

Sensitivity of Penman–Monteith estimates of reference evapotranspiration to errors in input climatic data

M. H. ALI¹, A. K. M. ADHAM², M. M. RAHMAN², A.K. M. R. ISLAM³

¹Agricultural Engineering Division, Bangladesh Institute of Nuclear Agriculture, P.O. Box – 4, Mymensingh 2200, Bangladesh, Email: mha_bina@yahoo.com.

² Dept. of Irrigation & Water Management, Bangladesh Agricultural University, Mymensingh 2202, Bangladesh

³ Graduate Training Institute, Bangladesh Agricultural University, Mymensingh 2202, Bangladesh

ABSTRACT

The Penman-Monteith (P-M) equation with its new definition of reference crop evapotranspiration (ET_0) is recommended by FAO as the standard method of crop water requirement calculation, and also to compare other methods. The ET_0 component of the CROPWAT model, which is based on the P-M equation, was examined for sensitivity to errors in input data under the environment of a semi-humid sub-tropic region of Bangladesh. The results showed that the ET_0 estimates are most sensitive to maximum temperature and least sensitive to minimum temperature. The order of sensitivity noticed is: maximum temperature > relative humidity > sunshine duration > wind speed > minimum temperature. The sensitivity coefficients showed seasonal variation. The model parameter 'Angstrom's coefficients' showed sensitivity to errors in single or pair values. The implications of sensitivity to ET_0 estimates and in selecting appropriate method for ET_0 estimation in a data-short environment are discussed.

Keywords: Sensitivity, Penman-Monteith equation, reference evapotranspiration, CROPWAT

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Irrigation -yield response factor of winter wheat for different growth phases

M. H. ALI

Agricultural Engg. Division, Bangladesh Institute of Nuclear Agriculture, P.O. Box - 04, Mymensingh 2200, Bangladesh, Email: mha_bina@yahoo.com, hossain.ali.bina@gmail.com

ABSTRACT

The yield response factor of semi-dwarf winter wheat was determined from field experimental data conducted during three consecutive years (2002-03 to 2004-05). The yield response factor (k_y) varies depending on growth phases and also among seasons. On an average, the k_y for early, vegetative, booting-heading, and flowering-soft dough stages were 0.27, 0.21, 0.25, and 0.17, respectively. According to the value of yield response factor, the most sensitive growth stages were in the order: CRI > booting-heading > maximum tillering > flowering-soft dough. For the alternate deficit strategies (deficit at tillering + flowering – soft dough; deficit at CRI + booting-heading stages), the k_y values were 0.77 and 0.61, respectively. For the whole growing period, the k_y values were 1.58, 0.43, 2.29, and 0.61 for deficit at early, vegetative, booting-heading, and flowering-soft dough stages, respectively. The sensitivity index (λ_i , of Jensen model) for early, vegetative, booting-heading, and flowering-soft dough phases were 0.35, 0.22, 0.31, and 0.14, respectively. A more sensitive growth stage has a higher value of λ_i , and therefore water supply is more important at early and booting-heading phases.

Key words: Wheat, yield response factor, sensitivity index

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Trends in weather and yield changes in past in coconut growing areas in India

S. NARESH KUMAR^{1a}, M.S. RAJEEV¹ AND VINAYAN¹ D.D. NAGVEKAR², R. VENKITASWAMY³, D.V. RAGHAVA RAO⁴, B. BORAIAH⁵, M. S.GAWANKAR⁶, R. DHANAPAL¹, D.V. PATIL⁷ and K.V. KASTURI BAI¹

Central Plantation Crops Research Institute, Kasaragod, 671124, Kerala, India;

² CRS, Byte, Ratmagiti, Maharashtra;

