



ABSTRACTS OF PAPERS

1. Optimum Size and Shape of Plot for Field Experiments on Wheat under North Gujarat Condition

G.K. Chaudhary, B.H. Prajapati, J.K. Patel,
R.I. Prajapati and J.M. Loria

A uniformity trial on wheat, cv. GW-322 was carried out at the Seed Technology Research Station, S.D. Agricultural University, Sardarkrushinagar during *rabi* season in the year 2009-10 to determine optimum size and shape of plot for field experiments using maximum curvature method and fair field Smith's variance method. Four rows each of one meter length i.e. 0.90 m² area was considered as basic unit. The variability as judged by coefficient of variation per unit area (C.V. %) decreased from 19.60% to 7.62% with increase in plot size from 1 unit to 100 units. A plot of 14.4 sq.m having 3.6 m width × 4 m length (i.e. 16 rows each of 4 m length) a rectangular shape of plot (net) was considered as optimum size and shape of plot for field experiments on cumin.

SD Agricultural University, Sardar Krushinagar

2. Optimum Size and Shape of Plot for Field Experiment on Mustard under North Gujarat Condition

B.H. Prajapati, G.K. Chaudhary, M.K.
Chaudhary and J.M. Loria

The optimum plot size for field experimentation on mustard crop (cv. GM 3) worked out using uniformity trial data. Two methods viz. (i) Maximum Curvature method and (ii) Fair-field Smith's variance law were used for the purpose. The optimum plot size of 20 basic units (5.0 m × 3.6 m) with 6 replications worked out by using maximum curvature method has more reliability. The Smith's law served as guide line only.

SD Agricultural University, Sardar Krushinagar

3. Robust Analysis of Block Designs

Ranjit Kumar Paul¹ and Lalmohan Bhar²

Many robust regression functions are available in the literature for its application to the linear regression model. But most of the functions are less efficient for their application to the design of experiments in the sense that they produce relatively larger variance of a set of orthonormal contrasts. The objective of the present paper is to develop a new objective function for M estimation for its application to the design of experiment. Bhar and Gupta (2001) modified the cook statistic for the detection of outliers in the design of experiments. We used this cook statistic for development of a new objective function, which will be applicable in the design of experiments. To this end, application of the new function has been shown with illustration. Since it is based on Cook-statistic, the overall robust analysis has given a clear picture on the behaviour of treatment effects. Using new objective function for M estimation, the analysis resulted in a valid conclusion. SAS software package version 9.2 has been used for analysis of the data.

¹Central Inland Fisheries Research Institute, Kolkata

²Indian Agricultural Statistics Research Institute, New Delhi

4. Construction of A Series of Balanced Ternary Rectangular Designs

H.L. Sharma¹, R.N. Singh² and R.B. Singh¹

In the present paper, a new method of construction of a series of balanced ternary designs (BTRD) using a series of rectangular design has been given by the addition of pairs of first or second associate treatments which occur less in those blocks. The association scheme of the constructed BTRD is the same as that of corresponding rectangular designs. The authors claim that BTRD based on rectangular designs would be certainly useful in fractional factorial plans and certain related problems. For an illustrative example, a table

of BTRD within the range of $R \leq 50$, $K \leq 10$ has been included.

¹Jawaharlal Nehru Krihi Vishwavidyalaya, Jabalpur

²Agricultural Research Institute, RAU, Pusa, Samastipur

5. Effect of Different Seed Rate and Spacing on Yield and Economics of Ginger (*Zingiber officinale* Rosc) Cultivation

D.K. Ghosh and A. Bandopadhyay

In a field experiment, conducted at Horticulture Research Station, Mondouri, BCKV, West Bengal to study the on effect of different seed rate and spacing on yield of ginger shows that among the five different spacing (20×15 cm, 20×20 cm, 25×20 cm, 25×25 cm and 30×20 cm) and two seed rhizome size (20 g and 30 g), increasing trend in yield per plant was observed with increase in spacing. The plants raised from the bigger seed rhizome (30 g) produced bigger clump 276.13 g. The maximum length of 10.75 cm and 10.68 cm and maximum breadth of 2.99 cm and 2.89 cm were recorded with 30×25 cm spacing in the respective years. In case of interaction effect, closest spacing (20×15 cm) in combination with bigger seed rhizome (30 g) produced highest yield per ha of 13.95 t and 11.04 t as compared to minimum yield of 9.00 t and 7.78 t with widest spacing (30×25 cm) in combination with smaller seed rhizome (20 g). It was observed that maximum cost of cultivation were recorded (Rs. 104,312) and (Rs. 101,146) in both the year respectively with 20×15 cm spacing and 30g seed size. The gross return (Rs. 175,597 and Rs. 155,362) were also highest with this treatment. The benefit: cost ratio was highest in P_5S_1 (2.16 and 2.29) followed by P_4S_1 (2.12 and 2.27) in the respective years.

Bidhan Chandra Krishi Viswavidyalaya, Kalyani

6. Construction of Equi-Neighbouring BIB Designs

Anurup Majumder and Aatish Kumar Sahu

Kiefer and Wynn (1981) developed the optimality conditions for one-order neighbour balanced or equi-neighbouring incomplete block designs. They also developed the conditions for minimum number of blocks to be required for construction of a neighbour balanced incomplete block designs. A series of equi-neighbouring BIB designs (EBIBD) has been developed

by using the method of insertion of one treatment to each of the blocks of an existing BIB designs (v , $b = pv$, $r = pk$, k & λ) with parameters $v^* = v$, $b^* = pv$, $r^* = p(k + 1)$, $k^* = k + 1$ and $\lambda^* = \lambda + \theta$, where θ is a positive integer if and only if $\theta = 2pkl(v-1)$ and p is a positive integer. The solutions of designs for prime v ($v \leq 37$) are also presented.

Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia

7. Response Surface Model with Neighbour Effects

Eldho Varghese and Seema Jaggi

Response Surface Methodology (RSM) consists of the experimental strategy for exploring the relationship between the response variable and the input variables and to develop an appropriate approximating relationship between them. It is used in situations where several input variables potentially influence some performance measure or quality characteristic of a process. In the literature, the work on RSM is done assuming observations to be independent and no effect of neighboring units. But in field experiments the units may experience overlap effects from neighbouring units. For example, in an experimental trial when the combination of pesticides is used, wind drift may cause the effect of spray spill over to adjacent plots. Hence, it is important to include the neighbour effects in the model to have the proper specification. We consider here a second order response surface model with interaction in which the experimental units i.e. plots assuming the plots to be placed adjacent linearly with no gaps. Conditions have been derived for the estimation of coefficients of second order response surface model. A method of constructing designs for fitting second order response surface model with interaction in which the experimental units i.e. plots experience the equal neighbour effects from immediate left and right neighbouring pots assuming the plots to be placed adjacent linearly with no gaps. Conditions have been derived for the estimation of coefficients of second order response surface model. A method of constructing designs for fitting second order response surface in the presence of neighbour effects has been developed.

Indian Agricultural Statistics Research Institute, New Delhi

8. Statistical Assessment of Long Term Effects of Soil and Weather Variables on Sustainable Finger Millet Productivity under Semi-arid Alfisols

G.R. Maruthi Sankar¹, B.M.K. Raju², G.N. Dhanapal³, B.K. Ramachandrappa⁴, P.K. Mishra⁵, K.L. Sharma⁶, M. Osman⁷ and A. Girija⁸

Based on the permanent manorial experiments on finger millet conducted during 1984 to 2008 under semi-arid alfisols at Bangalore, Karnataka in southern India, a detailed assessment was made by examining (i) multivariate regression models; (ii) principal component models; (iii) autocorrelation and auto-regressive error structures based on residuals; (iv) 4, 5 and 6-yearly moving averages of random variable yield and regressor variables; (v) testing of outlying observations of yield and regressor variables. The mean yield ranged from 537 kg/ha with coefficient of variation of 80% for control to 3167 kg/ha with variation of 23% for FYM @ 10 t/ha + 100% NPK treatment in the 25 year study. Based on multivariate regression analysis, 6 different combinations of regression models of yield attained by each treatment were calibrated as a function of different subsets of regressors of monthly rainfall of June to November, crop seasonal rainfall (CRF), crop growing period (CGP), soil N, P and K nutrients observed during 1984 to 2008. Based on the models, residuals were derived as a difference of the observed and expected yields and were standardized. The outlying observations were identified based on the large values of standardized residuals (SR) and were examined for deletion ($SR > 2$). The models were assessed for the serial dependence of residuals (autocorrelation of residuals), first-order auto-regressive error structures and refined after deletion of outliers. The improved estimates of coefficient of determination (R^2) and prediction error were derived and used for model selection. The analysis indicated that the years 1984 and 1986 were outliers for soil N, P and K nutrients; 1989 was an outlier based on SR values for all the 5 treatments; 2006 and 2007 were outliers for yield. After iteratively deleting the 5 outlying years, the models gave predictability in the range of 0.27 to 0.64 for different treatments indicating the superiority of model 6 in which all the 5 outliers were deleted. The prediction error of treatments was in a range of 339 to 701 kg/ha based on the revised model 6.

