ABSTRACTS OF PAPERS

1. Statistical Investigation on Price Behaviour of Groundnut Oil and Oilseeds

A.D. Katola and S.K. Dixit
Gujarat Agricultural University, Anand

The present investigation was undertaken with a view to study the price behaviour of groundnut oil and the major oilseeds of Gujarat State, viz. groundnut, castor, sesamum and mustard using fourteen years (1976-77 to 1989-90) price data of Rajkot regulated market, which could be considered as price setter for groundnut oil.

The prices of groundnut oil and the oilseeds exhibited very high inter-year and intra-year fluctuations. In general, groundnut and groundnut oil were found to be relatively more sensitive to intra-year market pressures. The results on trend analysis indicated a very rapid increase in the prices of groundnut oil and groundnut as compared to the other oilseeds. However, the rise in groundnut oil price was appreciably higher when compared with that of the groundnut. All the commodities under study reflected fall in the prices during post harvest months and rise in off-season. The irregular variation in groundnut oil and sesamum was minimum, whereas, it was quite high in case of mustard and castor.

2. Hectareage Prediction Model for Groundnut Crop of Gujarat State-An Empirical Investigation

D.J. Parmar and S.K. Dixit
Gujarat Agricultural University, Anand

The present investigation was undertaken with a view to identify the models for predicting the crop hectareage of groundnut in Gujarat State. The time series data on area, production, productivity and farm harvest prices were

collected for the period from 1964-65 to 1987-88. The linear multiple regression technique (basically *Nerlovian* type) was employed. Out of eight single equation and four simultaneous equation models tried for the crop, a model was selected on the basis of the value of coefficient of multiple determination $R^2 = 0.7698$.

Positive impact of expected productivity of the crop and areas under maize was noticed whereas area under groundnut responded negatively to its lagged price. Groundnut growers of Gujarat were found to be yield risk averters and return risk takers.

3. The Common Principal Components Approach for Clustering Under Multi Sampling Situation

B.S. Kulkarni and G. Nageswara Rao
A.N.G.R.A.U., Hyderabad

The situation of using Common Principal Components (CPC) for tackling the crucial assumption of homogeneity of covariance matrices (which is not satisfied in general) has been examined in the context of clustering under the multi-sample situation. The approach overcomes the crucial assumption by providing a "common" (pooled) estimate for the principal components of the objects instead of a pooled estimate for the covariance matrices of the objects. An illustration of the approach with regard to the rainfall based classification of the districts of Andhra Pradesh State has also been described.

4. Statistical Analysis of Yield Gap and Constraints Using Discriminant Function Approach

R.K. Pandey
IASRI, New Delhi

This paper is an attempt to examine the extent of yield gap and identification of factors responsible for the gap in the wheat production. The study was undertaken in the operational research project on pulses operated in three clusters of five villages each in Bawal/Jatusana block of Mahendragarh District in Haryana. For conducting the survey, one village from each cluster has been randomly selected and from each village a random sample comprising

of about 20 per cent of the farm households were selected for detailed survey. The total sample thus obtained consisted of 106 farm households. The data were collected during 1985-86.

The yield were estimated using the difference of yield potential and average yield of the crop. The constraints to higher yields were analysed using discriminant function technique. The study indicated that yield levels of wheat could be increased in ORP area of Mahendragarh District during adoption of improved input use. The application of discriminant function technique to farm level data suggested that application of nutrients and plant protection measures were the major characteristics discriminating the two groups of farms i.e. farms with higher and lower wheat yields.

5. Composite Weather Index for the Forecast of Rice Yield

T. Rai and Chandrahas
IASRI, New Delhi

The aim of the present study is an attempt to understand how the intensity and distribution pattern of weather parameters at different stages of growth affect the rice yield. The study is conducted for the Raipur District of Madhya Pradesh. The results show that the crop reacts differently to weather parameters during different stages of development. Relative humidity and number of rainy days is beneficial upto early growth phase whereas sunshine hours and maximum temperature in addition to relative humidity contribute positively towards rice yield upto the vegetative phase. At the reproductive phase minimum temperature and rainfall have the deleterious effect on the yield of rice.