³ARS, Aliyarnagar, Tamil Nadu,

⁴CRS, Ambajipeta, Andhra Pradesh,

⁵ARS, Arsikeri, Karnataka,

⁶ARS, Mulde, Maharashtra, CPCRI-RS, Kidu, Karnataka

*Corresponding author email: nareshkumar.soora@gmail.com

ABSTRACT

Analysis of past weather data indicated increase in maximum temperature at varied magnitudes over various coconut growing areas across the country except in southern Kerala. In case of minimum temperature, sixty percent of the locations studied showed a declining trend, widening the difference between maximum and minimum temperatures. The days above 33 °C, optimal for coconut growth and development, were in increasing trend in most of the coconut growing area while days below 15 °C are increasing in northern Kerala, plains of Karnataka and western Tamil Nadu. Annual Rainfall showed declining trend in most of the coconut growing areas with change in amount. Dry spells are in increasing trend in parts of Karnataka and Kerala. Change in coconut productivity during past three decades across the country ranged from -114 to 270 nuts/ha/year. The productivity of coconut during the study period was in increasing trend except for parts of Maharashtra, Karnataka and Tamil Nadu, where consecutive droughts affected the yields.

Key words: Climate change, weather, coconut

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Stochastic modelling of water deficit

B.S. DEORA and R.V. SINGH¹

S.D. Agril. University, S.K. Nagar, Gujarat -385 506

¹*College of Tech. and Engineering, MPUAT, Udaipur-313 001*

ABSTRACT

A stochastic model for weekly water deficit series, using 28 years climatological data, under climatic condition of S.K. Nagar has been developed. The turning point test and Kendall's rank correlation test are applied for detecting the trend. Correlogram technique is used to detect the periodicity, which is then analyzed by Fourier series method. Significant harmonics were also identified. The statistical properties of the generated water deficit series were compared with observed series. The developed model was validated by predicting two years ahead and compared with the observed water deficit series, The test results indicated the high degree of model fitness. The developed model may be used for representing the time-based structure of the water deficit time series.

Key words: stochastic, water deficit, time series, periodic.

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A study of basis risk in the use of weather derivatives for hedging of agricultural yield

RAJIV SETH¹, VALEED A ANSARI² and MANIPADMA DATTA³

¹*TERI University, New Delhi; rajivseth@teri.res.in*

²*Aligarh Muslim University, Aligarh; valeedin@yahoo.com*

³*Institute of Management Technology, Ghaziabad, mdatta@imt.edu*

ABSTRACT

Weather derivatives are a newer form of hedging the weather-related agricultural yield risk. The paper discusses the issue of geographic basis risk, which is likely to be an important factor when weather derivative trading is introduced in India. With the large number of villages and the large geographic spread, an understanding of the implications of basis risk would help, not only in the acceptability of weather derivatives as viable hedging instruments, but also in relevant policy matters. This would be so especially with respect to the number and kind of weather recording stations which would be required. The paper brings out a study of past data from two weather stations in New Delhi, located just a few kilometers apart, on rainfall correlations and uses these to indicate risks involved in using proxy weather stations.

Key words: Weather derivatives, agricultural risk.

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Agro-topo climatological studies for crop planning- a case study for the northern hills agroclimatic zone of Chhattisgarh state

A.S.R.A.S. SASTRI, DIWAKAR NAIDU and SOMNATH CHOUDHURY

ABSTRACT

In the Northern Hills agroclimatic zone in Chhattisgarh state (India), the soils are undulating with 15 per cent at the top to 0 per cent slope in the valley areas. Analysis of field hydrological conditions in different soils in the topo-sequence revealed that in the top (sandy) soils agroforestry is a better option while in the valley areas with continuously flowing water from Mid July to November, tall varieties of rice are only suitable. In the clay loam soils rice is the best suited crop while in sandy loam soils maize is an alternative crop for diversifying rice.

Local climate analysis indicated that it varies from near arid type climate at the top of the topo-sequence to near moist sub-humid conditions in the valley areas. Thus, the farmers in the zone need to plan from arid climate crops to moist sub-humid type crops like rice.

Key words: Crop planning, Agro-topo-climatology, CROPWAT

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Rainfall characteristics of north west alluvial plain zone of Bihar

P.K.SINGH, L.S.RATHORE, K.K.SINGH and A.K.BAXLA

*National Centre for Medium Range Weather Forecasting, A-50,
Institutional Area, Sector-62, NOIDA-201307*

ABSTRACT

Rainfall data for the period 1960-2005 is used to analyze the probability of occurrence of deficit /normal /excess rainfall. The mean annual rainfall is 1200 mm with 28 percent variability; with standard deviation of 336 mm. July is the wettest month (average rains- 326.5 mm). Rainfall of August and September months shows lower coefficient variation- 57 percent. Each standard week from 25th to 40th receives a rainfall of more than 40 mm, indicating the crop suitable period from June third week to October 1st week.

