop water requirement.

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Optimization of water allocation for minors 11 and 12 of Waghodia Branch of Deo Irrigation Project, Gujarat - II: General strategy

T. M. V. SURYANARAYANA, M. R. KHATRI and D. T. SHETE

*Water Resources Engineering and Management Institute(WREMI),
Faculty of Tech. & Engg., The Maharaja Sayajirao University of Baroda, Samiala – 391 410
dtshete@yahoo.com*

ABSTRACT

The study was aimed at evaluation of ground water conditions demand and availability of surface water, economic analysis and strategic development of conjunctive utilization. The study was carried out for general strategy, i.e. using unit cost of surface and ground water strategy. A mathematical model consisting of linear objective function and various linear constraints was developed. The objective function was subjected to various linear constraints. The sensitivity analysis was also carried out by 6 different ways. The computer program MATLAB (MATrix LABoratory) was used to determine optimal cropping pattern and release policy. Maximum possible designed irrigation intensity of 110% for minor 11 and 170% for minor 12 could be achieved. The highest optimal area, surface water releases, ground water lifted and the highest net benefits were 428.74 ha., 30.06 ha. m, 18.21 ha. m and Rs. 13,49,300 respectively could be obtained for minor 12.

Key Words: Optimal cropping pattern, optimal release policy, unit cost of surface water and ground water.

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Upper air circulations associated with two extreme epochs in the Indian summer monsoon rainfall

C.V. NAIDU, S.S.V.S. RAMAKRISHNA, B. R. SRINIVASA RAO and S.V.V. ARUN KUMAR

*Department of Meteorology and Oceanography, Andhra University
Visakhapatnam, India*

ABSTRACT

The all-India summer monsoon rainfall during 1871-2005 is smoothed using 11-year running average technique. It reveals systematic epochal changes. The epochs of good and poor monsoons occurred around 1958 and 1969. The upper air mean and anomaly circulations associated with these extremes are examined.

Key words: Summer monsoon rainfall, upper air circulations, trend

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Validation of astro-meteorological rainfall forecast for Gujarat

M.C. VARSHNEYA, V.B. VAIDYA, VYAS PANDEY, A.M. SHEKH and B.I. KARANDE

Anand Agricultural University, Anand – 388 110, Gujarat

ABSTRACT

Nakshatra –charan wise rainfall prediction based on astro-meteorological techniques for eight stations representing each agroclimatic zone of Gujarat was made in 2005. This technique was further extended to predict daily rainfall in year 2006 wherein qualitative rainfall predictions were made as no rainfall, low rainfall, medium rainfall and heavy rainfall. The rainfall prediction on daily basis was further extended to district levels in the year 2007. Qualitative rainfall was converted to quantitative values using low rainfall projection technique. These predicted rainfall were validated with actual rainfall recorded. The results revealed that the accuracy of forecast varied between 42 to 73% for various zones during 2005, 42 to 74% for various zones during 2006 and during 2007 accuracy of forecast varied between 59 to 73% for various regions with average accuracy of 66% for Gujarat state.

Keywords: Astrometeorological forecast, monsoon research almanac, validation skill score, rainfall projection.

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Forecasting of tropical cyclone using QLM model over the Arabian Sea- A case study

P. SUNEETHA¹, Y. V. RAMARAO² and O.S.R.U. BHANU KUMAR¹

Department of Meteorology & Oceanography, Andhra University, Visakhapatnam - 530 003.

N.H.A.C. Indian Meteorological Department, Mausam Bhawan, Lodhi Road, New Delhi.

ABSTRACT

The main aim of this study is to predict the central pressure, vorticity, winds, around the eye of tropical cyclone and its track during 5-10 May 2004 over the

Arabian Sea using Quasi lagrangian model (QLM). The main synoptic feature of it is that it caused exceptionally heavy rainfall of 117cm at Aminidivi (11.1°N/72.7°E) during the 24 hr period ending 0300UTC of 6 May. The QLM model has predicted a mean sea level pressure of 994 hPa and vorticity near the center based on the initial conditions of 6 May/00UTC and wind at 850hPa brings out a well developed cyclonic circulation with wind speeds of 40-50 knots. The model forecast indicates that the predicted storm track is very close to the observed track; it has produced the initial structure of the storm and maintained the intensity of the system. Next, forecast verification has been carried out for the geographical distance between the predicted location of the storm and the verifying position at valid hour. The QLM results highlight that the mean error of 24hrs forecast is about 146km, which increases to about 248km for 48hr forecast and 172km for 72hr forecast. Finally simulated central pressure, vorticity and winds are validated with the datasets of India Meteorological Department and satellite products and the results are promising.

Keywords : Tropical cyclone, QLM model, Arabian sea

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Prediction of heavy rainfall situations in India during 2007

JAGVIR SINGH, R.G.ASHRIT, JOHN P. GEORGE, R.SINGH and V.K.JAIN*

National Centre For Medium Range Weather Forecasting (NCMRWF)

A-50, Sector-62, Noida-201307

** School of Environmental Sciences, Jawahar Lal Nehru University*

(email for any correspondence: jvsingh@ncmrwf.gov.in)

ABSTRACT

The NCMRWF T80 and T254 model products have been used in studying the five weather systems which caused very heavy rains over different parts of country during June-September2007. This study shows that both the models are able to predict all these five systems reasonably. Whether analyses have shown all the systems, predictions up to 2 days have been reasonable, thereafter predictability decreases sharply. For the same systems, T254 model have shown reasonable predictably even up to day-4. But, models have shown higher skill for excess rainfall in day to day and weekly cumulative predictions at meteorological sub-divisional scales. In view of present increasing rate of population, India will require approximately 300 million tonnes of food grains, each effort needs to be made towards minimizing the losses to agriculture. There is good potential of making the use of weather prediction in respect of agricultural and civic life towards administrating the flood and drought like situations which emerge out of heavy rainfall.

Keywords: Low pressure area, well marked low, depression, deep depression, cyclonic storm, heavy rainfall

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Some aspects of heavy rainfall activities associated with duration and intensity of floods over NE India

SUNIT DAS and R P SAMUI

Regional Meteorological Centre

LGBI Airport, Guwahati

ABSTRACT

Ten years daily rainfall data of 23 well distributed stations over NE India have been used to study the heavy rainfall (HRF) activities over the region. The study reveals that spatial distribution of HRF is not homogeneous over the region rather it is confined to certain areas like plains of west Assam, NE Assam and adjoining Arunachal Pradesh and Barak Valley and southern parts of Meghalaya. The contribution of HRF to the mean annual rainfall over these areas is more than 35%. The frequency of HRF is the highest in the month of June.

Key words: Crop production, heavy rainfall, synoptic situations, *kharif* rice.