6. A Study of Technological Impact on Pulse Production in Uttar Pradesh

B.V.S. Sisodia, A.K. Singh and Sunil Kumar
N.D.U.A.T., Faizabad

The scenario of overall pulse production has not been satisfactory in the State as well as in the country during recent past. As a result, State/Central Government has given a lot of emphasis on technological development in order

to increase the pulse production vis-a-vis its productivity. This paper attempts to study the growth trends of some major pulse crops and pulse crop as a whole in Uttar Pradesh as well as in Eastern Uttar Pradesh. Efforts are also made to quantify the impact of technological development. The time series data on area, production and productivity of pulse crops during the period 1960-61 to 1992-93 are considered for this study. The studies are carried out decade wise and for overall period. The time series data are also grouped into two sub-periods, pre-green and post- green revolution periods, and studies have been carried out accordingly to determine the impact of technological development.

7. On the Relative Efficiency of Certain Randomized Response Strategies

Manoj Bhargava and Ravindra Singh[1]
H.P. Krishi Vishwavidyalaya, Palampur

In surveys involving sensitive characteristics, randomized response procedures are useful for generating trustworthy data while protecting respondent's privacy. Several research workers have made comparisons using variance as the measure of efficiency but they have not taken into account the degree of protection offered to the interviewees. In the present article, an attempt has been made in this direction and some important randomized response strategies have been compared with the Warner's model, taking into account the aspect of privacy protection.

1 Punjab Agricultural University, Ludhiana

8. Resampling Procedure for Estimation of Ratio in Complex Surveys

Anil Rai, Tauqueer Ahmad and R.K. Shukla[1]
IASRI, New Delhi

Recently, considerable attention has been paid to the problems of statistical inferences from sample survey data for non-linear statistics such as ratio, regression and correlation coefficient etc. Most of these techniques are highly computer intensive and mainly related to the problems of estimation of second

order statistics in case of complex survey data. Three most commonly used techniques for variance estimation are, linearisation (or Taylor) method, the Jacknifed method and Balanced Repeated Replications (BRR). Relatively, recent in origin, the bootstrap technique substitute considerable amount of computation in place of theoretical analysis. It has been realized that for simple problems computer intensive methods like bootstrap can provide simple, although approximate solution in an era of exponentially declining computational costs.

There are number of techniques for variance estimation especially bootstrap methods, available in the literature. Hence, there is a strong need to study the relative performance in case of non linear statistics for complex survey data. In this article an attempt is made to evaluate the performance of various bootstrap techniques for estimating ratio in case of complex survey data, particularly in stratified sampling designs. The second order comparisons are made theoretically for bias, estimate of variance as well as bias of the estimator of the variance for various procedures for estimation of ratio. Also, these are compared to a proposed rescaling without replacement bootstrap technique by Tauqueer (1996). Further, a small simulation study is done to support these theoretical findings.

---

1 National Council of Applied Economic Research, New Delhi.

9. Statistical Appraisal of the Progress of Production of Wheat

K. Chugh and Satya Pal
IASRI, New Delhi

Fifty years back, the partition of the country resulted in transfer of wheat and rice surplus areas of Pakistan. During the next three decades foodgrain shortages remained the chronic feature of the economy. The position improved by the late seventies due to success of the high yielding varieties programme especially in wheat.

An attempt has been made to make a statistical appraisal of the progress of production of wheat in wheat growing states. Harayana, Madhya Pradesh, Punjab, Rajasthan and Uttar Pradesh account for about 7/8th production of wheat in the country. The region can be appropriately called the wheat growing belt. Linear and exponential models have been fitted to the production data to estimate the growth rates and study the trends in production. The highest linear

growth rate of 13.3% has been estimated for the state of Haryana followed by Uttar Pradesh (10.7%). The highest yield rate of 3053 kg./ha was estimated in Punjab which is now not showing higher growth rate in production. Inter state comparison of lines of regression show significant difference in growth rates. The study has been done utilising the production data from the year 1973-74 to 1992-93 (20 years).

10. A Study of Variability and Trends of Yield Rates of High Yielding Varieties of Wheat

Satya Pal and R.M. Sood
IASRI, New Delhi

The present study is an attempt to know the variability and trends of yield rates of high yielding varieties of wheat during the period 1970-71 to 1978-79. The average rates of consumption of (N+P+K) in Bihar State is 33-224 kg/ha and in Uttar Pradesh the range is 41-179 kg/ha. The percentage increase in average yield of HYV over local ranges from 15 to 124 in Bihar and –2 to 105 in Uttar Pradesh. The average rate did not show any specific trend either in different holding size classes or over different varieties. The growth rates in average in all the holdings and in all the districts are negative except in Monghyr (Bihar). The same is the trend in fertilizer consumption. The quadratic fit is the best in an average yield where the value of % R^2 ranges from 34 to 85 except in holding size > 4 in Monghyr (Bihar) where it is 12%.