^{1,2,5,6,7,8}CRIDA, Hyderabad

^{3,4} University of Agricultural Sciences, Bangalore

9. Efficient Designs for Single Factor Microarray Experiments

Sukanta Dash, Rajender Parsad and V.K. Gupta

Microarray experiments are conducted to measure the relative expression level of thousands of genes within a particular cell population or tissue. In 2-colour cDNA microarray experiments, four basic experimental factors viz., array (A), dye (D), variety (V) and gene (G) are studied. These four factors give rise to 15 effects from which all the main effects and selected two-factor interactions viz. array-gene interaction (AG), dye-gene interaction (DG), variety-gene interaction (VG) are the seven effects of interest to the experimenter. Here, same set of genes is spotted on each array where Genes/ gene specific effects (G, AG, DG, VG) are orthogonal to global effects (A, D, V). Thus optimality aspects of designs for microarray experiments can, therefore, be studied leaving gene specific effects from the model i.e. by taking only array, dye and variety effects in the model. So here designs that are efficient under the model containing global effects are also efficient under the model containing both global and gene specific effects. Considering arrays as blocks, varieties as treatments and number of varieties that can be accommodated on each array as block size, classical block designs with block size 2 can be useful for microarray experiments. In 2-colour micro-array experiments, only 2-varieties labeled with two different dyes can be accommodated on one array, therefore, array effects should be taken as random. If array effects are random, then the model is a mixed effects model so robustness of designs that are efficient under a fixed effects model has been investigated under mixed effects model. Thus there is a need to obtain designs by considering array effects as random. Here, a new method has been developed to construct design and compare its efficiency in terms of A-optimality and D-optimality criterion with those of designs developed till today. It seems that these design construct using this method is more appropriate for mixed effect model and specially for row column design its efficiency is far better than those of design available.

Indian Agricultural Statistics Research Institute,
New Delhi

10. Construction of Optimal Multi-level Supersaturated Designs by Association Scheme

V.K. Gupta¹, Basudev Kole¹, Kashinath Chatterjee² and Rajender Parsad¹

A new method of constructing multi-level supersaturated designs has been proposed. The method of construction is based on the association between the rows of the design. An algorithm has been developed to construct such designs. The designs constructed by this method are both fNOD- optimal and $_2$ - optimal. A catalogue of 11 optimal multi-level supersaturated designs is also prepared. Another method of constructing optimal mixed-level supersaturated design has been given. This method generates designs by juxtaposing mixed orthogonal arrays of strength two with uniform designs. Mathematical expression for E(fNOD) and E($_2$) criteria and their lower bound have been obtained for these designs by exploiting the combinatorial properties of mixed orthogonal arrays and uniform designs.

¹Indian Agricultural Statistics Research Institute, New Delhi

²Visva Bharati University, Santiniketan

11. Estimation of Crop Loss in Mango cv. Himsagar due to Infestation of Mango Hopper

Arunava Samanta and Vishal Walmikrao Dhote

The experiment was conducted during 2009-10 at Horticulture Research Farm, Mondouri, BCKV, Mohanpur, Nadia, West Bengal, India to assess the yield loss in mango due infestation of mango hopper and economics of its control. It was evident that protected plots recorded significantly lower number of hoppers (average 4.25 per twig or panicle) over unprotected plots (average 17.05 per twig or panicle) and also observed that protected plots recorded significantly higher number of fruits both at marble stage (363 fruits per 100 panicles) and harvest stage (190 fruits per 100 panicles) as well as higher yield (42.67 Kg/100 panicles and 60.17 Kg/plant).

Bidhan Chandra Krishi Viswavidyalaya, Nadia

12. Measurement of Sustainability in the Production Behaviour of Vegetables and Cereals in SAARC Countries to Meet the Challenges of Future Demand

Pradip Kumar Sahu¹ and Rakhee Banerjee²

The term sustainability is a multifariously defined phenomenon. It integrates mainly three components- environmental health, economic profitability and social and economic equity. The principle of sustainable production is to meet the needs of the present generation without compromising the ability of the future generations to meet their own needs. Productions of cereals and vegetable in a sustainable manner are of prime importance. In the present endeavor an attempt has been made to examine the growth and trend in area, production, productivity, waste and actual availability of cereals and vegetables in major SAARC countries namely Bangladesh, India, Nepal and Pakistan with an objective to visualize the behaviour of the production process of these crops to meet the future requirement of these countries. Forecasting of production behaviour for these crops with the help of Box-Jenkins method reveals that 54.43 mill tones of cereals and 0.709 mill tones of vegetable would be available for 18.14 crores (projected, FAO, 2006) people of Bangladesh during the year 2015 and the figures could be 229 and 58.46 million tones respectively for a population of 126.4 crores (FAO projection) in India during the same year. Higher sustainability of vegetable productivity is shown by India, next to World (Singh 1990) and Nepal (ICARDA 1994). The study also reveals that a sizable percentage of production of these crops are wasted because of various reasons and thereby reducing the actual availability. The study suggests for improvement in productivity of these crops in a sustainable manner so as to meet the future requirements of the crops.

¹*Bidhan Chandra Krishi Viswavidyalaya, Nadia*

²*Haldia Institute of Technology, Haldia*

13. Block Designs Robust against the Presence of an Aberration in a Treatment-control Setup

Amrita Biswas

In the present paper the problem of finding designs insensitive to the presence of an outlier in a treatment-control block design setup for estimating the set of

elementary contrasts between the effects of each test treatment and a control treatment is considered. The criterion of robustness suggested by Mandal (1989) in block design setup for estimating a full set of orthonormal treatment contrasts is adapted here. A new class viz. Partially Balanced Treatment Incomplete Block Designs (PBTIB designs) is introduced and it is shown that balanced treatment incomplete block designs (BTIB designs) and PBTIB designs, under certain conditions, are robust in the above sense. Such designs are important in the sense that the inference on the treatment contrasts under consideration remain unaffected by the presence of an outlier.

University of Calcutta, Kolkata

14. A Class of Estimators for Population Variance in Two Occasion Rotation Patterns

G.N. Singh¹, Priyanka², Shakti Prasad¹ and Sarjinder Singh³

A variety of practical problems can be addressed in the framework of rotation (successive) sampling. The present work is an attempt to present a sample rotation pattern where sampling units are drawn on two successive occasions. The problem of estimation of population variance on current (second) occasion in two-occasion successive (rotation) sampling has been considered. A class of estimators has been proposed for population variance, which includes many estimators as a particular case. Asymptotic properties of the proposed class of estimators are discussed. The proposed class of estimators is compared with the sample variance estimator when there is no matching from the previous occasion. Optimum replacement policy is discussed. Results are supported with the empirical means of comparison.

¹Indian School of Mines, Dhanbad

²Shivaji College, University of Delhi, Delhi

³Texas A&M University – Kingville, USA

15. Ratio Estimator for Finite Population Mean in Double Sampling

Bhim Singh

This study presents a new ratio estimator for estimating finite population mean using auxiliary information in double sampling based on the Prasad

(1989) estimator. We obtain mean square error (MSE) equation of proposed estimator and show that proposed estimator is more efficient than traditional ratio estimator in double sampling as suggested by Sukhatme (1962) in all conditions. In addition, this theoretical result is supported by the three numerical illustrations.

College of Horticulture & Forestry (MPUAT), Jhalrapatan, Jhalawar

16. Estimation of Finite Population Mean Subsequent to Preliminary Test of Significance of Correlation Models in Repeated Surveys

B.V.S. Sisodia¹, S.P. Singh² and Nidhi²

In repeated surveys, the correlation structure between the values of the same characteristics under interest between any two occasions plays an important role in improving the estimates of population parameters on the current occasion. Various correlation structures were assumed in literature (Yates, 1949; Patterson, 1950; Tikkiwal, 1951; Singh 1968) and the improved estimators were developed for the current occasion. In the present paper, these correlation structures were explored by using test of significance and consequently a preliminary test estimator (PTE) of population parameter is developed for current occasion. A case of three occasions are considered for simplicity. The properties of PTE are studied and its efficiency is evaluated with usual estimators. It has been found that under certain situations, the PTE performed well over usual estimators.