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Regional scale evapotranspiration from MODIS AQUA and NOAA AVHRR : validation over Indian agroecosystems

***B.K. BHATTACHARYA¹, K. MALLICK¹, V.U.M. RAO², D. RAJI REDDY³, S. BANERJEE⁴, H. VENKATESH⁵, V. PANDEY⁶, G. KAR⁷, J. MUKHERJEE⁸, S.P. VYAS¹ and N.K. PATEL¹**

¹*Agriculture-Forestry and Environment Group, Space Applications Centre (ISRO), Ahmedabad 380015, India*

²*Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad 500 057, India*

³*Agromet-cell, Agricultural Research Institute, ANGRAU, Hyderabad 500 030, India*

⁴*Deptt. of Agril. Meteorology, Bidhan Chandra Krishi Viswa Vidyalaya, Kalyani, Nadia 741235, India*

⁵*Regional Agricultural Research Station, Bijapur 586101, India*

⁶*Deptt. of Agril. Meteorology, Anand Agricultural University, Anand 388 110, India*

⁷*Water Technology Centre for Eastern Region, Bhubaneswar, India*

⁸*Deptt. of Agronomy and Agril. Meteorology, Punjab Agricultural University, Ludhiana 141004, India*

ABSTRACT

A study was carried out to estimate clear sky evapotranspiration (ET) in a single source surface energy balance framework using noontime observations from MODIS (Moderate Resolution Imaging Spectroradiometer) AQUA and NOAA AVHRR over Indian subcontinent. Two key evapotranspiration components, net available energy and evaporative fraction, were derived solely from satellite optical and thermal band data without any ground data support. Validation of latent heat flux / ET estimates were carried out using intensive ground based observations in six energy-water balance (EWB) regions representing homogeneous agriculture landscapes and five micrometeorological tower observations including one eddy correlation system in LASPEX (Land Surface Processes Experiment) region representing heterogeneous agriculture landscapes, spread over different agroclimatic regions in India. Two approaches were used to estimate evaporative fraction. LST-albedo 2D model by Roerink-Su- Menenti (EFRSM) was found to produce better realistic ET / latent heat flux estimates under all growing conditions than NDVI-LST based model by Jiang-Islam (EFJI). The latter one only performed better during continuous dry down period. The root mean square error (RMSE) of daytime latent flux estimates, computed using net available energy and EFRSM, were 23 Wm⁻², 29 Wm⁻² producing 'r' 0.96 and 0.87, with pooled datasets from EWB (n=135) and LASPEX (n=113), respectively. Errors were comparable with existing global ET algorithms.

Key Words : Regional ET, LASPAX, MODIS AQUA AVHRR

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Influence of weather parameters on growth and yield of Amaranth in Uttarakhand region

N.S.MURTY, R.K.SINGH and SUMANA ROY

G.B.U.A.T., Hill Campus, Ranichauri, Uttarakhand

ABSTRACT

The performance of Amaranth crop in hill zone of Uttarakhand was studied in three *kharif* seasons of 2004, 2005 and 2006 with three dates of sowing and two varieties viz. Annapurna and local variety. The study revealed that the growing degree days (GDD) at maturity decreased as the sowings were delayed. The accumulated GDD varied from 941.2 to 1200.4 with different dates of sowing at maturity. The total dry matter was highest with first date of sowing. A correlation between total dry matter and growing degree days during different growth stages was found to be significant. Significant yield reduction was recorded with delayed sowing. The reduction was 32 per cent in case of second date of sowing and 42 per cent with third date of sowing in comparison to first date of sowing. Results revealed that Amaranth can be a potential crop, if sown during first fortnight of June, for delayed sowing the local variety may be preferred.

Key words: Amaranth, hill region, weather, growing degree days, yield

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Thermal indices in relation to crop phenology and seed yield of soybean (*Glycine max* L. Merrill)

PRASANTA NEOG, J. BHUYAN¹ and N. BARUAH

Department of Agrometeorology,

¹AICRP on Soybean

BN College of Agriculture, Biswanath Chariali-784176, Sonitpur, Assam

ABSTRACT

Field experiments were conducted on sandy loam soil of farm area of BN College of Agriculture, AAU, Assam with five varieties of soybean for two *kharif* seasons (2005 and 2006). It was observed that in the first crop season all the varieties matured within 107 to 122 days, while in the second crop season crop matured within 96 to 116 days, thus the crop took 3 to 14 days more to mature in first crop season. The mean GDD accumulation from sowing to maturity ranged from 1760.9 to 2213.1^oD. The varieties, RAUS 5 and SL 742 consumed the lowest and highest GDD for attaining physiological maturity in different sowing dates among all varieties. The phenothermal Index (PTI) in all the varieties and seasons varied from 17.74 to 19.46 ^oD/day and 17.44 to 18.47 ^oD/day in vegetative and reproductive stage respectively.

Key words: Soybean, GDD, PTI and HUE

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Estimation of wheat yield gap in Anand and Panchmahal districts using CERES-wheat model

V.J.PATEL, H.R.PATEL and VYAS PANDEY

*Dept. of Agricultural Meteorology, B. A. College of Agriculture
Anand Agricultural University, Anand- 388 110 (Gujarat)*

ABSTRACT

CERES-Wheat (ver. 3.5) model was evaluated for Anand and Panchmahal district of Gujarat State (India) for wheat (cv. GW-496) in order to estimate yield gap. The CERES-wheat model was validated for both the locations. Ten years (1995-2004) district yield data reported by Govt. of Gujarat, Bureau of Statistics & Economics were collected for two districts viz., Anand and Panchmahals. For the corresponding period daily weather data of Anand (Lat. 22° 35', Longi. 72° 55') and Godhra (Lat. 22° 45', Longi. 73° 40') stations were collected from Agricultural Research station of Anand Agricultural University. The results revealed that wheat yield of Anand district showed increasing trend while reverse for the Panchmahal district. The trend of potential yield was found decreasing with the rate of change of 74 kg ha⁻¹yr⁻¹ in Anand. Similar trend was found at Panchmahal district with the rate of change of 36 kgha⁻¹yr⁻¹. The attainable yield was estimated by imposing the management constraint of delayed sowing of 20 days from the optimum time (15th Nov.) of sowing. In both the districts this constraints significantly decreased the wheat yield. This was mainly due to spilling over the days to anthesis phase from January to February with relatively higher average temperature and subsequently shortening the duration of the wheat crop. Under delayed sowing, the result showed that every one day delayed sowing decrease wheat yield to the tune of 33.6 and 35.1 kgha⁻¹day⁻¹ at Anand and Panchmahal districts, respectively. Thus, it can be concluded from the findings that DSSAT crop simulation model proved to be an effective tool for efficient resource management. Estimation of yield gap based on past crop data and subsequent adjustment of appropriate sowing window definitely provides possibilities for obtaining potential yield.