11. Post Production Losses in Milk-A Methodological Investigation

R.S. Khatri and J.P. Goyal
IASRI, New Delhi

Milk is one of the important livestock products and being a perishable commodity, the qualitative as well as quantitative losses occur at different stages after its production. Although India's milk production ranks second in the world but the per capita per day availability as estimated during 1996-97 was only 72 per cent of the requirement of 280 gms. as recommended by the

Nutrition Advisory Committee. The position will be still worse if the post production losses are excluded from the production. Therefore, the role of post production technology for milk becomes extremely important so that its production is remunerative to the producers and it is available to the consumer at a reasonable price in good quality and adequate quantity. A major portion of its production is from unorganised sector where post production technology such as chilling and transportation is not available and as such a considerable quantity is lost in handling and storage. Thus production becomes unremunerative to the milk producer. In this study an attempt has been made to estimate the quantitative losses in milk occur at different stages on account of various causes in unorganised sector.

12. Effect of Two Stage Sampling on Regression Analysis

Y.K. Sharma, Randhir Singh[1], Anil Rai[1] and S.S. Verma
Defence Institute of Physiology and Allied Sciences, Delhi

Regression analysis when applied to two stage sampling data gives misleading results. In two stage sampling, the cluster used always exhibit some degree of homogeneity with respect to variable under study. The consequence of this homogeneity is that units within a selected cluster are not independent of each other. Therefore, in this study the effect of intracluster correlation on standard procedure of linear regression has been examined. The results suggest that for a model which allows separate effect for each cluster, the ordinary least square model gives optimal estimates of all effects under the assumption that intra-cluster correlations in different clusters are not same.

1 IASRI, New Delhi

13. A Case Study on the Opinion of Residents of Uyyalawada Village in Andhra Pradesh on NSS Camp

R. Srinivasulu
Agriculture College, Mahanandi

Information and results on the data pertaining to behavioural sciences is seldom available to research workers. Even after collecting such data proper

use of statistical tool is another vital important aspect. In the present study, an attempt has been made to study the performances of villages towards the activities of National Service Scheme (NSS) Special Camp.

14. On An Alternative Aspect of Optimum Stratification

Arti J. Rajyaguru and P.C. Gupta[1]
Sir K.P. College of Commerce, Surat

In the problem of optimum stratification suggested by Dalenius (1950) and his coworkers, the criterion of stratification is to minimise the variance of estimator of the character under study, when the stratification variable is same as the character under study or it is different. Various researchers have suggested different approximate solutions to the equations giving the optimum boundary points, notably amongst them are Mahalanobis (1952); Aoyama, H. (1954); Kitagawa (1956); Ekman (1959); Singh and Sukhatme (1969, 1973); Singh and his coworkers (1975, 1976, 1984).

In the present paper, we have proposed a new criterion of optimum stratification, viz., minimising the weighted average of square of coefficient of variations, both when the stratification variable is same as the study variable and when it is different. We have, however, confined our study to the use of proportional allocation, for allocation of sample to different strata.

Stratification based on auxiliary variable, however, assumes the form of regression as, $Y = \Phi(x) + e$ with $E(e/x) = 0$ and $V(e/x) = n(x)$.

The equations giving the optimum boundary points have been obtained in both cases, and the approximate working rule for stratification have been developed. The utility of the results developed have been illustrated with the help of three elementary distributions namely; (i) Rectangular, (ii) Right-triangular, and (iii) Exponential.

---

1 South Gujarat University, Surat

15. Sample Survey for Estimation of Brackish Water Resources and Catch from Them

H.V.L. Bathla and K.K. Kher
IASRI, New Delhi

Fish culture in brackishwater resources provides a vast potential for development. The position of statistics of catch from these resources is very unsatisfactory. Keeping this in view, the present survey was undertaken for the estimation of area under brackishwater units and prawn catch from them. The survey was undertaken in four districts of Orissa State in India viz. Puri, Ganjam, Cuttack and Balasore. A stratified sampling design was adopted for the estimation of area under brackishwater units, and a two stage stratified sampling design was followed for the estimation of prawn catch from these resources. The villages were stratified on the basis of number of brackishwater units in them. The study indicates the feasibility of estimating area per pond, number of prawns and prawn per catch from them with a reasonable degree of precision.