*ND University of Agriculture & Technology, Faizabad
RAU, Pusa, Samastipur*

17. Comparison of Some Ratio Estimators using Linear Transformation

Amar Singh, B.V.S. Sisodia, Sunil Kumar and K.K. Mourya

Various authors have proposed different version of linear transformation of the auxiliary variable (x) in sample surveys to reduce the bias and mean square error (MSE) of usual ratio estimator. Notable among them are Mohanty and Das (1971), Reddy (1974), Srivenkatramana (1978), Das and Tripathi (1980), Sisodia and Dwivedi (1981), Singh and Kakran (1993), Mohanty and Sahoo (1995), Upadhyay and Singh (1999), Swain (2009) etc. A comprehensive review of

transformed ratio estimators is presented in this paper. Moreover, when a prior value of y -intercept in the simple linear regression of y on x is available, a linear transformation of study variable y is suggested to find out another modified transformed ratio estimator. Following Swain (2009), a linear transformation of x based on minimum and maximum values of x is also proposed and accordingly another new transformed ratio estimator is developed. Properties of proposed modified transformed ratio estimators are studied. An empirical study with some real populations is also carried out to highlight the precision of transformed ratio estimators.

ND University of Agriculture & Technology, Faizabad

18. Estimation of Finite Population Mean in Stratified Sampling under Super Population Model using Prior Value of some Regression Parameters

R.P. Kaushal and B.V.S. Sisodia

Following the work of Bouza (1990, 1994), two sets of shrunken estimators are developed under the model M and M_h respectively, in stratified sampling, where slopes of the models are common and uncommon across the strata. The proposed shrunken estimators have been found more efficient and robust as compared to that of Bouza (1990, 1994).

ND University of Agriculture & Technology, Faizabad

19. Hybrid Fuzzy Classification of Massive Data Sets

Sumanta K. Das

Machine analysis of massive data sets (MDS) is a challenging task. Most of the statistical and numerical algorithms fail for MDS. In this paper, an optimal method of MDS classification has been proposed by hybridizing the well known fuzzy c-means clustering (FCM) algorithm and the fuzzy supervised classification (FSC) via fuzzy cluster space representation (FCSR). Although FCM is widely used fuzzy clustering algorithm, it can not identify the information classes with its spectral classes and the CPU time required by this algorithm is very large. On the other hand the FSC is simple and easy to implement but it requires sufficient number of training data which is not easily available. This paper utilizes the power of

random sampling for estimating population parameters from the clustered data.

Institute for System Studies and Analysis, DRDO, Metcalfe House, Delhi

20. Official Statistical Database and Data Mining : A Case Study of Forest Sector

M. Sivaram

In India, besides National Statistical Organizations, various government departments under different ministries collect, compile and publish huge amount of official data for their administrative, monitoring and policy making purposes. These data are generated from registration and administration records and by conducting sample surveys. The radical technological changes and adoption enabled large number of e-governance initiatives in the government to keep pace with the growing economy. This has further accelerated the voluminous of data being accumulated by various agencies. However, the official statistical databases maintained by various agencies are not fully explored. In this paper, we illustrate the development of forestry statistical database for Kerala State and its data mining applications to sustainable forest management. A computerized database and data retrieval system on forest resources of Kerala State, India was developed. The database contains the spatial-temporal data collected from different sources covering themes such as forest area, forest plantations, production, supply, demand and prices of forest products. The data in the database are stored in popular file formats such as Excel (xls), Word (doc) or Acrobat (pdf). The database has an interface developed using 'Microsoft Visual Basic'. It helps to retrieve the required data in a few clicks. The graphical representation of the data, data source and glossary are also integrated in the system.

The following two major data mining applications of the database are also presented in the paper.

- i. Projection of availability of teak wood from forest plantations was undertaken under different scenarios, taking into account the factors such as species-mix, age structure, rotation age, productivity and planting rates. The projections indicated that the promotion of teak outside the forests such as home gardens and farmlands would help to bridge the gap between future demand and supply.

ii. The long term trends in the real prices (deflated current prices) of teak wood in different girth classes for the period 1956 to 2005 were analyzed by fitting different spline models. The analysis indicated that there was a declining trend in real prices since 1995 probably due to increased availability of substitute materials in the market. However, of late, the prices of teak wood have been increasing. The short-term price forecasts of teak wood were made using artificial neural network and auto-regressive integrated moving average models. The forecasts indicated that the quality teak wood would fetch high returns. Therefore, efforts should be made to produce quality teak wood.

Kerala Forest Research Institute, Peechi, Thrissur

21. Design and Development of Data Mart for Consumption Expenditure Survey Data

Debasis Dutta, V.K. Mahajan and Anil Rai

Planners, researchers, development agencies and Government of India require information on consumption expenditure for further studies and evolving realistic strategies for improvement of the standard of living of the people of this country. Data is also required for keeping watch on consumption of different commodities including durables and non-durables and change in life style of the people of different states. Further, there is a need to study the pattern of consumption expenditure in order to relate it to some other aspects such as religion, social group, land holding, household type etc. Indian Agricultural Statistics Research Institute (IASRI), New Delhi has designed and implemented a Central Data Warehouse (CDW) under a National Agricultural Technology Project (NATP) Mission Mode sub-project entitled "Integrated National Agricultural Resources Information System (INARIS)". In this CDW, 13 different data marts related to various subjects in agriculture were designed, implemented and integrated. In this article, attempt was made to discuss design and development of data mart for consumption expenditure survey data in relation to available NSSO data on consumption expenditure in the country. Different aspects starting from Dimensional Modeling, hierarchies in the data mart, Fact design and development of power cubes (OLAP cubes) were also discussed. This article will provide guidelines for

design and development of similar type data marts in agricultural sector.

Indian Agricultural Statistics Research Institute, New Delhi

22. e-Governance Projects in West Bengal – Useful tool to Capture and Analysis Data for Better Governance

Manas Kumar Sanyal, Sudhansu Das and Sajal Bhadra

The objective of this paper is to explore the e-Governance initiatives taken by Government of West Bengal (GoWB) as an enabling force in its efforts to meet the present and emerging challenges of a digital age upon the people in West Bengal. e-Governance projects are useful tool for GoWB to capture data and analyze them to generate Management Information System (MIS) reports for better management. e-Governance highlights several elements of Good Governance such as transparency, accountability, participation, social integration, public financial management reform & development. GoWB has taken e-Governance initiatives, aiming at improving the quality, accessibility and effectiveness of government services to citizens and business with the help of Information and communications technologies (ICTs). This study is based on research and personal interviews of selected representatives of GoWB. The findings of the study is what are the holistic e-Governance initiatives taken by GoWB, how the e-Governance projects are implemented, how fast and organized these e-Governance projects are in capturing data, how useful they are to generate MIS reports for governance process re-engineering.

Kalyani University, Kalyani

23. Classification of Spatial Attributes with GIS and Spatial Statistics Analysis

Bijoy K. Handique¹ and Gitasree Das²

Recent advances in Geographic Information System (GIS) along with satellite remote sensing have added new dimensions in handling spatially located massive data sets in the field of agriculture, forestry, geology etc. Spatial statistics analytical techniques with advanced GIS software help in analyzing the spatial order and association of multi-dimensional variables

and classify them for various decision making. An earlier study carried out by Handique and Das (2007) demonstrated the potential application of GIS and spatial statistics analysis to categorise timber species richness hotspots and emphasized the need of studying species diversity and disturbance indices. In this paper an attempt has been made to demonstrate classification of spatial attributes with GIS and spatial statistics analysis to categorise timber species diversity hotspots in Langting Mupa reserve forest, the biggest reserve forest in the district of North Cachar Hills of Assam. Satellite remote sensing data provided the required stratification base for optimal ground sampling for collection of field data on diversity of timber species measured by Shannon Weiner Index. Comparison has been made for locations of timber species richness hotspots with diversity hotspots. Three level of categorization has been done for diversity hot spots and cold spots based on statistical significance and recommendations made for conservation planning.

¹North Eastern Space Applications Centre, Dept. of Space, Umiam, Meghalaya

²North-Eastern Hill University, Shillong, Meghalaya

24. Learning Rules using Decision Tree Induction for Prediction of Mature RNA

Rajni Jain¹ and Amarendra Kumar Mishra²

The role of bioinformatics in genomics and molecular biology research can be likened to the role of intelligence gathering in battlefield. Intelligence is clearly very important in leading to a victory in the battlefield. Computational algorithms are the heart of bioinformatics as they enable predictions, understanding and interpretation of the data generated from laboratory experimental research carried by biologist. The article discusses Decision tree induction and its application for generating rules from a dataset extracted from biological databases. Data regarding Pre-miRNA of Anopheles was compiled from various databanks available on Internet using many tools. The data is finally converted to 16 attributes. Class attribute is true or false and shows the status regarding whether the mi-RNA will lead to production of mature RNA. The dataset after preprocessing contained 132 instances. Different trees were induced from different sets of features are illustrated by mapping the corresponding trees to rules. Rules are obtained by following the path from tree to leaves. Ten fold cross validation scheme

was used for evaluating test accuracy. Coverage of a rule means fraction of total instances which are covered by a rule. Accuracy of a rule means fraction of cases predicted correctly within the coverage of a rule. The paper illustrated that coverage and accuracy of rules are the important parameters for selection of rules by the user. The results are encouraging and can be applied to other species. Other machine learning techniques especially Support Vector Machine, Principal Component Analysis can also be very useful for such type of predictions in bioinformatics domain.