Key words : CERES-wheat, yield gap, potential yield

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Prediction of wheat growth and yield using WOFOST model

CHANDER SHEKHAR, DIWAN SINGH, RAJ SINGH and VUM RAO*

*Department of Agricultural Meteorology
CCS Haryana Agricultural University, Hisar-125 004
* PC Unit, AICRPAM, CRIDA, Hyderabad- 500 059*

ABSTRACT

In present study, the predictive performance of WOFOST model for wheat crop has been investigated and tested by comparing the model generated output with the field observed output recorded for three consecutive crop seasons (2004-05, 2005-06 and 2006-07) at Hisar. The wheat grain and straw yield simulated by model had deviations of around 11 and 33 per cent, respectively. On an average the model overestimated grain yield by 57 kg ha⁻¹ and underestimated straw yield by 771 kg ha⁻¹. The predicted values of the maximum LAI attained by crop was quite close to the observed ones and the deviation was within 4.5 per cent

Key words: WOFOST, wheat yield and growth, performance indices

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Agroclimatic models for prediction of yield and yield components of boro rice in West Bengal

G. C. MAITY and S. A. KHAN

*Department of Agricultural Meteorology and Physics
Bidhan Chandra Krishi Viswavidyalaya, Kalyani-741235, West Bengal.*

Email: sakhan_bckv@sify.com

ABSTRACT

Field experiment was conducted during two consecutive years with two varieties viz. 'Kshitish' and 'IR-36' and four dates of transplanting of boro (summer) rice. Productivity and yield components of crops transplanted during first fortnight of January were more than those transplanted in the second fortnight due to higher accumulated day temperature and sun shine hours and hence the first fortnight of January appears to be the optimum time for transplanting of boro rice in the New Alluvium Zone of West Bengal. Multiple regression models for prediction of panicles m^{-2} , filled grains, test weight and grain yield of two varieties of boro rice have been developed. The R^2 of the multiple regression models for yield prediction were 0.91 in Kshitish and 0.98 in IR-36.

Key words: Boro rice, grain yield, panicles, filled grain, test weight, regression model

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Analysis on seasonal rainfall behaviour and its influence on the productivity of coconut

A. GURUSAMY, C. NATARAJAN, R. VAITHILINGAM and S. ARULRAJ*

*Coconut Research Station, Tamil Nadu Agricultural University, Veppankulam-614 906
AICRP (Palms), CPCRI, Kasaragod.*

ABSTRACT

The objective of this study is to assess the mean annual and seasonal rainfall behaviour and also to identify the influence of weather parameters on the coconut productivity. South west monsoon and winter rainfall seasons had negative correlation with coconut productivity, where as summer and NEM rainfall had positive correlations with coconut productivity. The percentage of barren nut production in coconut had positive correlation with summer rainfall and negative correlation with winter, south west and north east monsoons. The weather variables namely maximum temperature, minimum temperature, relative humidity, pan evaporation and rainfall had positive correlation with coconut productivity. But there was no significant influence on the productivity of the plams.

Keywords : Rainfall behaviour, coconut, weather parameters.

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Crop weather relationship in rabi sorghum

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

Zonal Agricultural Research Station, MPKV, Solapur-413 003 (MS).

ABSTRACT

An experiment was conducted for five years on sorghum by using four different sowing windows to study the relationship between weather parameters and yield in rabi season. Rabi sorghum sown at MW 39 (24-30 Sept.) produced maximum grain yield (850 kg ha^{-1}), fodder yield (29.06 q ha^{-1}) and total monetary returns (Rs.13781 ha^{-1}). However, the crop sown at MW 40 was also produced the on par yields with crop sown at MW 39 and of high degree of sustainability. Weather parameter had showed significant positive association with grain yield. The stepwise multiple regression

were obtained for different phenophase wise weather parameters with yield of rabi sorghum which explained 78% variation in the yield.

Key words: Rabi sorghum, weather parameter, correlation, stepwise regression

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Wheat yield prediction in semi-arid region using moderate resolution satellite optical and thermal infrared data

K.K. DAKHORE¹, B.K. BHATTACHARYA², K. MALLICK², R. NIGAM², N.K. PATEL², V. PANDEY¹ and A.M. SHEKH¹

¹*Deptt. of Agril. Meteorology, Anand Agricultural University, Anand 388 110*

²*Agriculture-Forestry and Environment Group, Space Applications Centre (ISRO), Ahmedabad 380 015*

ABSTRACT

Regional wheat yield was predicted using water use efficiency (WUE) and radiation use efficiency (RUE). District wise wheat WUE were generated from historical consumptive water use and reported yield. A single source energy balance algorithm was used to estimate actual evapotranspiration (AET) from MODIS (MODerate resolution Imaging Spectroradiometer) AQUA seven band reflectances and land surface temperature (LST). Time series AET from historical (2002-2003, 2003-2004) MODIS eight day composites and district wise crop calendar were used to generate wheat consumptive water use. In second approach, wheat yield was determined from the product of total net primary productivity (NPP) accumulated during wheat growth period and harvest index (HI). NPP was estimated on spatial (1km) and temporal (8 day) domain by using LAI derived fAPAR and maximum radiation use efficiency (RUE_{max}) of crop following CASA (Carinege Ames Stanford Approach). Temperature scalars estimated from MODIS AQUA day-night LST and water scalar computed from LST-albedo based evaporative fraction were used to constrain RUE_{max} .

Energy balance estimates derived from MODIS AQUA were validated with *insitu* attended and unattended observations for two wheat seasons, 2005 - 06 and 2006 - 07, within a 5 km x 5 km 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^{-2} ($r = 0.72$) and 26 Wm^{-2} ($r = 0.8$), 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. The predicted district wheat yield for 2004-05 from WUE approach was found to produce RMSE 479 $kg ha^{-1}$ (18.5%) ($r = 0.89$) respectively. The error was almost similar in productivity based approach (RMSE = 471 $kg ha^{-1}$, $r = 0.75$). But latter does not require any pre-calibration with historical datasets.

Key words : Yield prediction, wheat, semi-arid, ET, MODIS

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Influence of temperature and relative humidity on quality constituents of dried chilli cultivars in storage

K. UMA JYOTHI, S. SURYA KUMARI, P. VENKATA REDDY and C. RAVI SHANKAR

Regional Agricultural Research Station, Lam, Guntur-522034

ABSTRACT

Chilli (*Capsicum annum* L) including paprika is valued for its colouring matter, oleoresins and pungent principles. Traditionally in South India after harvest, the fruits are sun dried to a moisture content of less than 11 % and stored in gunny bags for marketing.. Storage of chilli in cold store is extensively followed around Guntur as the produce fetches premium price due to excellent colour retention. In view of the facts mentioned above, an investigation was undertaken to evaluate the impact of temperature and relative humidity on quality constituents of dried chilli cultivars in storage under cold store and ambient conditions was conducted at the Chillies Improvement Project, Regional Agricultural Research Station, Lam, Guntur and in the Priyanka Cold Store, Chilakaluripet Road, Guntur during the year 2001-2002. The fresh ripe chilli cultivars viz: LCA 334, LCA 357, LCA 206, LCA 235, Paprika type, Guntur Grand and Wonder Hot were collected and sun dried till the moisture came down to 11%. Later the dried chilli was packed in gunny bags in two sets. One set was kept in cold store and the other set at ambient condition. The results showed significant differences among the cultivars for all bio-chemical quality parameters viz., oleoresin, Capsanthin and capsaicin. After drying, the initial bio-chemical analysis revealed that the cultivar LCA 235 for oleoresin, Wonder Hot for Capsanthin and LCA 334 for capsaicin were found to be promising. Irrespective of storage condition, all the cultivars showed a declining trend in storage for all the biochemical parameters studied. The storage of dried chilli under cold store proved better in retention of biochemical parameters than the ambient condition. On storage, the chilli cultivars LCA 206 for oleoresin, LCA 235 for capsaicin and LCA 357 for Capsanthin were found to be promising in retention of quality.