16. Sampling Schemes by Combining Two or More Sample Spaces

Aloke Lahiri and M.N. Das[1]
IASRI, New Delhi

There are several primary sampling schemes like simple random sampling, systematic sampling and pps sampling. Some of these others are quite difficult to adopt but these provide more information. For example, systematic sampling is quite simple to adopt but it has the drawback that it cannot provide an estimate of accuracy of estimate of the population mean. Again, pps sampling scheme is quite difficult to adopt but it provides more information as it takes into account the size measures of the units while drawing samples. A new technique is proposed to reduce such difficulties retaining the advantages of the schemes.

The method for achieving above objective is to combine two or more sampling schemes using a probability scheme. For example, systematic sampling scheme can be combined with simple random sampling without replacement. The technique of combination consists of first selecting out of a number of

schemes the more operationally convenient or desired scheme with a very high probability P so that the other schemes get selected with probability 1-P. A high value of P approaching unity ensures that the desired scheme will most probably be selected. Whatever scheme gets selected, the final sample is drawn from the selected scheme. The method ensures that if for atleast one of the sampling schemes variance of mean is estimable then for the combined scheme also this variance is estimable.

1 I-1703, Chittaranjan Park, New Delhi.

17. An Extension of G-Order Partially Balanced Repeated Replications (BRR) Technique for Variance Estimation in General Stratified Design

S.P. Verma, Anil Rai and B.C. Saxena
Indian Agricultural Statistics Research Institute, New Delhi-12

A modified approach to G-order balanced repeated replications (BRR) considered as 'Two-unit reduced G-order partially balanced design (PB)' used for variance estimation of an estimator in general stratified design has been given here, particularly for a situation when the number of strata (L) is very large (say > 80) which poses a great practical problem in estimating variance even by computer because of the spurt in the size of the set of half samples entailing huge computation time by BRR technique suggested by McCarthy (1966). Unlike the alternate strategy of efficient grouping of strata randomly given to McCarthy (1969) for G-order partial balancing which is restricted to 2 primary selection per stratum, the proposed technique is an extension of this to general design which consists in reducing initially the n_h-unit stratified design to 2-unit stratified design, n_h being the number of selected units in h-th stratum, h =1 to L and then resorting to partial balancing. For illustration, an example of PB design for n_h^{12} half samples where L =12 and each strata having n_h units has been cited. In terms of number of replication, the design based on this technique seems to have computational advantage over the non-reduced design although some loss in precision do occurs.

18. On Optimality of Some Partial Diallel Cross Designs

Ashish Das, Angela M. Dean[1] and Sudhir Gupta[2]
Indian Statistical Institute, Calcutta

Various forms of diallel crosses play an important role in evaluating the breeding potential of genetic material in plant and animal breeding. Let p denote the number of lines and let a cross between lines i and i' be denoted by (i, i'), $i < i' = 1, 2, \ldots, p$. Our interest lies in comparing the lines with respect to their general combining ability effects. Complete diallel cross designs involve equal numbers of occurrence of each of the $p(p-1)/2$ distinct crosses among p inbred lines. If r denotes the number of times that each cross occurs in a complete diallel, then such an experiment requires $rp(p-1)/2$ experimental units (or crosses). When p is large, it becomes impractical to carry out a complete diallel cross even for r = 1. In such situations, we consider designs having no requirement that the distinct crosses appear equally often. This leads to what we call Partial Diallel Cross (PDC) designs. Let n denote the total number of crosses observed in the experiment. In the literature PDC designs have been discussed for $n = ps/2$ ($s < p-1$) distinct crosses each appearing an equal number of times, where $s = 2n/p$ is an integer. Partial diallel crosses can, themselves, be quite large and it is sometimes desirable to use a block design for the experiment rather than a completely randomised design.

In this paper we consider partial diallel crosses in incomplete block or completely randomized designs. Optimal designs in both the unblocked and blocked situations are characterised. The methods of construction of MS-optimal designs are proposed leading to design families which have very high A-and D- efficiencies.