¹National Centre for Agricultural Economics & Policy Research, New Delhi

²Indian Agricultural Research Institute, New Delhi

25. Blending Rough Sets and Clustering Methods for Discovery of Patterns

Alka Arora¹, Rajni Jain² and Shuchita Upadhyaya³

Majority of clustering algorithms gives results which are confined to number of clusters and member objects in those clusters and lacks in generating patterns of obtained clusters. Approach presented in this paper is based on integration of reduct from rough set theory with obtained clusters and results in pattern extraction for better understanding of clusters. Reduct is a set of attributes which can distinguish entities in the dataset as if the entire set of given attributes are considered. The proposed method involves three steps. First step is to generate clusters using EM clustering from the given dataset. Second step involves identification of reducts from each cluster. As reduct attributes in individual clusters give irrelevant attributes for the corresponding cluster, these are removed from the corresponding cluster. Third step is to rank all the remaining attribute in the cluster. Fourth and final step is to concatenate relevant attributes to formulate concise cluster patterns based on the ranking done in the previous step. The proposed approach is validated using benchmarking datasets from UCI machine learning repository. It is observed that patterns provide meaning to individual clusters and also help in charactering the clusters.

¹Indian Agricultural Statistics Research Institute, New Delhi

²National Centre for Agricultural Economics & Policy Research, New Delhi

³Kurukshetra University, Kurukshetra

26. Discrepancy in Fitting between Log-normal and Gamma Models: An Illustration

Rabindra Nath Das

Analysis of positive observations is generally done using log-normal and gamma models. For constant variance, log-normal and gamma model fits give almost same regression coefficient estimates, except the intercept. It is difficult to interpret about the estimates from these two model fits for non-constant variance. This article focuses the discrepancy in fitting between log-normal and gamma models for non-constant variance. It shows that for non-constant variance, even though the estimates and the measures of model selection criteria are almost same in both the models, but the fittings are not identical. An example illustrates this point.

The University of Burdwan, Burdwan

27. Models to Predict the Yield of Soybean Grown under Different Tree Species in Agroforestry System

S.N. Megeri, R. Veena and S.J. Patil

In this article an effort is made to fit a model for the yield of soybean crop grown in between the tree species at one meter distance from each tree species. Here we have considered seven tree species namely *Azadirachta indica*, *Dalbergia latifolia*, *Prosopis cineraria*, *Ceiba pentandra*, *Terminalia bellarica*, *Mangifera indica*, *Tamarindus indica* and soybean as field crop in tree interspace. The required data was collected from AICRP (All India Co-ordinated Research Project) on agroforestry, UAS Dharwad. The models for the yield of soybean grown under *Azadirachta indica*, *Prosopis cineraria* and *Terminalia bellarica* were Rational function followed by Hoerl model and under *Dalbergia latifolia* and *Ceiba pentandra* Rational function followed by Sinusoidal model and also under *Mangifera indica* and *Tamarindus indica* Hoerl model followed by Rational function were found best fit based on R^2 and standard error. The R^2 values were significant at one per cent level of significance for all the models. In general Rational function was better fitted for all the tree combinations. Based on the best fitted models the soybean yield was forecasted for next six years. This study indicates that one can grow

soybean in between the above tree species up to eleven years.

University of Agricultural Sciences, Dharwad

28. Non-linear Growth Studies for Forecasting Area of Paddy in Madhya Pradesh

R.B. Singh, H.L. Sharma and Mahesh Malviya

Rice (*Oryza sativa L.*) is the second largest crop grown in the world in terms of area. It occupied the prime position among the food crop and largest area among all crop area. Madhya Pradesh has made great production of rice and has created large potential. Looking to the importance of crop in M.P. an attempt has been made to apply some non-linear mechanistic growth models to forecast paddy area in M.P. For this purpose the data of paddy area of M.P. were collected from the Directorate of Economics and Statistics Govt. of M.P. Bhopal from 1980-81 to 1904-05 and were utilized for developing forecast model and keeping one year 2005-06 data for validation of the model. Data were subjected to fitting of mechanistic growth models viz Logistic, Gompertz, Monomolecular and Richard. The Logistic and Gompertz models were found to be appropriate for forecasting the area of Paddy in Madhya Pradesh.

Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur

29. Application of ARIMA Methodology for Modelling and Forecasting of India's Pigeonpea (*Cajanus cajan*) Production

Sarika and M.A. Iquebal

An empirical study of modelling and forecasting time-series data of pigeonpea production in India has been described in this paper. Box-Jenkins ARIMA time-series methodology was considered for modelling and forecasting country's pigeonpea production data (1969-70 to 2007-08). The augmented Dicky Fuller (ADF) test was applied to test stationarity in data set. Root Mean Square Error (RMSE), Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) were used to identify the best model. The performance of fitted model was examined using Mean Absolute Error (MAE), Mean Percent Forecast Error (MPFE), Root Mean Square Error (RMSE) and Theil's Inequality Coefficients (TIC). ARIMA (2, 1, 0) model performed better among other models of ARIMA family for

modelling as well as forecasting purpose. One and two-step ahead forecast value for year 2006-07 and 2007-08 for India's pigeonpea production was computed as 2.54 and 2.53 mt. with standard errors 0.29 and 0.31, respectively.

Indian Institute of Pulses Research, Kanpur

30. Forecasting of Cotton Area and Yield by using ARIMA Model

S.N. Megeri, C. Prabhakara, V. Puneeth and Y.N. Havaladar

In this article an effort is made to forecast the area and yield of Cotton by considering ARIMA (auto regressive integrated moving average) time series model since it is most prominent commercial crop grown widely. Cotton production has been an important human activity since prehistoric times, and cotton clothing dominated the clothing market before man-made fibre was invented. For present study the area and yield data of Cotton was collected from 1950-51 to 2007-08. Different ARIMA (p, d, q) models were tried and the best model obtained were ARIMA (1,0,1) and ARIMA (0,1,0) for area based on AIC and SBC. However based on the limits for prediction ARIMA (1,0,1) found to be best. Similarly for yield ARIMA (0,1,0) was best. Hence the area and yield was forecasted using selected model and they are in close agreement.

University of Agricultural Sciences, Dharwad

31. Forecasting of Rice Area and Yield by using ARIMA Model

S.N. Megeri, V. Puneeth, C. Prabhakara and Y.N. Havaladar

In this article an effort is made to forecast the area and yield of rice by considering ARIMA (auto regressive integrated moving average) time series model. For this study the yield and area data of rice was collected from 1950-51 to 2007-08. Different ARIMA (p, d, q) models were tried and the best model obtained for both area and yield was ARIMA (0, 1, 1) based on AIC and SBC. The area and yield forecasted using the model and actual values are in close agreement with forecasted.

University of Agricultural Sciences, Dharwad

32. Weather based Forecasting Model for Crops Yield using Neural Network Approach

Ratna Raj Laxmi¹ and Amrender Kumar²

Application of Neural Networks (NNs) for crop yields (rice, wheat and sugarcane) forecasting using Multi-Layer Perceptron (MLP) architecture with different learning algorithm has been attempted. For development of neural network based forecast models, yields of crop at district level (Uttar Pradesh state, India) was considered as output variable and indices of weather variables viz. maximum and minimum temperatures, rainfall and morning relative humidity were considered as input variables. Forecasts based on MLP architecture using Conjugate gradient descent algorithm for learning have been found to be close to the observed ones in most of the cases. The findings of the study substantiates that neural networks possess potential for prediction purposes.

¹Maharshi Dayanand University, Rohtak

²Indian Agricultural Statistics Research Institute, New Delhi

33. Modelling and Forecasting of Chickpea (*Cicer arietinum*) Production in Madhya Pradesh using Artificial Neural Networks Methodology

M.A. Iquebal and Sarika

Madhya Pradesh is known as chickpea bowl of the country which shares 40% in the national chickpea production. Neural networks are used increasingly as statistical models. Artificial neural network (ANN) is a technique with flexible mathematical structure which is capable of identifying complex non-linear relationship between input and output data without attempting to reach understanding in to the nature of the phenomena. In present study, applicability of multi layer perceptron (MLP) neural network for modeling and forecasting of chickpea production (1950-51 to 2008-09) in Madhya Pradesh was investigated. STATISTICA 9.0 software package was used to train the neural networks. Performance of fitted model was examined using R^2 , mean absolute error (MAE), root mean square error (RMSE) and mean absolute deviation modulus (P). MLP (1-6-1) model performed best in terms of having minimum mean square errors (MSE) for training, testing and validation sets. One and two-step ahead forecast value for year 2007-08 and 2008-

09 for chickpea production was computed as 2.02 and 2.18 million tonnes which were closer to the actual values 1.91 and 2.55 million tonnes respectively. Hopefully in future, research workers would start applying not only MLP but also some of the other advanced ANN models, like “Radial basis function (RBF) neural networks” in their study.