Keywords: Oleoresin, capsanthin ,capsaicin, ambient, cold store, chilli

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Influence of storage temperature and relative humidity with post harvest chemical treatments on germination and vigour index of Chilli CvLCA-334

K. UMAJYOTHI S. SURYA KUMARI, P. VENKATA REDDY and C. RAVI SHANKAR

Regional Agricultural Research Station, Lam, Guntur-522034

ABSTRACT

An experiment "Effect of storage condition and post harvest chemical treatments on germination and vigour index of chilli cultivar LCA 334" over a period of 9 months from April 2001 to December 2001 was conducted at Guntur and in Cold Store, Guntur .The germination percentage initially from the seeds of the chilli treated with sodium chloride 1% and sodium hypo chlorite 1%, sodium carbonate 2%, calcium chloride 2%, ascorbic acid 0.5% and water dip were found to be maximum ranging from 95 to 99 % However, the germination percentage of seeds from the chilli treated with chemicals and stored showed a gradual declining trend during storage after the end of study. There was a maximum loss of germination (55.13%) in case of seeds obtained from the chilli that was treated earlier with sodium chloride 2%. It is interesting to note in the present study that the chilli treated with sodium chloride 2% but kept in cold store extended the viability up to the end of the storage period i.e., 9 months. It recorded 70 % germination only with a loss of 9.09 % of seed germination. It explains, irrespective of chemical treatment, if stored in cold store, the inhibitory effect of the salt can be prevented. Probably the lower temperature in cold store might have checked the osmotic effect and toxic effect of sodium chloride in storage. .The vigour index was found to be more in cold store not only of one month after storage but also after 9 months after storage. The cold store chilli has given seed of vigour index of 323.03 with a loss of 25.85 % Among the interactions of chemical treatments and storage conditions on vigour index, water dip and absolute control showed relatively greater vigour index over other chemical treatments. Even after 9 months after storage, the vigour index was lost only by 17.9 and 19.05 % respectively which are more or less

comparable with other interaction treatments. However, the seeds after treating with chemicals or water or without water treatment but kept in cold store proved better compared to ambient temperature

Keywords: Temperature, relative humidity, germination, vigour index, ambient, cold store and chilli

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Validation of growth subroutine of CERES – Sorghum model for *kharif* sorghum

M.G. JADHAV, M.C. VARSHNEYA, S.S. SALUNKE and P.V. THANEDAR

Department of Agricultural Meteorology, MPKV, CASAM, Agril. College, Pune-5

ABSTRACT

The present study was planned and conducted by using data from the experiment carried out at Deptt. of Agril. Meteorology, Center of Advanced Studies in Agricultural Meteorology (CASAM), College of Agriculture, Pune during the monsoon season of 1997-98. The experiment was laid out in randomized block design with five replications. The treatments employed were four sowing dates, in monsoon season with one genotype (CSH – 9). The soil type of the experimental field was clayey. Sowing of sorghum was done on 11th July (S₁), 29 July (S₂), 5th Aug (S₃) & 12th Aug (S₄). The model predicted grain yield fairly well (error 17.86 %), while predicted yield attributes viz. GPSM (error 0.02%), GPP (error 8.2%) and kernel weight (error 4.1%) very correctly. However under predicted LAI (1.27/ 3.81, 0.82/2.67, 1.08/ 3.60, 1.17/ 3.27) in all four treatments. Biomass (error 30.5%) and stover yield (error 9.9%) were also under predicted in all four treatments.

Key words : CERES-Sorghum, validation

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Comparison of PET computed by various methods in different agroclimatic stations of Gujarat state

M. K. KHANDELWAL¹ and VYAS PANDEY²

¹*Central Soil Salinity Research Institute (ICAR), Regional Research Station, Maktampur, Bharuch 392012*

²*Department of Agricultural Meteorology, Anand Agricultural University, Anand 388110*

ABSTRACT

Monthly values of potential evapotranspiration by Thornthwaite, Turc, Christiansen Pan Evaporation, Modified Penman, FAO Blaney Criddle, Hargreaves, FAO Penman Monteith and FAO Makkink Radiation methods and potential evaporation by Christiansen Default Option Method were computed for 7 stations of Gujarat state using the most appropriate values of constants, coefficients and the corresponding input variables. The computed values of potential evapotranspiration by different methods and monthly potential evaporation by Christian Default Option Method were statistically compared with average of the monthly observed pan evaporation. Correlation of computed potential evaporation/potential evapotranspiration with observed pan evaporation resulted significantly higher coefficient of determination in most of the cases. The STATGRAPHICS software was used for selecting the most appropriate method for the given meteorological station. The Christiansen Default Option method was found to be accepted in all stations except for Anand and Junagadh. Similarly Thornthwaite method was found to be accepted by all stations except for Surat. However, the Turc method was rejected by all stations and so it can

not be considered for computation of potential evapotranspiration for any of the stations in the state. Detail findings are presented hereunder in the paper.

Key words: Potential evapotranspiration, penman method, pan evaporation

Journal of Agrometeorology (Special issue - Part 2): 444-447 (2008)

Effect of growing environments on stomatal conductance, transpiration rate and grain quality of wheat crop

M.L.KHICHAH and RAM NIWAS

*Department of Agricultural Meteorology,
CCS Haryana Agricultural University Hisar 125 004, Haryana, India*

ABSTRACT

Field study was conducted to find out the influence of growing environments on optical and physiological characteristics, nitrogen uptake, grain quality and yield of wheat. The observations on agrophysiological parameters were taken at different phenological stages. The per cent absorbed photosynthetically active radiation (PAR) was higher at anthesis as compared to other phenophases, whereas a reverse trend was observed in case of transmitted PAR. The wheat crop sown on 20th November absorbed maximum and minimum was absorbed by 20th December sown wheat crop. The corresponding values of PAR absorptivity at anthesis stage were 89.2 and 85.3 % respectively. The reflectivity of PAR showed a reverse trend i.e. 7.5 and 5.9 % in 20th December and 20th November sown wheat, respectively. The stomatal conductance of wheat leaves was higher in timely sown wheat (860 mol m⁻² s⁻¹) over late sown wheat (761 mol m⁻² s⁻¹). The rate of transpiration loss of water was 8.4 in 20th November sown and 7.1 mol m⁻² s⁻¹ in 20th December sown wheat crop at anthesis phenophase. The nitrogen content of grains was not much influenced by growing environments. The protein content of wheat grains was decreased by 1.0 % with delay in sowing.

