ABSTRACTS OF PAPERS*

SECTION : A

1. **Comparison of Several Product-Type Estimators Under A Super Population Model**

   BY

   D.N. SHAH AND M.R. GUPTA
   Sardar Patel University, Vallabh Vidyanagar

In recent years several papers have come out using the prediction approach for estimating finite population characteristics. In this paper an unbiased product-type and some other product-type estimators using Quenouille's method of bias reduction, based on splitting the sample at random into two half-samples, are suggested to estimate the population mean of a study character under a super population model with uncorrelated errors and a gamma-distributed auxiliary character. The efficiency of the estimator is compared with the usual product estimator under the model. A numerical example is also provided.

2. **Estimation of Population Mean in Double Sampling under A Linear Model**

   BY

   L.N. UPADHYAYA AND A.K. SINGH
   Indian School of Mines, Dhanbad

A class of estimators has been proposed for estimating the population mean $\bar{y}$ of a study character y using supplementary information on an auxiliary character x in two phase sampling. Assuming a linear model, the bias and MSE of the proposed estimators has been derived and its efficiency compared with the usual unbiased estimator $\bar{y}$ and the conventional ratio estimator in double sampling. It has been found that the suggested estimator is more efficient than that of the usual and the ratio estimator.

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3. On Double Sampling for Stratification and Use of Auxiliary Information

By

T.P. TRIPATHI* :
University of Ilorin, Nigeria

AND

ABEL F. IGE** :
University of Ibadan, Nigeria

The usual unbaised estimator in double sampling for stratification [Rao (1973), Cocharn (1977)] ignores, at the estimation stage, auxiliary information obtained on the first phase sample. The usual ratio and regression estimators in double sampling utilize the information collected on the first phase sample only at the estimation statge. This motivates us to propose alternative sampling strategies, based on double sampling-for stratification (DSS) utilizing the auxiliary information obtained on the first phase sample both at the designing and estimation stages. The general properties of the proposed strategies are studied and conditions for optimality obtained. The situations in which the proposed estimators are better than the usual unbaised estimator in DSS are identified and some of the proposed estimators are compared with the corresponding estimators based on un-stratified double sampling (USDS) with and without cost consideration.

4. Some Remarks On Use of Transformed—Variate in PPS Sampling

By

B.V.S. SISODIA, S.P. SINGH AND R.C. BHARATI
Rajendra Agricultural University, Pusa (Samastipur)-848125.

Midzuno sampling scheme can be used with revised probabilities only if the initial probabilities of selection Pi satisfy the condition, $Pi > (n-1)/n(N-1)$, for all i (i=1, 2, ..., N). A simple transformation of measure size x was suggested by Mohanty (1978) to satisfy the above condition with new transformed probabilities. This transformation greatly increase the scope of Midzuno sampling scheme in the practice and even in some cases may increase the efficiency. A transformation of study variate, y, was suggested by

*On Leave from Indian Satistical Institute, Calcutta, India.
**On study Leave from University of Ilorin, Nigeria.

Narsimha and Srivenkataramana (1980) under Midzuno sampling scheme which led to a modified Horwitz-Thomson (H-T) estimator as proposed by them. The efficiency of modified H-T estimator is substantially high than that of usual H-T estimator. An attempt was made to explore the possibilities of the scope of using both above mentioned transformations simultaneously so as to suggest a best sampling strategy. An empirical study was made with many real populations and three standard populations considered by Yates & Grundy (1953) in this regard and reduction in the variance of the modified H-T estimator when it was used with revised probabilities was observed in many of the populations undertaken. However, it was interesting to note that the usual H-T estimator with revised probabilities has performed well than the modified H-T estimator in some of the populations.

5.   Sample Survey for estimation of fish catch from inland resources

By

O.P. KATHURIA AND H.V.L. BATHLA
I.A.S.R.I., New Delhi

AND

K.K. GHOSH
CIFRI, Barrackpore.

A pilot sample survey was conducted in 24-Parganas district of West Bengal with a view to (i) evolve a suitable sampling methodology for estimation of inland fishry resources and total catch of fish from them and (ii) to study prevailing practices of pisciculture. The survey was undertaken jointly by the IASRI, New Delhi and CIFRI, Barrackpore. The study was confined mainly to estimating the resources under ponds and tanks and fish catch from them.

The sampling design followed in the survey consisted of two stage cluster sampling, clusters of villages and ponds with in the villages, constituted first and second stage units respectively. A sample of 10 clusters of 4 villages each was selected from the district. The ponds and tanks in each of the selected clusters of villages were completely enumerated for estimating the area under them. For estimating the total catch 10 ponds were randomly selected from each cluster. The paper presents characteristics of ponds and tanks in the selected sample of villages such as seasonality, extent of

utilisation for fishry purpose and pisciculture techniques followed etc.

The main objective of the study being to evolve a suitable sampling methodology for estimation of inland fishry resources and catch from them, alternative estimators were tried using cluster sampling, and ratio method of estimation for estimating the area under ponds and tanks and fish catch from them. The efficiencies of these estimators were also compared.

6. Sampling from Two-Dimensional Populations Spread over Space and Time

By

D.L. AHUJA AND A.K. SRIVASTAVA

I.A.S.R.I., New Delhi.