Key words: Seasonal rainfall, Gamma probability and weekly probability by Markov Chain

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Rainfall variability and probability for crop planning at Madhepura in Bihar

SUCHIT K RAI and K A SINGH

*Indian Grassland and Fodder Research Institute, Jhansi-284003
Email: Suchitrai67@yahoo.co.in*

ABSTRACT

Daily rainfall data of thirty years (1974-2004) have been analyzed for establishing the long term averages of weekly, monthly, seasonal and annual rainfall and its variability. July receives maximum rainfall of 386.5 mm followed by August (330.6 mm). The stable rainfall period was of 13 weeks spread over 25 to 37th standard meteorological weeks (SMW). The probability of receiving 10 and 20 mm of average weekly rainfall during 25 to 39th SMW exceeds 70%. At 75% probability level rainfall of 45.8 mm can be expected to occur during the month of May that can be utilized for summer ploughing or seedbed preparation for raising rice seedlings; maize sowing may be advanced to last week of April to first week of May. Sowing of jute and other crops (cowpea, groundnut, pigeon pea, black gram, direct sown rice etc) could also be performed in this region.

Key Words: Rainfall pattern, initial and conditional probability, crop planning

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Rainfall probability during dormant and growing seasons of apple in Himachal Pradesh

MOHAN SINGH, JAYANT KUMAR and S.S. BHARDWAJ

Regional Horticultural Research Station
Dr. YS Parmar University of Horticulture & Forestry
Seobag, PO Neoli – 175 138, Kullu (HP)

ABSTRACT

Variation of seasonal rainfall and probabilities of occurrence of assured weekly rainfall provide useful information for efficient agricultural management. In the present study, seven stations of Himachal Pradesh have been selected for the analysis of the rainfall data. In general, the station Dalhousie received the higher rainfall during both the growing and dormant seasons along with annual rainfall. Probability percentage of receiving 10 mm, 20 mm, 50 mm and 75 mm rainfall have been computed for standard weeks during growing and dormant seasons at four stations Katrain, Bajaura, Mashobra and Nauni (Solan). A critical examination for spatial and temporal probability distribution revealed that high rainfall belt is located in the north western part of the state. For better apple production, monsoon rainfall plays significant role. It not only moderates the temperature during summer but also recharges the much-needed moisture, which almost depletes by mid June. Well distributed winter rains and early snowfall before January are beneficial in providing chilling, optimal flowering and good fruit set.

Key words: Rainfall probability, apple growing season

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Climatic variability in Jhansi region of Uttar Pradesh

P. K. SINGH, K. K. SINGH, L. S. RATHORE and A. K. BAXLA
National Centre For Medium Range Weather Forecasting, NOIDA-201307, U.P.

ABSTRACT

The daily rainfall and temperature data 1969-2000 of Jhansi were analyzed to know seasonal and annual variability. Three distinct crop growth seasons *kharif* (26-41 SMW), *rabi* (42-15 SMW) and summer (16-25 SMW) were characterized for seasonal trends. The stable rainfall period was worked out. The annual and *kharif* rainfall showed a decrease in rainfall in recent decade (1984-1993). Trend analysis on rainfall reflects a decrease of 0.89 and 1.12 mm per year in annual and *kharif* season during past 35 years whereas no such specific trend was observed for *rabi* and summer seasons. The temperature variability was small indicating only minor year-to-year variations. However, during recent decade, the minimum temperature showed an increase of 0.05 and 0.13 ° C per year during annual and *kharif* season.

Key words: Climatic variability, rainfall, temperature and trends

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Rainfall pattern and moisture availability index in relation to rice (*Oryza sativa* L.) crop planning in eastern plateau region of India

P. BANIK* and R.C. SHARMA
Agricultural and Ecological Research Unit, Indian Statistical Institute, 203, Barrackpore Trunk Road,
Kolkata 700 108.