Keywords: Environment, photosynthetically active radiation, wheat, stomatal conductance, transpiration, nitrogen uptake, protein content

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Studies on the radiation and water use efficiencies of medium duration pigeonpea (*Cajanus cajan* (L.) Millspaugh) under different weather conditions

N N SRIVASTAVA, V U M RAO, Y S RAMAKRISHNA, P VIJAYA KUMAR, M S PRASAD, J V N S PRASAD, and G SUBBA REDDY

Central Research Institute for Dryland Agriculture, Santoshnagar, Hyderabad

ABSTRACT

The objective of this study was to determine radiation and water use efficiency of medium duration pigeonpea. The crop was sown in large plots with onset of sowing rains during *kharif* seasons of 2003-06. Recommended package of agronomic practices was followed. Leaf area index, dry matter productivity and radiation interception were periodically recorded. The extinction coefficient 'k' was estimated from pooled data as the differences were not significant among individual years. Its value was 0.509. The radiation use efficiency under water deficit regimes was found to be 1.394 g MJ⁻¹ and under stress free conditions it was 2.493 g MJ⁻¹. The differences

in average water use efficiencies were not statistically significant. WUE was found to be 2.250 g kg⁻¹ from the pooled data for the four years.

Key words : RUE, WUE, leaf area index, extinction coefficient

Journal of Agrometeorology (Special issue - Part 2): 455-456 (2008)

Testing of BRASSICA model on mustard GM-2 under South Gujarat

A. L.NIHALANI, B. AJITHKUMAR, K.K. DAKHORE, and M.B. SAVANI

¹Department of Agril. Meteorology, AAU, Anand 388 110, Gujarat

ABSTRACT

The suitability of BRASSICA model to predict the growth, phenology and yield of mustard crop under South Gujarat agroclimatic region was assessed using the field experiments conducted at Navsari, Gujarat. The results revealed that on an average the deviations in simulated and observed parameters like days to flower, physiological maturity, seed yield, and biomass was less. Overall performance of the predictions of the different parameters by Brassica model revealed that it could be used as an agrometeorological tool to simulate the sowing dates and thereby take the maximum advantage of favourable weather conditions for the optimum crop yield.

Key words : BRASSICA model validation, mustard, Gujarat.

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Influence of weather parameters on wheat yield under varying sowing dates

A.P.DUBEY, C.B.SINGH, NAUSHAD KHAN, P.N. YADAV and A.N.TIWARI

Department of Agronomy, C.S.Azad Univeristy of Agriculture & Technology, Kanpur -208002

ABSTRACT

A field experiment was conducted during three-consecutive years (2004-05 to 2006-07) in Split Plot Design with four replications to assess the influence of weather parameters on wheat yield under varying sowing dates in sandy loam soil of central alluvial tract of U.P. The treatments consisted three dates of sowing allocated to main-plot i.e. Nov.30th, Dec.15th and Dec. 30th and three genotype namely, HD-2285, K-8804 and K-91 07 in sub-plot. The yield was significantly influenced by different dates of sowing. The first date of sowing (D₁-Nov. 30th) had produced significantly higher grain yield (4574.8 kg ha⁻¹) over the subsequent sowing dates. Thus, the reduction in grain yield of wheat was observed to the tune of 20 percent with delayed sowing by 30th days. Crop sown in early (Nov.30th) took more number of days from sowing to maturity than delayed sowing (Dec. 30th). Days taken from sowing to physiological maturity reduced with subsequent delay sowings. Delayed sowing reduced the crop duration by 14 day's. Flowering and dough phases of the wheat were found to be most sensitive to weather parameter. Lower sunshine hours and temperature range between 11.3 - 24.2° C enhanced the flowering, moreover at the dough stage favourable temperature was observed between 15.3 - 29.0 °C for maximum production of wheat.

Key words: Wheat, weather parameters, sowing dates

Journal of Agrometeorology (Special issue - Part 2): 462-466 (2008)

Influence of monsoon on quality of coffee beans along the West Coast of India

G.S.L.H.V. PRASADA RAO and P.B. PUSHPALATHA

College of Horticulture, Kerala Agricultural University Vellanikkara - 680 656, Thrissur, Kerala, India

ABSTRACT

The study revealed that increase in moisture content on an average in Arabica beans was 21.3 % while 22.9 % in Robusta. It was high in 2005, varying between 29.5 % in Arabica and 34.7 % in Robusta when compared to that of 2003 (17.3 % in Arabica and 15.6 % in Robusta) and 2004 (17.1 % in Arabica and 15.7 % in Robusta). It also revealed that Robusta responds to monsooning much better when compared to that of Arabica due to its bigger bean size. Increase in volume of beans and bulging might be due to the absorption of atmospheric moisture. Absorption of atmospheric moisture and resultant swelling of coffee beans may contribute to changes in biochemical reactions. On an average, the decline in acidity in Arabica was 0.5 % while 0.7 % in Robusta. Similarly, differential increase in sugars was 1.7 % in Arabica while 2.1 % in Robusta. The percentage increase in sugars was more in Robusta types than that of Arabica. However, Arabica coffee is considered superior in quality than Robusta in international market due to inherent low level of acidity and high level of sugars. Increase in sugars and decrease in acidity and polyphenols might be contributing to a favourable sugar acid blend in coffee, which is responsible in up gradation of quality. It appears that the moisture content in coffee beans depends on atmospheric vapour pressure and night temperature as they accounted 87 % variance. Based on above relationship, a simple regression ($R^2 = 0.87$) was worked out.

Key words: Arabica, Robusta, monsooning, vapour pressure deficit, moisture content of beans, acids and sugars

Journal of Agrometeorology (Special issue - Part 2): 467-469 (2008)

MAI based crop planning in assured rainfall region of South Gujarat

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

*Department of Agricultural Meteorology, BACA,
Anand Agricultural University, Anand – 388 110*

ABSTRACT

The rainfall data for 28 talukas of six districts of South Gujarat region was analyzed for calculating expected rainfall at 50% level by incomplete gamma distribution. The rainfall amount at 50% probability level and weekly potential evapotranspiration was used in water balance computation by Thornthwaite and Mather (1955) method. The length of growing period (LGP) was determined on the basis of moisture availability index (MAI). The results revealed that the annual rainfall at 50% probability was highest (1967 mm) at Gandevi taluka of Navsari district, whereas, the lowest rainfall (676.9 mm) was observed at Zagadia taluka of Bharuch district. The length of growing period (LGP) varied between 12 to 24 weeks in different districts of South Gujarat. Crops like paddy, sorghum, other millets, pigeon pea, gram, pearl millet, maize and other pulses are found suitable in Bharuch, Surat and Navsari districts. The long duration crops like sugarcane, cotton and paddy can be taken in areas having higher LGP. The area was also suitable for orchard crops like mango, sapota and banana etc.