Indian Institute of Pulses Research, Kanpur

34. Artificial Neural Network (ANN) Modeling and its Application in Forecasting India's Rice Production

S. Ravichandran

Rice production in India is an important part of the national economy. India is the world's second largest producer of white rice, accounting for 80% of all world rice production. Rice is India's preeminent crop, and is the staple food of the people of the eastern and southern parts of the country. Modelling and forecasting all-India rice production is carried out by utilising data on all-India rice area, production and yield for the period 1950-51 to 2008-09 along with all-India rainfall data from June to September for the corresponding period using various time series modelling methodologies such as Autoregressive Integrated Moving Average (ARIMA) and Artificial Neural Network (ANN). Autoregressive integrated moving average (ARIMA) model is a generalization of an autoregressive moving average (ARMA) model. These models are fitted to time series data either to better understand the data or to predict future points in the series (forecasting). They are applied in some cases where data show evidence of non-stationarity, where an initial differencing step (corresponding to the “integrated” part of the model) can be applied to remove the non-stationarity where as ANN is an information processing system that roughly replicates the behaviour of a human brain by emulating the operations and connectivity of biological neurons. ANN modelling methodology performs better for modelling and forecasting time-series data. Modelling rice production data is carried out using ANN methodology by making use of time series production data of the country as a whole. Time series data is obtained from the Directorate of Economic and Statistics, Government of India along with rainfall data obtained from Indian Meteorological Department (IMD). Developed model is utilized for forecasting kharif 2010 rice production.

Modelling and forecasting data on all-India rice production is carried out by making time-series data on all-India rice area, production and yield during 1950-51 to 2009-10 along with all-India rainfall data for the corresponding period including the rainfall received by the country during July 2010. India received good monsoon rainfall in 2010. As per Indian Meteorological Department, monsoon during 2010 is normal. Based on the data on rice production and rainfall for the period 1950-51 to 2009-10, ANN models were developed using various ANN algorithms by making use of 70% of the data for training the model, 20% for testing and remaining 10% of data is utilised for validating the developed model. Forecasting was carried out by making use of the most efficient model which satisfied the goodness of fit of statistical modelling. Based on the best developed ANN model, prediction of rice production for the year 2010-11 was worked out separately for kharif and rabi. Rice production for 2010-11 would be 98.7 million tons out of which kharif rice production would be around 80 million tons.

Directorate of Rice Research, Hyderabad

35. A Study on Forecasting Prices of Mustard Oil by ARIMA Methodology and Artificial Neural Networks

Abhishek Singh and G.C. Mishra

Forecasting of prices of commodities specially those of agricultural commodities is very difficult because they are not only governed by demand and supply but by so many other factors which are beyond control like weather vagaries, storage capacity, transportation etc. In this paper time series namely ARIMA (Autoregressive Integrated Moving Average) methodology given by Box and Jenkins has been used for forecasting prices of edible oils and this approach has been compared with ANN (Artificial Neural Network) methodology.

Banaras Hindu University, Varanasi

36. The Estimates of Parameters of Mango Hopper Population with Special Reference to Discrete Probability Distributions

Manoj Kanti Debnath, H.L. Sharma and S.B. Das

In recent years, the application of probability distributions has attracted increasing attention of

scientists who are associated with the research of insect-pests for describing the innate unpredictability in the event to be observed from the field. Present research work was carried out at department of Mathematics and Statistics JNKVV, Jabalpur (MP) during Rabi season 2008-09. The data on occurrence of mango hopper were gathered since the incidence of pest. Three suitable probability distributions. (Binomial, negative binomial and Poisson distribution) were suggested as the methods for explaining the inherent variation in the occurrences of mango hopper population and their parameters estimated by method of proportion of zeroth cells, method of maximum likelihood and method of moments. The Negative binomial distribution was found to be adequate for describing the inherent variability of the mango hopper population in trunk and secondary branch where as Poisson distribution is suitable for describing the spatial spread of mango hopper only in tertiary branch. The method of proportion of zeroth cell was found to be better estimation procedure in the fitting of negative binomial distribution but method of moments was found to be better in the fitting of Poisson distribution for estimating the parameter of the model.

Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur

37. Using Logistic Regression to Fit Proportional Odds Models to CD4 Counts of People Living with HIV/AIDS

Prabhakar, D.M. Basavarajaiah, Mamatha Kale, Sadaksharappa, N. Vidyashankar

A total of 497 patients were selected from cohort prospective and non concurrent method and classified into 'Low group' or a 'Medium group', ART was started based on the CD4 count, (threshold CD4 Count < 250 cells/microL and > 250 cells/microL). Associated risk factors were analyzed by conditional logistic regression; change in CD4 count was evaluated. The mean age of HIV patients was 32.90 years and the majority (63%) were men. 484 patients were initiated ART at CD4 < 250 (IQR 49-125) and 14 patients initiated at CD4 > 250 (IQR 250-375). Patients initiated at CD4 > 250 were 12.5% less likely to die (aHR 0.31, 95% CI 0.19-0.49), and 20% less likely to be lost to follow-up (aHR 0.59, 95% CI 0.41-0.84). Using subject decision CD4 count as predictor variable (The variable CD4 < 250 at start ART and >250 no start ART were coded : Code 1 and Code 0 respectively). The model was constructed by an iterative maximum likelihood

procedure – 2 log likelihood statistics was very small (107.49) with Cox & Snell R² (0.013) and mean CD4 count was (458±36.10). It depicts that better the CD4 count at the start of ART more the mongevity of life.

Bowring and Lady Curzon Hospitals, Bangaluru

38. Initiation of (HIV/AIDS) Antiretroviral Therapy and Associated Reduction in Mortality, Loss-to follow up Trend in Bowring and Lazy Curzon Hospotals

Prabhakar, D.M. Basavarajaiah and Sadaksharappa

The latest World Health Organization guidelines recommend initiating antiretroviral therapy (ART) at CD4 < 250 cells/mm³. However, donors and national governments are reluctant to support implementation due to uncertainty regarding feasibility and relative benefit. We assessed outcomes at four years of monthly cohort comparing early and late initiation.

Bowring and Lady Curzon Hospitals, Bangaluru

39. Statistical Modeling on Prevalence Rate and Effect of Seropositive Cases in PLHA

K. Maheshappa, K.S. Wali and D.M. Basavarajaiah

AIDS is devastating disease caused by HIV, which is transmitted by either sexual or other contacts in which body fluids are exchanged, the first case was reported among homosexual men in the USA 1981. It was reached pandemic proportions, as no country in the world is free from HIV.

University of Agricultural Sciences, Bangaluru

40. Statistical Learning Theory for Fitting Multimodal Distribution to Rainfall Data: An Application

Himadri Ghosh and Prajneshu

Promising methodology of "Statistical Learning Theory" for estimation of multimodal distribution is applied in real data sets. The "tail" of the p.d.f. is estimated by a parametric-tail model through Hill's, UH and Moment methods. Further, the "body" is estimated by nonparametric Structural risk minimization method of empirical distribution function under regression set up. As an illustration, rainfall data for meteorological subdivision of Orissa, India during the period 1871-

2006 are used. It is shown that Hill's method has performed the best for tail density.

Indian Agricultural Statistics Research Institute, New Delhi

41. Use of Data Reduction Techniques in Crop Yield Forecasts

Ranjana Agrawal and Chandrahas

Weather based modeling is one of the major approaches for forecasting crop yields. The approach utilizes data on various weather variables affecting crop yield. Weather affects crop differently during different stages of crop growth. Thus extent of weather influence on crop yield depends not only on the magnitude of weather variables but also on the distribution pattern of weather over the crop season which, as such, calls for the necessity of dividing the whole crop season into fine intervals. This will increase number of variables in the model and in turn a large number of parameters will have to be evaluated from the data. This will require a long series of data for precise estimation of the parameters which may not be available in practice. Thus, a suitable data reduction technique is required which converts weather variables in different periods during the crop season to relatively smaller number of manageable variables which could be used in the model. Four approaches have been studied for the purpose viz. weighted weather indices, discriminant function, principal component analysis and factor analysis using data of wheat yield in various districts of Uttar Pradesh. Results revealed that principal component analysis and factor analysis were not found appropriate in most of the cases. Out of the remaining two, in some cases discriminant function approach performed better than weather indices based approach whereas in some cases, reverse trend was observed. As such, out of these two, none of the method revealed uniform superiority over the other.