1 The Ohio State University, Ohio, USA
2 Northern Illinois University, USA

19. Estimation of Variance of Genetic Parameters

S.D. Wahi, V.K. Bhatia and Lal Chand
IASRI, New Delhi

The present study was conducted to get the estimates of standard error of genetic parameters by using the distribution free and more robust analytical

methods based on resampling technique. The results of the present study has clearly shown that the approximate formulae used for estimation of standard error of genetic parameters by half-sib, full-sib and parent-offspring covariances given by Falconer (1989) grossly under estimate the standard errors except in case of heritability estimates by parent-offspring covariance. Further, the results of this study has indicated the need of larger samples for estimation of standard error of genetic parameters in case of parametric bootstraping as compared to non-parametric bootstraping. The bootstrap estimates of bias are also found negligible in majority of cases when the initial sample is sufficiently large. The role of initial sample size to get the good and reliable estimates of standard error of genetic parameters is quite important and needs further investigations.

20. Optimal Nested Row-Column (BN-RC) Designs with Unequal Block Sizes

A.K. Chakraborty, B.K. Samanta and P.R. Sreenath[1]
Central Research Institute for Jute & Allied Fibers, Barrackpore

Optimal Nested Row-Column designs with unequal block sizes are defined. Methods for the construction of equireplicate variance balanced partially balanced and universally optimal Nested Row Column designs with unequal block sizes are given. Using the method of symmetric differences BN-RC designs with unequal block sizes for $v = 8t + i$, $0 \leq i \leq 7$ are constructed for column size 2. They require minimum number of experimental plots in their category and reduction is quite remarkable compared to that with equal-sized designs.

1 Retd. Principal Scientist, IASRI, New Delhi

21. Von Bertalanffy Growth Model in Random Environment

Prajneshu and R. Venugopalan[1]
IASRI, New Delhi

The well-known Von Bertalanffy growth model for describing age- length relationship was formulated in a randomly fluctuating environment. The

fluctuations in the system were assumed to be described by a Gaussian white noise stochastic process. The resulting model, in terms of a stochastic differential equation, was solved analytically. It was shown that the probability density function of the length of a fish was Gaussian stochastic process. Finally, as an illustration, the methodology was applied to some pearl oyster data.

1 CMFRI, Cochin (Ernakulam)

22. Statistical Studies on Rainfall at Banda in Bundelkhand

D.P. Handa and R.M. Sood
IASRI, New Delhi

The data on rainfall from 1955-1977 for a period of 17 years were analysed. Of the average annual rainfall of 908.54 mm, the contribution of the months of June, July, August and September were 57, 72, 251.03, 347.35 and 129.09 mm respectively with the corresponding per cent coefficient of variation being 117.14, 40.03, 41.03 and 58.43 respectively. Average rainfall per rainy day was worked out to be 15.38 mm and average number of rainy days per year was 45.07. The number of rainy days are 3, 12, 12 and 8 during June, July, August and September months respectively. Frequency distribution of months as per category of rainfall indicates that 50.78% of rainfall is below 50 mm and only about 25% rain is more than 200 mm. The amount of rainfall that is expected with 50% of change in months of June, July, August and September is 46.2 mm, 260.3 mm, 323.8 mm and 118.1 mm respectively. Out of total 204 months 102 months, (50%) were drought months, 38.23% were normal and 11.77% were above normal.

23. Construction of Efficient Asymmetrical Factorial Experiment

D.P. Handa and P.R. Sreenath
IASRI, New Delhi

A method of construction of asymmetrical factorial experiments with smaller number of experimental units involve obtaining first a suitable

confounded design for symmetrical factorial experiments (2^n or 3^n) and thereafter merging the combinations of some of the factors to form the levels of factor of asymmetry. Since we have several choices for such many to one correspondence, one would like to look for one such choice which is best in some sense. In this paper efforts has been made to search for such optimal correspondence in the construction of asymmetrical factorial design of practical interest i.e. of the type q x 2^n for q < 8. If has been observed that in general the type of correspondence involving 1 to 1 and 2 to 1 correspondences only is the best under the Average Variance i.e. A-Optimal. Among these the association scheme based on the average variance for 5^{th}, 6^{th} and 7^{th} levels of the factor of asymmetry is (1, 1, 2, 2, 2) and (1, 1, 1, 1, 1, 1, 2) are optimal under the generalised variance.