*Corresponding Author (e-mail pbanik@isical.ac.in)

ABSTRACT

Studies were undertaken to identify the quantum and distribution of rainfall with the frequency of dry spell occurrence during monsoon at Giridih, Jharkhand state, India. Rainfall at different confidence levels was calculated using mixed gamma distribution. The normal onset of monsoon at Giridih was 24th standard meteorological week (SMW) and the mean monsoon rainfall was 1112 mm. If monsoon onsets two weeks earlier (22nd SMW) than the normal (24th SMW) the total monsoonal rainfall was more than the normal with increased number of dry spells. The co-efficient of variation of June and September rainfall was very high. Moisture availability index (MAI) indicated possibility of rice cultivation from 25th SMW and the flowering stage of rice should be completed within 39th SMW (normal withdraw of monsoon). Thus to minimize crop failure, conventional cultivation of 135 ± 10 days rice could be replaced by 95 ± 10 days one, particularly in upland (without bund; direct seeded rice) and medium land (low bund land) situation.

Key words: Monsoon rainfall, mixed gamma distribution, potential evapotranspiration, moisture availability index, rice.

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Weather relations on floral phenology and autogamy in niger [*Guizotia abyssinica* (L.f.) Cass] under north- western Himalayas

VEDNA KUMARI and RAJENDRA PRASAD¹

*Department of Plant Breeding & Genetics, ¹Department of Agronomy,
Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya
Palampur-176062*

ABSTRACT

A study was undertaken for understanding of floral phenology, influence of weather parameters on selfing and seed set in five genotypes of niger [*Guizotia abyssinica* (L.f.) Cass] at CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur during *kharif*, 2006. The results revealed that the disc florets opened between 9.00 AM to 10.30 AM during sunny days and between 10.00 AM to mid day during cloudy days. The maximum opening of disc florets were recorded between 11.00 AM to 12.00 noon when inflorescence experienced bright sun shine hours between 0.0 to 1.0 hour with a mean value of 0.71 hour. Seed set in all baggings viz., single capitulum two capitula, three capitula, single branch and whole plant ranged between 1.6 to 8.5 per cent. Under open- pollinated conditions, the seed set varied from 35.0 (JNS-4) to 49.6 percent (JNC-6). A maximum temperature of 24.5 to 25.0 °C, minimum temperature of 12.5 to 14.0 °C, bright sunshine (7-8 hours) and higher percentage of foliage wetness were found to be related with maximum flower opening under Palampur conditions. Among different genotypes, JNS-3 recorded highest seed set (6.6 percent) followed by JNC-1 (6.2 percent) in all types of baggings. These genotypes can be selected for the development of inbreds to be utilized in hybrid development programme in niger.

Key words: Niger, *Guizotia abyssinica* (L.f.) Cass, floral phenology, selfing, self compatibility, weather relations

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Response of chickpea seed germination to varying temperatures

SURENDER SINGH, DIWAN SINGH and VUM RAO*

*Dept of Agril Meteorology
CCS Haryana Agricultural University
Hisar-125004, India*

ABSTRACT

Fifteen cultivars of chickpea were evaluated by having vigour test viz. percent germination, shoot length, root length, dry matter per seedling, vigour index and growth rate index. These were determined in the laboratory of National Seed Project centered at Haryana Agricultural University, Hisar during 2005. The germination was below 90 per cent at 35°C temperature in HC-3, HK-1, HC-1, H-208, Gora Hisari and H Gaurav cultivars. At 25°C temperature, germination rate index was above 13.0 in most of the cultivars. Seed vigor (SG1) was maximum around 25°C. It is concluded that temperature had a strong influence on the germination and seed vigour of different chickpea cultivars.

Key words: Chickpea cultivars, germination rate index, seed vigour test, optimum temperature.