Indian Agricultural Statistics Research Institute, New Delhi

42. Trend and Changing Direction of Export of Cashew nut from India

Y.N. Havaldar, K. Padmanaban and S.N. Megeri

Cashew is one of the most important dollar earning crops of the country. Cashew held the third position by

contributing 0.44 per cent of the total export earnings of the country (2006-07). The markov chain analysis was attempted through linear programming method to assess the transition probabilities for the major cashew kernel export markets. The major cashew kernel markets were categorised as stable market (USA, Netherland, UAE, France and Others) and unstable markets (United Kingdom and Japan) based on the magnitude of transition probabilities. The cashew kernel export was estimated to be 2677.74 crores during the year 2015. The country needs to prepare a strategy to ease out the supply side constraints to meet the growing market demand. It was estimated that during 2015 the major cashew kernel export destination would be USA (32.61 per cent), Netherland (8.06 per cent), UAE (12.16 per cent), UK (4 per cent), Japan (3.33 per cent), France (3.06 per cent), others (36.76 per cent). The increasing share of other countries clearly shows the need to explore and exploit the market potential of other countries. Efforts are also needed to improve the efficiency of production and quality in order to stabilise the markets and also to make the product acceptable and price competitive in other importing countries. The export of cashew kernel almost constant in the initial study period, after it showed increasing trend up to 2008. Then it started to decline. Because, the Vietnam and Brazil emerged as stiff competitors to the Indian cashew industry and some of the African countries stopped the export of raw cashew nut to India.

University of Agricultural Sciences, Dharwad

43. Some Ruminations on Regression and Diagnostic Techniques

Sibnarayan Guria

Different data generating processes has a special feature and peculiarities and often suffer from clustering or repeated measures, therefore, choosing correct covariance structure is an important issue in data analysis. Fitting linear regression to experimental data is prevalent in all the spheres of science. It seems reasonable to have a geometric characterization of such a linear regression. Selecting which approach is optimal for analysis of a particular study is very difficult because of each method has different conceptual paradigm and its own strengths and weaknesses. In this paper I focus on exchangeable linear model and using deletion technique in checking outliers for such models.

Proposed technique will be verified numerically by a real life data set.

West Bengal State University, Barasat

44. Generalized Capability Index Based on Quality Loss Function

Sudhansu S. Maiti and Mahendra Saha

A Generalized Process Capability Index, defined as the ratio of proportion of specification conformance (or, process yield) to proportion of desired (or, natural) conformance, has been developed by Maiti *et al.* (2010). Almost all the process capabilities defined in the literature are directly or indirectly associated with this generalized index. In this article, a loss function has been attached to the product quality characteristic for deviation from its target to define the index named as generalized quality capability index. Symmetric as well as asymmetric loss functions have been considered. We deal with the index in case of normal, non-normal and discrete processes. An algorithm for determining optimum process center for an off-centered process has been prescribed. A process data set has been analyzed.

Visva Bharati University, Santiniketan

45. A Study on Statistical Models for Pre-harvest Forecasting Wheat Yield Based on Discriminant Functions

R.R. Yadav¹ and B.V.S. Sisodia²

Time series data on wheat yield and weekly data from 44th SMW of previous year to 6th SMW of the following year on five weather variables *viz.*, minimum temperature, maximum temperature, relative humidity, wind velocity and sun shine hour covering the period from 1990-1991 to 2009-2010 have been utilized for development of pre-harvest forecast model. Statistical methodology using discriminant functions for pre-harvest forecast model has been described. In all seven procedures have (five existing and two proposed) been used to develop the pre-harvest forecast model. The procedure-1 is based on weather indices and rest are based on discriminant functions. The procedure 6 and 7 are proposed one. On the basis of Adjust R^2 and RMSE, the model-I has turned out to be the best followed by the model-VI and model-III. However, there has not been much difference in the values of

adjust R^2 corresponding to model-I, III and VI (97.0, 93.3, 93.3 per cent respectively). Moreover, it required to generated number of weather indices (in present study it in 30) for the development of the model-I, which requires more labor. On the other hand, model-III and VI are easy to develop using discriminant functions. RMSE of model-VI is little less (0.570) as compared to model-III (0.572). Validating of the models and forecasting of the wheat yield based on the model VI for the years 2008-09 and 2009-10 have favoured the model-VI. Therefore, the model-VI can be recommended for pre-harvest forecast of the wheat yield in practice. However, the model-III is as good as model-VI.

ND University of Agriculture & Technology, Faizabad

46. Statistical Analysis of Agricultural Workforce in Nadia District

Banjul Bhattacharyya and Mun Mun Ghosh

Nadia is one of the nineteen districts of West Bengal. This district is very densely populated and majority of population is directly or indirectly dependent on agriculture and allied activities. Agriculture plays a pivotal role in the economy of the district. The district comprises four subdivisions and seventeen community development blocks. Agricultural workers constitute by far the largest segment in the unorganized sector. In addition, a significant number are listed as cultivators (large, medium and small) of whom the foremost part belongs to the category of small and marginal farmers. Many of these small and marginal farmers on account of utterly deficit, small and uneconomic holdings and low yield work on the land of others. Further, a significant number engaged in livestock, forestry, fishing, orchards and allied activities as well as small and marginal farmers work as agricultural workers in their spare time or in times of difficulty to supplement their meagre incomes. In spite of the fact that these agricultural workers have such numerical strength, they are extremely vulnerable to exploitation on account of low levels of literacy, lack of awareness, persistent social backwardness and absence of and other forms of viable organization. The present paper attempts to decisively analyse the participation set-up of workforce of Nadia districts considering the gender aspects. Classification has been made for workers based on division of works, literacy and type of region. Efforts have been taken to get the

real picture on the sway of literacy on Work Participation Rate (WPR) in agriculture. The influence of urbanization on the Work Participation Rate (WPR) in agriculture is also taken into consideration.

Bidhan Chandra Krishi Viswavidyalaya, Nadia

47. Scenario and Growth Pattern of Pulses in India: A Brief Study

M.K. Sharma¹, B.V.S. Sisodia², Anil Kumar²
and G.K. Jha¹

In India, the word “pulse” is used to describe the seeds of legumes that are usually dicotyledons and have no seed coats. During recent past, these pulses are becoming out of reach from the common people of country because of its shoring prices. Fortunately or unfortunately, till today the country has not been able to achieve self-sufficiency in pulse production as compare to its aggregate demand. In India pulses are grown on 22-23 million hectares of land with an annual production of 13-15 million tonnes (mt). India accounts for 33% of the world area and 22% of the world production of pulses. The major pulse crops grown in country are chickpea, pigeon pea, lentil, moong bean, urd bean and field pea. About 90% of the global area under pigeon pea, 65% under chickpea and 37% under lentil falls in India, corresponding to 93%, 68% and 32% of the global production respectively (FAOSTAT 2009). Due to stagnant production, the net availability of pulses have decline from 60 gm/day/person during 1951 to 31 gm/day/person as per recommendation of 65 gram/day/capita by ICMR (Indian Council of Medical Research). Stagnant production in the country has contributed to steep increase in prices of pulses. During this period domestic pulse prices have increased relative faster as compare to other food prices. Department of Agriculture & Co-operation under Union Agriculture Ministry has launched pulses also under the ambit of Technology Mission on Pulse Production (TMPP) during August 1990. Under which, new and improved technologies, timely supply of necessary inputs, extension support, remunerative price for the produce, marketing infrastructure and post-harvest technologies were provided for increasing pulses production with the Mission Mode approach. Referring to as to why India has to rely on imports of pulses, it points out that its pulses imports grew at CAGR 10.38% from 172.96 thousand tonnes in 1980-81 to 2255.649 thousand tonnes in 2006-07. The import of pulses

increased steadily due to low import tariff rates (attracting low or zero duty). Interestingly, India’s export of pulses grew at a far greater pace than its imports i.e. from 1.09 thousand tonnes in 1980-81 to 447.44 thousand tonnes in 2005-06. The time series data pertaining to 1970-71 to 2009-10 have been considered, which has been divided into two periods, before (1970-71 to 1989-90) and after (1990-91 to 2009-10) i.e. launch of Technology Mission on pulse production to carry out study on growth pattern of major pulse corps in India. Impact evaluation of TMPP has been also carried out in the present paper. Export and import scenario have also been highlighted in the paper.