24. Study of Heterogeneity of Error of Variance in Agricultural Field Experiment

Rajendra Kumar and P.R. Sreenath
IASRI, New Delhi

In this paper, an attempt has been made to study the presence of heteroscedasticity, if any in agricultural field experiments conducted in the past. For this purpose experimental data with factorial structure of treatments specially involving factors such as date of sowing, seed rate, size of seeds, method of sowing and variety was used. The experiments relating to sorghum, pigeonpea (Arhar), sunflower, safflower, cotton and pulses (greengram, cowpea and blackgram) crops conducted during the period 1972-78 at various research stations in Maharashtra state. The present study indicated the existence of heteroscedasticity (unequal variances) in 10 to 25% of the experiments in different crops indicating the necessity to address to the problem of heteroscedasticity in field experiments. It was observed that heteroscedasticity was more prevalent in safflower, cotton and pigeonpea (Arhar) than in the other crop experiments. The nature of relationship between the means and corresponding variances for different levels of the factors contributing to unequal variances showed no consistent results. In the case of experiments exhibiting unequal variances, the contribution factors for such heteroscedasticity were

1. Date of sowing in case of green gram, pigeonpea (Arhar) and sufflower.
2. Varieties in cotton, sorghum, pigeonpea (Arhar) and safflower.

3. Fertiliser levels in greengram, sorghum and sunflower.

4. Row spacing in sunflower.

Within row spacing and date of sowing in sunflower indicated no heteroscedasticity.

25. Impact of Command Area Irrigation Project on Agricultural Production of Groundnut

Madan Mohan and R.M. Sood
IASRI, New Delhi

A number of irrigation schemes have been introduced in the country since independence, consequently a new integrated approach for water and crop management was initiated in the area between Bhawani river and Lower Bhawani Canal. In this study of Command Area Development Programme (CADP) pertaining to the groundnut crop reveals that overall yield of 2143 kg/ha and 962 kg/ha for Non-command Area in 1989-90 and 1990-91 were significantly higher as compared to Command Area which was of the order of 928 and 820 kg/ha for the same years as observed by t-test, but in season-II of the crop study shows the reverse trend i.e. the average yield was of the order of 1854 and 1515 kg/ha for Non-command Area in comparison to 2478 and 1918 in case of Command Area.

26. Probabilistic Estimation of Rainfall of Telangana District (A.P.)

J.V.L.N. Reddy, B.S. Kulkarni and G. Nageswara Rao
A.N.G.R.A.U., Hyderabad

An attempt has been made to estimate the availability of monthly rainfall during the South-West monsoon season corresponding to the districts of Telangana region, A.P. The study is based on 35 years of rainfall data covering the years 1961-62 to 1995-96. It was found that the distribution of rainfall in most of the districts corresponding to the months was Pearsonian Type I or Beta. The estimation of rainfall was carried out by applying the three

procedures, viz. Fitting of normal distribution, Gamma distribution and the distribution free approach. It was found that the estimates obtained by all the three procedures were similar in a majority of cases and that the similarities in the estimates had a bearing on the coefficients of skewness and kurtosis.

27. Determination of Optimum Plot Sizes for Soyabean and Rice

G.L. Khurana and Rajinder Kaur
IASRI, New Delhi

The secondary data of the experiments of agricultural field information system of Soyabean as well as rice crop conducted at Marathwada Agricultural University, Parbhani in Maharashtra State for the period 1985-87 were utilised for the estimation of optimum plot size. It was found that with the increase in the value of b, the regression coefficient, the value of optimum plot size also increases. The value of 'b' more than '1' was reduced by more than 50% using the methods of weights i.e. the elements of the inverse of the covariance matrix (information matrix). The value of b is the index of soil variability and varies between unity and zero. In this study proportional costs i.e. k_1 proportional to number of plots per treatment and k_2 proportional to the total area per treatment were utilised for the estimation of optimum plot size.

28. Statistical Assessment of Rice Based Cropping Sequences

Ajit Kaur Bhatia and Rajinder Kaur
IASRI, New Delhi

A study was undertaken to statistically assess the comparative performance of different rice based crop sequences with respect to productivity and energy (calories, carbohydrates and proteins) equivalents utilising the data of an experiment conducted under the Project Directorate of Cropping Systems Research at CSR centre Kathalagere from 1992-93 to 1995-96. The study revealed that in case of productivity and energy equivalents, Rice-Rice was the most preferable sequence. (11445 kg/ha of productivity, 3947 k x 10^4

calories/ha and 8955/ha of carbohydrates) Rice- Soyabean provided the highest quantities of proteins (1273 kg/ha). The above two crop sequences were also found to be consistent in their performance over the years.