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Optimum fertilizer in relation to seasonal rainfall in pearl millet and groundnut crops in semi-arid vertisol of Rajkot (Gujarat, India) region

K.N.AKBARI¹, G.R.MARUTHI SANKAR², V.D.VORA¹, G.S.SUTARIA¹, M.K.KHISTARIA¹ and D.R.PADMANI¹

*All India Coordinated Research Project for Dryland Agriculture, Junagadh Agricultural University,
Targhadia (Rajkot)–360003*

²Central Research Institute for Dryland Agriculture, Santoshnagar, Hyderabad–500059

ABSTRACT

A field experiment was conducted to select a sustainable treatment and optimize N in relation to seasonal rainfall for attaining maximum and economic yield of pearl millet in a semi-arid *Vertisol* (Rajkot, Gujarat state, India). The treatments were different combinations of urea, green leaf and compost Crops was raised in eight seasons with permanent and rotation strip

.Based on regression analysis, fertilizer N dose of 38 and 44 kg ha⁻¹ at crop seasonal rainfall of 250 mm; 55 and 64 kg ha⁻¹ at 500 mm; and 73 and 84 kg ha⁻¹ at 750 mm was found to be optimum for targeting maximum yield of pearl millet under permanent and rotation strips, respectively. Similarly, a dose of 25 and 29 kg ha⁻¹ at 250 mm; 42 and 49 kg ha⁻¹ at 500 mm; and 60 and 69 kg ha⁻¹ at 750 mm rainfall was optimum for attaining economic yield of pearl millet under permanent and rotation strips, respectively in a semi-arid condition. Similar results were obtained with groundnut crop.

Key words : Optimum rainfall, fertilizer application, economic yield, pearl millet, groundnut

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Sustainable rainfed crop sequence based on rainfall analysis under semi-arid vertisol

D.R.PADMANI, G.R.MARUTHI SANKAR, K.N.AKBARI, M.S.GAJERA, G.S.SUTARIA and M.K.KHISTARIA

All India Coordinated Research Project for Dryland Agriculture, Junagadh Agricultural University, Rajkot-360003

¹Central Research Institute for Dryland Agriculture, Santoshnagar, Hyderabad-500059

ABSTRACT

Based on field experiments conducted with 12 crop sequences (groundnut-groundnut, groundnut-cotton, groundnut-castor, groundnut-pearl millet, groundnut-sesame, cotton-cotton, cotton-castor, cotton-pearl millet, cotton-sesame, castor-castor, pearl millet-pearl millet and sesame-sesame) with 3 fertilizer treatments (control, integrated nutrient management (INM) and recommended dose of fertilizer for different crops) during 1999 to 2005, a statistical selection is made to identify an efficient crop sequence for attaining maximum sustainable yield in a semi-arid Vertisol at Rajkot, Gujarat state. The results revealed that rainfall in individual month, differences of crop sequences, fertilizer treatments and their interaction were significant for groundnut pod equivalent yield. Based on ranking of crop sequences for mean yield and sustainable yield index, groundnut-sesame was found to be highly efficient.

Key words: Crop sequence, nutrient management, rainfall, sustainable yield index.

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Study on growing degree days and population dynamics of thrips, *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae) on castor

P.V. PATEL, M.F. ACHARYA, M.V. GEDIA and H.J. VYAS

Department of Entomology

College of Agriculture, Junagadh Agricultural University, Junagadh

ABSTRACT

Investigations on population dynamics against thrips on castor was carried out during the year 2002-03 and 2003-04 at Main Oilseeds Research Station, Junagadh Agricultural University, Junagadh. Peak activity was observed in 44th standard week (first week of November) and 42nd standard week (third week of October) by registering 196 and 193 thrips per flag leaf during 2002-03 and 2003-04, respectively. Maximum temperature, sunshine hours and evaporation exhibited significant positive correlation whereas, morning/afternoon humidity showed significant negative association. Path analysis showed that maximum / minimum temperature exhibited highly significant positive direct effect. Stepwise regression analysis further revealed that an increase in 1°C of maximum temperature increased the thrips population by 18.44 and 16.51 per flag leaf during 2002-03 and 2003-04, respectively, whereas a unit increase in minimum temperature and morning relative humidity reduced the thrips population to the tune of 7.19 and 2.22 per flag leaf during 2002-03 and 2003-04, respectively. The requirements of heat units for thrips build up and to attain the peaks were almost similar in both the years. Relatively higher heat units in the month of October with the end of rainy season indicated the build up of thrips population.

Key words: *Scirtothrips dorsalis*, castor, population dynamics, GDD, path analysis