¹*Indian Agricultural Research Institute, New Delhi*

²*ND University of Agriculture & Technology, Faizabad*

48. Prediction of Economic Traits in Murrah Buffaloes - A Connectionist Approach

A.K. Sharma, D.K. Jain, A.K. Chakravarty,
R. Malhotra and A.P. Ruhil

In this paper, several predictive models based on connectionist paradigms, viz., Error Back-Propagation (EBP), Radial Basis Function (RBF) and Generalised Regression (GR) learning algorithms have been proposed to predict 305-day milk yield in different lactations (up to first six calvings) as well as for overall data of Murrah buffaloes. The data pertaining to various economic traits including reproductive and productive characters of Murrah buffaloes being maintained at Institute Livestock Farm, NDRI, Karnal for the period 1990-2006 have been utilized. The raw data were subjected to Least-Squares analysis. Further, the comparison among sub-classes within years, seasons in each lactation and also parities for pooled lactation was made. Moreover, constants for significant effects of non-genetic factors on reproduction and production parameters were used for adjusting the data. Furthermore, regression analysis technique was employed on the final dataset with all possible combinations of the different economic traits (lactation wise as well as overall) so as to isolate representative variables affecting the milk production. Finally, the proposed predictive models based on the aforesaid connectionist paradigms *vis-à-vis* Multiple Linear Regression (MLR) models were developed using the

same datasets. The results of this study revealed that the connectionist models have relatively better potential over the conventional MLR technique. The connectionist model based on EBP algorithm for predicting first lactation 305-day milk yield achieved Root Mean Square Error (RMSE) as 51.49%, while the corresponding MLR model attained RMSE as 52.49%. The connectionist model based on RBF algorithm for predicting second lactation 305-day milk yield achieved RMSE as 36.25%, whereas the corresponding MLR model achieved RMSE as 38.94%. The connectionist model based on GR algorithm for predicting third lactation 305-day milk yield achieved RMSE as 21.90% as compared to the corresponding MLR model with RMSE as 27.13%. The connectionist model based on RBF algorithm for predicting fourth lactation 305-day milk yield achieved RMSE as 31.88% in contrast with the corresponding MLR model with RMSE as 34.22%. The connectionist model based on GR algorithm for predicting fifth lactation 305-day milk yield achieved RMSE as 19.28%, but the corresponding MLR model attained RMSE as 31.32%. The connectionist model based on EBP algorithm for predicting overall lactation 305-day milk yield achieved RMSE as 20.87% as against the corresponding MLR model with RMSE as 22.12%. Hence, it is concluded that the connectionist models developed in this study are found to be suitable as plausible alternative to MLR models for predicting milk production in Murrah buffaloes.

National Dairy Research Institute, Karnal

49. A Study to Find Out the Innovations of Water Use in Some Selected Areas of West Bengal

P.K. Patar¹, T.K. Mandal², P.K. Pal³,
D. Mazumder⁴ and A.K. Roy⁵

Water is the most important input of crop production. It has become more relevant today in the context of present day scarcity, pollution and contamination hazards of water in general. Availability of drinking water is directly related with the use of irrigation water required for crop husbandry.

¹*SBKV, Kappari, West Midnapur*

^{2,3}*Uttar Banga Krishi Viswavidyalaya, Cooch Behar*

^{4,5}*Bidhan Chandra Krishi Viswavidyalaya, Nadia*

50. Growth Trend in Production and Trade of World Silk

Suresh Rai, A.K. Sinha, O.P. Dubey, B.M.K. Singh and B.C. Prasad

The world raw silk production, export and import data for study period 2000 to 2009 were collected from websites of International Sericulture Commission and International Trade Centre. The growth rate for global silk production, export and import were analysed using Exponential growth function for the period to study the recent trend of global silk industry. The growth rate of raw silk production for the World, China and India were recorded 5.06, 6.85 and 2.11 percent whereas growth rate of other country like Japan, Brazil, Rep. of Korea & others are in declining trend. Growth rate of silk export of China, India and world were found positive where as import has increased both for India and other countries excluding China. The slow growth in Indian silk industry and declining growth rate in other developing and developed country except China for raw silk production is going to widen the gap between demand and supply. If special measures are not taken at the level of silk producing countries & at global level the world may lose the availability of silk at a faster rate which remained the emblem of fashion, affluence & riches for centuries. Production trends are different for different silk producing countries. These are required to be discussed in view of developing strategies for reaching new height of production and to withstand the global demand.

Central Tasar Research and Training Institute, Ranchi

51. Women Empowerment – A Case Study in Sericulture Farming

Rakhee Banerjee¹ and Pradip Kumar Sahu²

Sericulture is treated to be one of such industries where money flows from the richer section of the society to the poorer section with ample opportunity for engagement of the women work force. Since time immemorial, sericulture is the ritual and livelihood of some of the areas of West Bengal, India. Though empowerment is multifariously defined contested phenomenon having its own nature depending up on the situations. Study of women empowerment is an important aspect for the development of sericulture farm families. It is with this pretext the present study

was undertaken in two major sericulture districts of West Bengal. Analysis of information obtained through sample survey, using different descriptive statistics, correlation-regression analysis, multivariate principal component and cluster analyses, the study reveals that 1) the major factor related to women empowerment quotient are occupation, age at marriage and family income, 2) in spite of spatial variations the sericulture villages could be grouped in to some groups so that uniform development plan could be taken up for the improvement of women empowerment among the females of the sericulture farm families.

¹Haldia Institute of Technology, Haldia

²Bidhan Chandra Krishi Viswavidyalaya, Nadia

52. Application of Canonical Correlation and Canonical Correspondence Analyses for Association Study between Lead and Copper Accumulation at Different Physiological Systems of Goat

Debasis Mazumdar¹, Pradip Das², Partha Karmakar³ and Sougata Karmakar⁴

Pb toxicity in mammals due to automobile pollution is prevalent around heavily trafficked highways in West Bengal, India. Extent of this environmentally induced Pb intoxication is actually a cumulative effect of several agonistic and antagonistic interactions with other heavy metals and micronutrients. Present investigation focused at association study between Pb and Cu accumulation in physiological systems of goat (n=200) reared around a 100 km stretch area along NH-34 in West Bengal by application of canonical correlation and canonical correspondence analyses. Pb was estimated from plasma, liver, bone, muscle, kidney, blood and milk where as Cu was measured from all these systems except blood and milk following standard methods. Both statistical techniques demonstrated a strong positive association between Pb and Cu at kidney, muscle, bone and liver. Bi-plot diagram of canonical correspondence analysis showed that Cu in all tissues under study were at the positive side along with Muscle-Pb, Milk-Pb and Kidney-Pb due to their positive loadings along Axis-2. It could be assumed from observations that there may be synergistic activity of Cu to the accumulation of Pb in various organs/tissues of goat. Cu accumulation in

goat's tissues somehow directed transferring of Pb-pool from blood, plasma and liver to other tissues.

¹Bidhan Chandra Krishi Viswavidyalaya, Nadia

²West Bengal University of Fishery Sciences, Kolkata

³Bidhannagar Government College

⁴Indian Institute of Technology, Guwahti

53. Life Testing using Probability Distributions

Pradeep Mishra, R.B. Singh, and H.L. Sharma

“Accelerated life testing” involves acceleration of failures with the single purpose of the “quantification of the life characteristics of the product at normal use conditions.” This paper is solely concerned with this type of accelerated life testing. During the last few decades, the statistician and other researchers had been concentrated about life testing using probability models. The parameters involved in the models usually had been estimated by method of moment and maximum likelihood. The present investigation was undertaken by taking the probability density function of exponential and Weibull distribution to determine general equation for failure rate function and failure time distribution, and also the study of mean life of the system through these distributions. This paper deals the life data analysis using Weibull distribution and exponential distribution and parameter of interest i.e. failure rates, mean lifetime of the system have been obtained. Basis of parameter the distribution have been compared at the last the hypothetical examples have been given to highlight the results.

Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur

54. A Study on Dynamics of Socio-economic Development in Eastern Uttar Pradesh

Suryapal Singh Rajpoot, Sunil Kumar and B.V.S. Sisodia

Socio-economic development is to improve the quality of life of people by creation of appropriate infrastructure, among others, for industry, agriculture environment. The level of development of different districts of Eastern Uttar Pradesh was obtained with the help of composite index based on optimum combination of a number of socio-economic indicators. Twenty eight districts of Eastern Uttar Pradesh were included in the

analysis. The data on various indicators for the year 2007-2008 were used in the study. The level of development was examined separately for agriculture, industry and infrastructure systems. The district of Maharajganj was ranked first and the district of Sonebhadra was ranked last in agriculture system. The district of Varanasi was ranked first and the district of Sravasti was ranked last in industry system. The district of Ghazipur was ranked first and the district of Balrampur was ranked last in infrastructure system. All the ranking discussed have been done based on method of Narain et al and just to corroborate their performance they were compared with presence in due clusters and was observed to be quite satisfactory. For situation like this there is no rigid method for evaluation of scores and ranking. Most important in such studies is that statistical results should match to ground realities and this study seems to be reasonable in this regard. Correlation between Food grain productivity and value of agricultural produce is high indicating that good marketing and price can result in increased productivity. Faizabad district seem to be well performing in Agriculture, Industry and General Infrastructure across the period 1995-2008. Presently Maharajganj, Azamgarh and Chandauli are advanced in Agriculture but not in General Infrastructure and Industrialization. This is not a very appreciable dynamics as desirable situation is that development of Agriculture and Industry should go hand-in-hand. Mau and Faizabad districts retain the advanced status in General Infrastructure since 1995.