29. Crop Residue Management in Rice Based Cropping Systems

Rajinder Kaur and Ajit Kaur Bhatia
IASRI, New Delhi

With the better management of crop residues (stubbles), soil organic carbon can be conserved to improve soil conditions and crop productivity. With this objective, study carried out at R.S. Pura and Kanpur in rice-wheat and in rice-rice-groundnut at Thanjavur has indicated some positive results. At R.S. Pura use of FYM @ 5 t/ha and 10 kg additional N in both the crops at the time of first ploughing was more productive. At Kanpur highest yields were obtained with the use of 20 kg N/ha in addition to recommended dose. Use of cellulose decomposing enzyme is found to be quite effective in increasing the productivity at Thanjavur.

30. Yield Forecast Based on Weather Variables and Agricultural Inputs on Agro-Climatic Zone Basis

Ranjana Agrawal, R.C. Jain and S.C. Mehta
IASRI, New Delhi

The present paper deals with developing forecast model on agro-climatic zone basis using time series data on weather variables and agricultural inputs in various districts within the zone. The study has been carried out for wheat and paddy in Madhya Pradesh. The results indicated that reliable yield forecasts can be obtained using about 15 years data when the crops are 11-12 weeks old i.e. about 2 months before harvest. The results also indicated that the approach works even if partial data for various districts or complete data for some of the districts within the zone are missing.

31. Repeatability of Annual Coconut Yield

K. Muralidharan and K. Vijaya Kumar
CPCRI, Kasaragod

The partitioning of variance into its components has many applications. When multiple measurements of a character like annual production of nuts in coconut is made, the partitioning of variance corresponding to 'repeatability' is of importance as the estimates of other genetic parameters are often not available. The biennial bearing tendency (high- and low-yields in successive years) and linear dependence of yield in the initial years of bearing with the 'bearing age' are the two systematic variations to be accounted for while estimating repeatability of annual coconut yield. There are many estimators suggested for repeatability which are derived according to the underlying linear model that describes the data and the method of estimation of variance components. The utility of these estimators to obtain the repeatability of annual coconut yield was examined based on two sets of experimental data. When data are summed over adjacent years (as in moving average) or the yields available for different sets of palms are not for a common period, estimates based on the intraclass correlation or its modification to the case of moving averages are of practical importance. By making use of the expression for the asymptotic standard error of ANOVA- based estimate of repeatability, the population size corresponding to varying number of years for fixed levels of significance (0.05 and 0.1) were worked out : For a moderate value of repeatability as 0.5 with 20 years of yield data the number of palms required are 225 and 60 in respective order. Estimates based on yield data from initial years of bearing need special attention as palms came to bearing at different years. One way to overcome this situation is to express the second and later years yield as first year equivalents. This approach will not be practicable when the empirical ratios were alternatively high or low in magnitude, as can happen with marked biennial pattern of bearing.

32. Two-treatment Cross-over Designs

B. Vijaya and V.K. Sharma
IASRI, New Delhi

Some important two-treatment cross-over designs available in literature have been studied here with a view to improve the efficiency of estimation

of direct, residual and cumulative effect contrasts when the observations follow a specific covariance structure. It has been found that inclusion of a 'pre-period' with a specific set of treatments improves the amount of information available per period for each of the effects in many designs. It has also been observed that the use of a pre-period in the design also increases the efficiency of estimation of contrasts among direct, residual and cumulative effects.

33. A Note on Embedding in Second-Order Slope-Rotatable Designs Over All Directions

G.V.S.R. Anjaneyulu, D.N. Varma and V.L. Narasimham
Department of Statistics, Guntur-522510, Andhra Pradesh

Anjaneyulu *et al.* (1993) introduced embedding in Second-Order-Slope Rotatable Designs and constructed the same using embedding techniques similar to those of Draper (1960), Herzberg (1967). Park (1987) studied the necessary and sufficient conditions for second order slope rotatability over all directions. Anjanejulu *et al.* (1997) showed that these designs have the variance sum property. In this paper an attempt is made to introduce embedding in SOSRDOAD.

34. SGD Designs and its Robustness Against the Unavailability of Two Blocks

D.K. Ghosh and Dipa D. Gosai
Department of Statistics, Saurashtra University, Rajkot-360 005

Das and Kageyama (1992) investigated the robustness of BIB design (1) When some observations in a block are unavailable. (2) When any one block of BIB design is lost. They further showed that the BIB design is fairly robust in terms of efficiency. Further Das and Kageyama (1992) also investigated that extended BIB designs are robust in terms of efficiency when a block with k observations is included in a BIB design.