Keywords : MAI, LGP, Probability of rainfall, Crop planning

Journal of Agrometeorology (Special issue - Part 2): 470-475 (2008)

Micro level variation in rainfall characteristics and its impact on climate for crop planning In Bhilwara district of Rajasthan

A.K.KOTHARI , P.M.JAIN and VIRENDRA KUMAR

Dryland Farming Research Station, Bhilwara-311001 ; Maharana Pratap University of Agriculture and Technology, Udaipur-313001

ABSTRACT

Water balance studies have been carried out to suggest different cropping plans either for an agroclimatic zone or at the most for a district for adoption at field (micro) level while the required data on rainfall and soils varies even within the district too. A water balance study was conducted at tehsil level in Bhilwara district of Rajasthan state which reveals that normal annual rainfall varies from 441 to 743 mm and available water holding capacity of soils varies from 90 to 200 mm which leads to variability in climatic conditions from arid to semi arid among different tehsils of the target district. The study also revealed that length of rainy season varies from 10.7 to 12.3 weeks; water surplus varies from 43.2 to 241.6 mm and water deficit from 61.4 to 124.7 mm at tehsils level. The suggested cropping plan varies from intercropping of groundnut / maize +pigeon pea in one tehsil to sole sesame/ black gram in other tehsil. Thus, distinct crop planning is required at micro (tehsil) level for efficient utilization of natural resources under dryland regions.

Key words: Crop planning, micro level, water balance, moisture adequacy Index

Journal of Agrometeorology (Special issue - Part 2): 476-478 (2008)

Optimisation of sowing window for soybean in coastal agro-eco-system

G. MEERAI AH, P.V.N. PRASAD, B. VENKATESWARLU and R. VEERARAGHAVAI AH

*Department of Agronomy, Acharya N.G.Ranga Agricultural University
Agricultural college, Bapatla- 522101, Andhra Pradesh*

ABSTRACT

Under noticeable shifts in rainfall pattern of coastal Agro-Eco-System, a field experiment was conducted during *kharif*, 2005 to arrive at optimum sowing window for soybean by taking three popular cultivars (Hardee, JS-335 and MACS-450) at Agricultural College Farm, Bapatla. The experimental site was located in coastal area of the Krishna Agro-Climate Zone of Andhra Pradesh. The rainfall pattern in the region has favoured the crop sown in the 33rd meteorological week (13th to 19th Aug, 2005) over that in the remaining 5 meteorological weeks irrespective of soybean cultivars tested. A low rainfall of 16.5 mm during the 33rd meteorological week associated with high temperature during the growing season and subsequent accumulation of thermal units favoured both the vegetative and reproductive growth and hence higher yield of soybean. On the contrary, sowings during the subsequent meteorological weeks (34th, 35th, 36th, 37th, 38th) wherein receipt of high rainfall and faster shrinking of day length affected the crop establishment to begin with and shortened growth stages leading to early maturity on account of soybean's short day response and hence lower crop productivity. Overall, it appears that soybean productivity would be reduced if sowings are delayed beyond the 2nd week of August in *kharif* season.

Keywords: Meteorological week, Rainfall shift, Soybean cultivars, Thermal units

Journal of Agrometeorology (Special issue - Part 2): 479-482 (2008)

Rainfall analysis for drought investigation in Central Brahmaputra Valley of Assam

P. K. BORA, R. M. KARMAKAR, K. KURMI and M. C. DEBNATH*

*All India Coordinated Research Project for Dryland Agriculture
Assam Agricultural University
Jorhat*

ABSTRACT

Daily rainfall of Central Brahmaputra Valley Zone of Assam for 36 years were analyzed to investigate its behaviour on monthly and weekly basis. In the study period 6 were found to be deficit and 6 were surplus years. The probability of drought occurrence in the month of July was zero. Similarly it was 0.002 to 0.007 during monsoon period whereas the probability of drought during December was 0.053. During *rabi* season (October to February), about 40.56% of months were drought, 42.78% months were normal and 16.67% months were wet. The 49th week was dry for maximum number (34) followed by 51st week (32). Drought occurrence was very frequent from the 1st week to the 12th week and 42nd week to 52nd week. In a year, there was 97% probability of having 17 drought weeks, 15 normal weeks and 3 wet weeks. Similarly, there is 3% probability of having 32 dry, 26 normal and 12 wet weeks in a given year.

Key words : Drought probability, drought week/month, wet week/month

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Agro-climatic analysis of citrus (*Khasi mandarin*) growing areas of Assam for sustainable production

R. M. KARMAKAR, K. BORKAKOTI, B.C. BHOWMICK, MARAMI DUTTA and D.C. KALITA*

Department of Soil Science, Assam Agricultural University, Jorhat - 785013

ABSTRACT

Climatic data and soil-site parameters of citrus (*Khasi mandarin*) growing areas of Assam were analysed for suitability assessment for sustainable production of *Khasi mandarin*. The climate of the citrus growing areas of Assam was found to be sub-humid to per-humid characterized by mean annual precipitation of 1282.0–2798.9 mm and mean annual temperature of 23.1–27.7 °C. The climate was suitable (S1) to moderately suitable (S2) for citrus cultivation. Relative humidity at ripening stage and mean temperature in the two months after harvest of the crop contributed to the moderately suitable class of the climatic parameters.

Key words: Citrus, agro-climatic, assessment

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Probability distribution analysis of consecutive days rainfall data for Patan district of Gujarat, India

R.B.SHELAT and D. T. SHETE

Water Resources Engineering and Management Institute

*Faculty of Technology and Engineering, The Maharaja Sayajirao University of Baroda,
Samiala – 391 410, Gujarat.
reems_shelat@yahoo.co.in*

ABSTRACT

In the present study 17 different types of continuous probability distributions were tested by Chi-square test values using Easyfit statistical software for Patan district of Gujarat, India using daily rainfall data from 7 raingauge stations for 43 years (1961 – 2003) period. Weibull, Weibull (3P), Gamma (3P) and Gamma distributions were best fitted to one day and consecutive 2, 3,4,5,6 and 7 days rainfall respectively. Overall Weibull distribution can be fitted to one day and consecutive 2, 3,4,5,6 and 7 days rainfall as either it has the first rank in 2 cases, second rank in 4 cases and third rank in 1 case out of the twenty three ranks.

Key words : Probability analysis, consecutive day rainfall

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Nakshtrawise rainfall variability and probability analysis for drought prone areas

V.R.BAFADEKAR, J.D. JADHAV, D.D.MOKASHI, S.V. KHADTARE and J.R. KADAM
Zonal Agricultural Research Station, Mahatma Phule Krishi Vidyapeeth Solapur-413002 (Maharashtra)

ABSTRACT

In northern part at Dhule, >50 mm rainfall was received in Mrugashira to Magha nakshtra with less variability (CV. <100). In central part, the rainfall in Mrugashira nakshtra at Kopergaon and Rahuri and Aaridra nakshtra at Kopergaon have less variability (CV < 100) in kharif season. Whereas, Purva, Uttara and Hasta nakshtra in rabi season has less variability at Rahuri and Chas (CV < 100). In southern part, at all the selected places the Mrugashira nakshtra has less variability (CV. <100 %). Whereas, Punarvasu and Pushya nakshtra at Mohol, Aaridra nakshtra at Pandharpur, Aaridra, Punarvasu and Aashelsha at Padegaon and Aaridra to Pushya nakshtra at Solapur has less variability. In northern part at Dhule, Mrugashira to Purva nakshtras have the highest probability (>50%) while, Purva nakshtra has the highest initial probability (73%). In central part, the highest initial probability (>50%) of rainfall in Mrugashira nakshtra was only at Rahuri. In southern part, the initial probability of getting >50% rainfall was in Mrugashira nakshtra at Mohol in kharif season only. While, it was in Uttara and Hasta nakshtra at Jeur and Padegaon, Purva, Uttara and Hasta nakshtra at Mohol and Solapur and Purva and Hasta nakshtra at Pandharpur indicating that rabi cropping can be under taken in these nakshtras.