ND University of Agriculture & Technology, Faizabad

55. Clustering Technique in Folk Varieties of Mango in West Bengal

Surajit Mitra¹, Kalyan Chakraborti¹, Amrit Paul² and Monanjali Bandyopadhyay³

In Gangetic West Bengal hundred selected monoembryonic varieties have been evolved as chance seedlings as a result of open pollination. Out of these only a few are commercially important and more than 90 per cent of the mango area is under those commercial taxa. The rest may be termed as minor taxa. Minor taxa may be grouped into two batches, viz. seedling germplasm and folk varieties. Folk varieties are closely related to culture and heritage of folk people. The folk varieties may be defined as the

genotypes of an indigenous crop grown by a traditional farmer-folk in subsistence level of farming equipped with age old knowledge within a given territory over a period of time after natural evolution and selection. These are confined in particular locations. It is now a common practice that orchardist-folk sells their orchards to the merchant-folk for a specific period of time. The folk varieties as defined are kept for their own consumption. The industrialists have developed recently new orchards with commercial varieties. They are engaged in large scale production through scientific intervention. They have least interest in folk varieties and more frequently than not they avail the opportunity of felling the minor taxa. In this treatise the authors have made an endeavor to evaluate twenty-five such taxa of West Bengal in the perspective of mango-lore during 2000 to 2005. The varieties were observed pertaining to tree, leaf, inflorescence and fruit characters and physico-chemical characters of fruits. Principal Component Analysis was used to compare the performance of these varieties for different physico-chemical traits. Different clusters were obtained through the application of Ward's method under Euclidean distance. All the clusters may be considered as genetically divergent groups of folk varieties. These may be considered as the base population for selecting of genetically divergent germplasm in mango breeding program.

¹*Bidhan Chandra Krishi Viswavidyalaya, Kalyani*

²*Indian Agricultural Research Institute, New Delhi*

³*Vidyasagar University, Midnapore*

56. Studies on Soil Moisture Behaviour in a Hilly Watershed of Darjeeling Himalayas, West Bengal

K. Mukhopadhyay¹, K. Das², A. Halder³ and P.K. Tarafdar³

Efficient use of water resources for optimization of crop productivity and proper land, water management both under irrigated and rainfed farming, requires thorough understanding the pertinent hydrological properties which includes soil water retention characteristics, available water capacity as well as plant available water capacity (PAWC) of the soils. The moisture retention characteristics of soils which provide information on the ability of soils for storing water and its subsequent availability to the crops

as well as moisture releasing behaviour were studied for nine mapped soil units under varying physiographic positions in Mamring micro watershed of Darjeeling Himalayas in West Bengal. Variation in water retention characteristics was attributed to textural variations and it had been found that moisture retentivity at 33 kPa and 1500 kPa tension was significantly and positively correlated with clay, silt plus clay and organic carbon, whereas, negative correlation was observed with sand content, porosity and bulk density. The moisture release behaviour of the soils under different range of suctions did not varied widely due to differences in physiographic positions. Plant available water capacity for these soils were also studied and it had been found that the value of PAWC was highest for the soils under hill top ridge and summit (10-15 % slope) and lowest in lower side slopes having 25-33 % slope. Again variation in PAWC was also observed with land use systems and it followed the trend of forest > vegetable > cereals > fallow land uses.

¹Howrah Krishi Vigyan Kendra, BCKV, Jagatballavpur, Howrah

²National Bureau of Soil Survey & Land Use Planning, Regional Centre, Kolkata

³Bidhan Chandra Krishi Viswavidyalaya, Nadia

57. Effect of Some New Generation Insecticides on Toxicity and Resurgence of Brown Plant Hopper of Rice

M.L. Chatterjee¹ and Amalendu Ghosh²

In India, Brown Planthopper (BPH), *Nilaparvata lugens*, is a key pest in most of the rice growing geographies. BPH can assume serious proportions to cause severe yield loss if proper and timely management practices are not implemented. Many conventional insecticides were used for a long time with growers obtaining average control of this pest. In the last 10 years, different neonicotinoid insecticides introduced helped growers to successfully manage BPH. Due to continuous and indiscriminate use of neonicotinoids over the last few years, frequent control failures by this class of insecticide became evident over the last 2 years, especially in the South Indian states. Farmers resorted to using various methods due to non-availability of suitable insecticides to control BPH. Industry and academicians suspected that BPH has

evolved resistance to neonicotinoid chemistry, as the pest is notorious for resistance development and resurgence are frequently occurs. The present investigation was conducted to test some new generation insecticides of neo-nicotinic and growth regulator of benzo-phenyl urea groups for bioassay studies in laboratory and resurgence study in field population of BPH. For bioassay, to find out the LC₅₀ (Lethal Concentration) values and relative toxicity, the statistical calculation was followed by the methods adopted by D.J. Finney's Probit Analysis (1971). For resurgence study of BPH in field after application of insecticides, the statistical calculation was followed by the methods suggested by Jayaraj and Regupathy (1985) after slight modification by Henderson and Tilton (1955) used for calculating the percent efficacy of insecticides.

¹Bidhan Chandra Krishi Viswavidyalaya, Nadia

²NAARM, Hyderabad

58. Unbiased Regression Estimators of Finite Population Mean when \bar{X} is Known but S_x^2 is not Known

B.V.S. Sisodia and Kritanjay Kumar Mourya

The present study has been undertaken to develop some sampling scheme which provides unbiased regression estimators. Micky (1959), William (1962) and Singh and Srivastava (1980) provided some sampling schemes, which yielded regression estimators of population mean in finite population sampling. The variances of the estimators were, however, quite complicated and faced computational hard-work. A new sampling scheme is proposed in the dissertation, which is quite simple and provides an unbiased regression estimator. The finite population mean of X per unit of the population. When the population means is known the population mean square for X is not known of the auxiliary variable 'x'. Some sampling scheme has been applied for the development of unbiased regression estimators. Its variance is derived which is simple one and is easily comparable with the usual biased regression estimator. An empirical study is also carried out illustrate the precision of the unbiased regression estimators. It is, therefore, obvious that the proposed regression estimator is although unbiased but it is less precise than the usual biased regression estimator.

Variance of t' is substantially increased and hence the estimator t' cannot be recommended in practice where S_x^2 is not known.

ND University of Agriculture & Technology, Faizabad

59. Development of Dynamic Website of National Dairy Research Institute, Karnal (India)

D.K. Jain¹, A.K. Sharma¹, R. Singh¹,
A.K. Chakravarty¹, R. Malhotra¹, A.P. Ruhil¹,
D.S. Sohi¹ and R.C. Agrawal²

A search-engine-friendly dynamic Website of Animal Sciences and Dairy Science, Education and Research along with Transfer of Technology (<http://www.ndri.res.in>) has been developed and launched by the National Dairy Research Institute (NDRI), Karnal (India) under the aegis of the AGROWEB – Digital Dissemination System for Indian Agricultural Research (ADDSIAR) subproject of the World-bank funded National Agricultural Innovation Project (Component 1) with the leadership of National Bureau of Plant Genetic Resources (NBPGR), New Delhi. The Website fully conforms to the prescribed uniformity guidelines for Institutes' Websites of the Indian Council of Agricultural Research, New Delhi. The latest software tools conforming to the industry standards as well as which are scalable, *i.e.*, ASP.NET 2.0 technology with SQL-SERVER 2005 as backend and IRONSPEED (code generator) have been used to develop the content management system of the Website. The Website is bilingual, *i.e.*, supports English and Hindi languages to view the Website contents. The Website comprises of 200 dynamic Web pages and 50 static Web pages. All the scientists, Research Divisions and the Purchase Section at NDRI have been involved in the process of

initial development and regular updating of the Web content at the source of information itself through the Role-based Security System. However, Website Administrator is responsible for updating the Web content. Various stakeholders of the Website including policy-makers, scientists, students, farmers, industry, *etc.*, can access the Website for getting information on aspects such as General information, Research, Academic including Library resources (M.Sc./Ph.D. theses' abstracts, *etc.*), Extension, Downloads, Farmers (in Hindi), FAQ's, Announcements/Upcoming Events, and Intranet and e-Resources, *etc.* Dynamic links have been provided with all Heads of the Divisions having right to browse, add, edit or remove any information about their Division's Profile, Research Projects, Courses and Curricula, Consultancy Services/ Collaboration, List of faculty members. Dynamic links have also been provided with every faculty member to upload and update his/her information instantly so as to ensure up-to-date information. The Institute Purchase Section can upload/update Tender/Employment and any other relevant information, instantly as and when needed. The traffic analysis for the period, May 5 to November 9, 2010) conducted using the Google Analytic tools for the Website, revealed that 30,451 visitors viewed 149,528 Web pages, viewing 3.25 pages per visit on an average. The visitors of the Website comprised of people from 103 countries including many prominent countries like USA, UK, UAE, Germany, Canada and Australia. The important Web pages visited by the visitors included Home Page, Tenders, Divisions' Profiles and Faculty Profiles.

¹*National Dairy Research Institute, Karnal*

²*National Bureau of Plant Genetic Resources, New Delhi*