Mukherjee and Kageyama (1990) obtained the robustness of GD design when one block is lost, in terms of efficiency of residual design. The present investigation obtained the robustness of SGD designs in terms of efficiency

of residual design when two blocks are lost. The investigation shows that SGD design are fairly robust in terms of efficiency.

35. Bayes Estimation and Detection of a Change in Prior Distribution of the Regression Parameter in Regression Model with Exponential Errors

P.N. Jani and Mayuri Pandya[1]
Sardar Patel University, Vallabh Vidyanagar, India

Consider an experiment which generates data at distinct time points N. Suppose the data appears to follow some linear trend for a period of time and then at some unknown time m appears to make a decisive change in trend. The Bayes estimate of m are obtained under the gama priors and the effect of a change in parameter of a gama prior for slope parameter of the two phase linear regression model is studied.

We also studied testing of hypothesis problem for change point problem in Bayesian frame work. We compute posterior odd ratio in favour of H_0: m=n and examine the robustness of the informal test. When gama priors of slope parameter vary over gama prior class.

1 Bhavnagar University, Bhavnagar, India

36. Estimation of Heritability of Stayability in Dairy Cattle by Path Coefficient Approach

V.K. Bhatia and Amrit Kumar Paul
IASRI, Library Avenue, New Delhi

Stayability in dairy cattle is an important characteristic and needs thorough genetic analysis. As it is known that it has a strong association with production and reproduction traits so there is a need to adjust for them while estimating the heritability of stayability. Keeping this in view, the methodology has been developed to estimate heritability by path coefficient approach by accounting the adjustment for more than one character. The method has been further extended to deal with the situations of both related and unrelated characters.

The estimate of bias from the actual estimates of heritability as well as from theoretical expression have also been obtained. In order to show the applicability of the procedure of path coefficient in diverse situations Monte Carlo Simulation technique is used using different parametric values from past studies.

In the situation of the one character influence on herd life both in case of derived formula and stochastic simulation it clearly shows that estimated value is closer to the true value in case of adjusted herd life as compared to that of without adjustment i.e. for the parametric value of h^2 =0.05 the estimate of heritability of herd life in terms of stayability without adjustment is 0.0818 whereas it is reduced to 0.0617 on account of adjustment due to production. This clearly implies that for true heritability of stayability, adjustment in the herdlife for production plays a significant role. The same phenomenon has been observed for more than one character both for either related or unrelated structures among themselves. This advocates that if one has the information about particular character which might affect the stayability then it is desirable to go for adjustment through path coefficient technique and get an accurate estimate of heritability of stayability which is closely associated with fitness.

37. Selection of Stable Maize Genotypes under Dryland Alfisols

G.R.Maruthi Sankar, P. Raghu Ram Reddy and S. Venkateswarlu
CRIDA, ICAR, Hyderabad-500 059

Field experiments have been conducted during 1991 to 1995 with ten maize genotypes for assessing their performance and making a selection of the best genotypes. The data generated on fodder yield, days to 50% silking and plant height are examined for screening and selection of the best genotypes based their mean and variation in their performance, rank sums over characters and the stability analysis over seasons. Based on the mean performance and variation of the genotypes over seasons, it is observed that the genotype HGT-3 has attained the highest fodder yield with a high standard deviation. Four genotypes viz., HGT-3, African Tall, Teosinte and Trishulata were found to attain fodder yields which are higher than the average and also have higher standard deviation. The plant heights and days to 50% silking of these genotypes were also found to be higher than other genotypes with a lower variation except Teosinte, which had a high variation. When mean performances of these genotypes were plotted against their variation over seasons, it is observed that Teosinte has performed

better than all other genotypes in both the individual seasons as well as the pooled data over seasons for both fodder yield and plant height, although it took longer number of days to 50% silking. The genotypes have also been ranked for each character and are evaluated based on the rank sums of the three characters. Based on the rank sums of each genotype, it is observed that Teosinte has a lower rank sum than all other genotypes. Similarly, based on the stability analysis of genotypes over seasons the genotype appears to be more stable than other genotypes. Thus the genotype is identified to be more stable over the five seasons studied. However, its performance has to be examined under farmers field conditions before it is recommended on a large scale for cultivation under dryland alfisols.