Key Words: Nakshatra, rainfall, probability, variability, cropping pattern

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**Influence of weather factors on insect pests and diseases on groundnut:
A case study**

G V RANGA RAO¹, S DESAI², Y V R REDDY¹, V RAMESHWAR RAO¹ and V S R DAS¹

¹International Crops Research Institute for Semi-Arid Tropics (ICRISAT), Patancheru 502 324, AP., India.

²Central Research Institute for Dry land Agriculture (CRIDA), AP, India

ABSTRACT

In India, forewarning systems have been developed in crops like groundnut, cotton, rice and others. The Decision Support System developed for late leaf spot of groundnut can be used as a stand alone forewarning system for different groundnut growing regions of India. Evaluation of limited research in plant protection and weather has shown positive or negative impacts or no impact. Hence, more critical data base on biotic stresses and their relation to abiotic factors is required for developing and fine tuning of pest prediction systems. In this paper, the development of weather-based forewarning systems for groundnut pest populations and identifying the critical gaps in our knowledge for their effective management is discussed.

Key words : biotic and a biotic stress, groundnut, late leaf spot

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Assessment of yield losses due to mustard aphid in Indian mustard sown on different dates

L.K.DHALIWAL, S.S.HUNDAL, J.S.KULAR, S.K.CHAHAL and A. ANEJA
Punjab Agricultural University, Ludhiana.

ABSTRACT

Field studies were conducted during the crop seasons to assess the yield losses due to mustard aphid in Indian mustard [*Brassica juncea* (L.) Czernj. & Cosson] sown on different dates. The crop was sown on 5 October, 30 October and 25 November during 2004-05 and 2005-06 but crop was sown on 30 October and 25 November during 2003-04. Yield attributes and seed yield decreased significantly with delay in sowing under both protected and unprotected conditions. On an average maximum seed yield of 1898 kg ha⁻¹ was recorded when the crop was sown on 5 October under protected conditions as compared to 1768 kg ha⁻¹ in unprotected conditions. Yield attributes and seed yield decreased drastically under unprotected conditions as compared to protected conditions under different sowing dates. Yield losses due to mustard aphid were highest (82%) during third date of sowing in 2004-05. Crop-weather-pest calendar was also developed to reveal that different phenological stages of mustard require different weather conditions and flowering was the most susceptible stage to mustard aphid.

Key words: Date of sowing, mustard aphid, yield losses, Indian mustard

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Population dynamics of stem borer in relation to inter and intra-seasonal variation of weather and operational rice protection at Pattambi, Kerala

R.P.SAMUI¹, N.CHATTOPADHYAY, J.P.SABL² and P. V. BALACHANDRAN³

¹ Regional Meteorological Centre, LGBI Airport, Guwahati-781015

² Agrimet division, IMD, Pune-411005,

³ RARS, Kerala Agricultural University, Pattambi-679306

ABSTRACT

Stemborer of rice being one of the dreaded pests, its intensity of occurrence in karif and rabi seasons along with meteorological parameters and associated synoptic situation were compiled from the survey report of plant protection, quarantine and storage, Faridabad and National data centre, IMD, Pune respectively. These data were analyzed and plotted. The study revealed that stem borer outbreak occurred in moderate to severe intensity in Gujarat, Orissa, Andhra Pradesh, Assam, Hariyana and punjab. Other rice growing states were also infested by the pest both in Kharif and rabi seasons but with lesser intensity. A critical examination of weather and synoptic situations indicated that drop in mean temperature in association with a prolonged spell of rainy days were most congenial for incidence of the pest. Synoptic situation favourable for the incidence of stem borer are also discussed. These findings were validated using light trap catches for 15 years (1987-2001) recorded at Regional Agricultural Research Station at Pattambi, Kerala. Weekly Stem borer population were correlated with weather data for the corresponding, 1st, 2nd, 3rd and 4th previous weeks. Stepwise multiple regression technique was used to determine the most predominant parameters. Multiple regression equation was developed for operational use. Multiple regression equations for stem borer accounted for 86% and 84% variation respectively in Kharif and rabi seasons. The influence of weather parameters on outbreak of stem borer within the season and inter seasons are discussed. Based on the findings, pest weather calendars for stem borer of rice have been prepared for operational crop protection. These pest weather calendars, present and forecast weather and pest population from the rice field would help to formulate agromet advisories for spraying and dusting operations.

Key words: Yellow Stem borer, synoptic situation, weather based forewarning, operational rice protection.

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Weather based forewarning of mustard aphid (*Lipaphis erysimi* (Kalt.))

S. A. KHAN, S. CHOUDHURI and S. JHA

*Department of Agricultural Meteorology and Physics and Department of Agricultural Entomology
Bidhan Chandra Krishi Viswavidyalaya, Mohanpur-741252.*

Email: sakhan_bckv@sify.com

ABSTRACT

Experiment conducted at Mohanpur during three years (2001 to 2003) on yellow sarson revealed that the previous weeks maximum, minimum and mean temperatures, growing degree days, wind speed and sunshine hours had negative correlation with aphid population. First and economic threshold limit (ETL) (≥ 30 aphids plant⁻¹) incidences of aphid occurred from 8 November to 13 January (15.6 °C i Tmean i 24.7 °C) and from 12 November to 30 January (14.3 °C i Tmean i 23.6 °C), respectively. Crops sown between 22 and 29 October escape severity of aphid infestation. Coccinellid and syrphid predators could not suppress aphid population, as evidenced by significant positive correlation coefficients between them. Threshold values of weather parameters and models emanated from this investigation could be useful for providing forewarnings to the farmers for management of aphid.

Key words: Mustard aphid, forewarning, agrometeorological parameters, ETL incidence, prediction

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Forewarning of tea mosquito bug *Helopeltis antonii* Sign. (Miridae: Hemiptera) in cashew

G. S. L. H.V. PRASADA RAO and PATHUMMAL BEEVI

College of Horticulture, Kerala Agricultural University, K.A.U. (P.O), 680 656, Vellanikkara, Thrissur, Kerala

ABSTRACT

The time of flushing and flowering phases of cashew fall in winter (November to February) during which the night temperature plays a major role in incidence of pest population. It is observed that the minimum temperature had a significant negative correlation with pest population and it varies between 10 and 24°C across the cashew tract of the West Coast including "Maidan areas" of Karnataka (highranges). It is also revealed that the pest population was low under the cold weather conditions (< 10°C of minimum temperature) coupled with minimum temperature above 24°C. The pest population was low to moderate (4-8/q/tree) when Tmin between night temperature 12 and 15°C and 22 and 24°C. The pest population was high when the night temperature was between 15 and 22°C. No variety is tolerant to pest infestation. The pest population was high at Pilicode as the night temperature range varied between 17 and 20°C for most of the days from December to February when compared to that of Madakkathara. The prediction equations were derived through multiple regression analysis based on pooled data for all the three years with respect to the pest population and the variance is very high at Pilicode and thus the equations can be used for field operations under the integrated pest management.

Key words: Tea mosquito, reproductive phase, night temperature, forewarning models

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Models for forewarning the incidence of castor semilooper *Achaea janata* Lin. (Noctuidae: Lepidoptera) and its parasitoids

M. PRABHAKAR, Y. G. PRASAD and D. YELLA REDDY

*Central Research Institute for Dryland Agriculture
Santoshnagar, Hyderabad – 500 059*

ABSTRACT

Analysis of three years data revealed that among different weather variables, rainfall at 7 days lag and evening relative humidity of 6 days lag were found to have significant positive influence, while maximum temperature and vapour pressure deficit at 6 days lag had significant negative influence on semilooper eggs. None of the weather variables were found to have significant correlation with larval population of castor semilooper. Maximum temperature at 3 and 4 weeks lag had significant negative influence, while evening RH during the same period along with vapour pressure deficit at 4 weeks lag and minimum temperature at 1 to 3 weeks lags had significant positive effect on the *Trichogramma* egg parasitisation. Minimum temperature at 3 weeks lag and max temperature and evening RH at 3 and 4 weeks lag had significant positive influence on larval parasitisation by *Snellenius*. The step-wise regression analysis of the three years data resulted in models to predict eggs and larval stages of *A. janata* and their two important natural enemies' 3 to 7 days in advance. The models developed explained 52 and 31 percent of the variability in predicting semilooper eggs and larvae, respectively while, it was 57 and 62 per cent for *Trichogramma* egg parasitoid and *Snellenius* larval parasitoids, respectively.

Key words: Castor semilooper, *Trichogramma*, *Snellenius*, parasitoids, weather, forecasting models

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Weather based agro-advisory service for food security in the Indian arid region

A.S. RAO

Central Arid Zone Research Institute, Jodhpur-342 003, India

ABSTRACT

Drought in the Indian arid region, which occurs frequently, adversely impact kharif crops whereas, severe cold wave followed by heat wave conditions that prevail affect rabi crops. Impact of weather extremes on the annual food grain production of the region showed variability from 1.38 to 6.82 million tonnes. A case study on the economic loss due to cold wave during 2005-06 winter showed that the crop losses were up to Rs.6220 million.

Weather based Agro-Advisory Service (AAS) for farmers of arid region based on Medium Weather Range Forecasts of NCMRWF, Noida were initiated in 1998 to minimize the risks from weather and weather induced pests and diseases. Contingency plans showing suitable crops and varieties for early, normal and late onset of monsoon were prepared. A survey on economic benefits accrued due to AAS showed that advisory particularly on early warning of cold waves, rainfall during critical stages of crops helped in enhancing yield by 36% in pearl millet, 19% in clusterbean, 11% in mustard and 33% in cumin compared to the yield obtained from non-AAS farmers.

Key words: Weather-based agro-advisories, arid region, food-security

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Economic impact assessment using agro-advisory services in middle Gujarat agro climatic zone

K.K. DAKHORE, H. R PATEL, V. PANDEY and A.M. SHEKH

Dept. of Agril. Meteorology, Anand Agricultural University, Anand 388 110, India

ABSTRACT

The impact of economics of AAS was assessed for tobacco and potato crop as both the crops are predominantly grown middle Agro-climatic zones of Gujarat. Detail economic assessment was based on pre fabricated feedback questionnaire to come arrive at significant inferences in terms of utility of Agro-Advisory Services. The results showed that nearly 18 per cent higher net return was obtained by AAS farmers as compared to Non-AAS farmers in tobacco crop which may be attributing to timely agricultural operations, timely input in recommended quantity and efficient soil moisture management and scientific plant protection majors in a need base manner during crop growing period as suggested in biweekly bulletins. AAS farmers benefited by timely application of top dressing of fertilizers and irrigation as suggested by AAB which might be the reason for higher yield of tobacco as compared to Non-AAS farmers. In case of potato crops farmers' net return increased to the tune of 12 % as compared to Non-AAS farmers. The net monetary return of potato crop mainly depended on cost incurred towards the seed (quantity and quality). Besides seeds quality, quantity, seed treatment, time of planting, method of planting, size of planting material and depth of planting material were major factors which decided sprouting percentage and plant stand in the field. AAS farmers adopted optimum planting time of potato, while Non-AAS farmers were not adopted optimum planting time. Delay in planting caused yield reduction of Non-AAS farmers as compared to AAS farmers.

Thus, by adopting weather based Agro-Advisory Bulletin AAS farmers had significantly reduced input cost and by this in an indirect way their net return increased significantly.

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Retrieval of air temperature in clear skies using Indian geostationary satellite data

S. A. BHOWMICK¹, KANISHKA MALLICK², *B. K BHATTACHARYA² and RAHUL NIGAM

¹*Meteorology and Oceanography Group, Space Applications Centre (ISRO), Ahmedabad 380015*

²*Agriculture-Forestry & Environment Group, Space Applications Centre (ISRO), Ahmedabad 380015*

ABSTRACT

Near surface air temperature is one of the most meteorological forcing variable required for modelling and monitoring of number of terrestrial processes. Coregistered and georegistered daily images from Very High Resolution Radiometer (VHRR) onboard Indian geo-stationary satellite KALPANA 1, has been used to retrieve air temperature. The noontime visible (VIS) band data, noon and nighttime (2100 GMT) data in thermal IR (8km) bands were processed during period of two contrasting months, winter (1st to 31st January 2007) and summer-monsoon (11th –20th August 2007), to retrieve maximum (Tmax), minimum (Tmin) and diurnal air temperature (Ta) at reference height (2m). Empirical linear air temperature models were developed from independent (November 2005 to March 2006) datasets. These were further used to retrieve Tmin from nighttime brightness temperature and Tmax from a proxy function. The estimates were validated with ISRO automatic weather station (AWS) datasets. Errors were relatively more in case of Tmax (RMSE 2.12 °C) than Tmin (RMSE 1.66 °C) with R2 = 0.84 from pooled datasets over January and August. Diurnal simulation of Ta produced from two diurnal limits were found to have fairly good accuracy (RMSE 1.1° C) when compared to AWS hourly measurements. Zone wise validation was also carried out which showed that the accuracy of retrieval was, in general, more in northern part of India as compared to other three zones. This could be associated with likely increase in cloud identification errors in northeast and southern zones.

Key words : Air temperature, K1VHRR, geostationary, land, India