Sampling in two-dimensional populations provides flexibility in the choice of sampling designs, as different sampling procedures may be used for the two-dimensions. One may have aligned or unaligned sampling in either dimension. When the two-demensional population under consideration has one of the dimensions spread over space and the other dimension spread over time, some sampling procedure has to be adopted taking into account the convenience of field work. Various combinations of equal probability sampling over space dimension and systematic sampling over time dimension have been examined. The cases when sampling is unaligned and when it is aligned in one or both the dimensions are considered. A particular case when sampling is aligned in both the dimensions and equal probability sampling is followed in one dimension whereas systematic sampling is adopted in the other dimension (r_1sy_1) is examined in detail. The problem is approached through varying probability sampling without assuming any super-population model. The suitability of the suggested procedure r_1-sy_1 has been illustrated with the help of date for tomato crop from "Pilot sample survey to evolve sampling methodology for estimation of cost of cultivation of important vegetable crops at Delhi (1978-81)". It is suggested on the basis of the study that selected fields should be observed for an interval of 7 days simultaneously after a gap of 14-21 days. The proposed procedure r_1sy_1 was found to be around 3 times more efficient than the usual procedure of observing the selected units for the entire time span.

7. **A Sampling Procedure for Two-Dimensional Populations Using Systematic and Double Sampling.**

By

D.L. AHUJA AND A.K. SRIVASTAVA

I.A.S.R.I., New Delhi.

In two-dimensional populations spread over space and time instead of observing the space units for the entire time span, one may come across certain intervals of time whose yields are highly correlated with the total yield for the entire period. In surveys where data are collected by actual observations, even a smaller number of units, if observed over all time units, restricts the movement of the enumerators. In such situations, a combination of double sampling and systematic sampling has been examined both from field work and efficiency point of view. The use of systematic sampling for the second phase sample spares the enumerators for utilising the in-between period of two systematic observations to cover more number of sampling units. The necessary theory for the proposed procedure has been developed and relative gains in efficiencies over the usual procedure of enumerating the selected units for the entire time span have been worked out with the help of data from "Pilot sample survey to evolve sampling methodology for estimation of cost of cultivation of important vegetable crops at Delhi (1978-81). It is seen that the gains due to double sampling only are quite small as compared to the proposed procedure particularly for smaller values of ρ. Gain in efficiency for the proposed 'double sampling $r_1 sy_1$' procedure increases with ρ. For smaller values of ρ, the contribution of systematic sampling appears to be dominant over that of double sampling. The gains due to applications of double sampling in combination with systematic sampling appear to be large for large values of ρ ($\rho \geq 0.8$).

8. **A Sampling Scheme for Two Stage Designs**

By

PADAM SINGH

Planning Commission, New Delhi

AND

A.K. VASISHT

IARI, New Delhi.

In two stage sampling, the primary sampling units (PSU's) are generally of unequal sizes. For the choice of number of Secondary

sampling units (SSU's) to be selected from different PSU's, the most common method is to take them either equal or in proportion to their sizes. The first choice of taking equal number of SSU's from each PSU, mainly for even distribution of work load results in less efficient estimators because of not taking into account the sizes and the variability of SSU's in different PSU's. In the second case of taking number of SSU's proportioned to the size of P.S.U., the overall sample size becomes a random variable and also there is a problem of distribution of work load to the enumerators employed in the survey.

For a special case of the method (Vide Rao 1975) of two sampling with PSU chosen by PPSWR method (with PSU sizes as size measure) and secondary sampling units (SSU) chosen by SRSWOR method from the selected psu's with frequencies proportional to the number of times the PSU's are drawn we work out the variance formula for the HORVITZ—Thompson (1952) estimator based on this sampling scheme. The same is done for an alternative scheme when the PSU's are chosen by Midzuno-Sen (1952-1953) Secheme. Their relative efficiencies are estimated empirically.

9. Predictive Estimation in Double Sampling Procedures

By

M.C. AGARAWAL

University of Delhi, Delhi

The ratio and regression estimators of the population total based on double sampling procedures are shown to be 'sensible' from the standpoint of the predictive approach, i.e., they could be regarded as predictive estimators. But, if the usual ratio-type estimator (biased) in double sampling is used as a predictor in respect of the unobserved units of the population, the resulting estimator is different from the usual one. The bias of this new estimator is found and compared with that of the usual one However, if the new estimator is corrected for the bias, it turns to be the usual unbiased ratio-type estimator based on double sampling.

10. Random Non-Response on Study Variable in Sample Surveys

By

SUKHMINDER SINGH

PAU, Ludhiana

The presence of random non-response on study variable as well as auxiliary variable has been considered by many research.

workers, recently. The more realistic situation in sample surveys arises when this type of non-response is present on the study variable only. This happens because of the fact that the information on auxiliary variable is generally readily available for all the sample units. In this type of situation in sample surveys, certain concepts have been defined for the estimates of two sampling strategies. A comparison has been made between the two with respect to their relative efficiency and non-response robustness.

11. Revisit Sample Size to Check the Quality of Data

By
A.K. SRIVASTAVA AND RANDHIR SINGH
I.A.S.R.I., New Delhi-12

Reinterview of a sub-sample by the surveyor or by more qualified investigator is generally accepted method for checking the quality of data reported by enumerators. But the cost of reinterview will be generally high and time required to complete the revisit and to process the results reduces their utility. Therefore, it is necessary to find the minimum sample size which can be sufficient to check the quality of data. In the present investigation, a method has been presented for determining the sample size of the revisit sample or check sample and an appropriate method of evaluating the quality on the basis of the revisit sample.

12. A Class of Estimators for Population Mean with Known variance

By
HOUSLA P. SINGH
Department of Statistics, Dibrugarh University
Dibrugarh, Assam

This paper proposes a wide class of estimators for population mean $\bar{Y}$ of a character Y under investigation with known population variance 6_y^2. The expressions for bias and mean squared error (MSE) have been derived to the first degree of approximation. Also the optimum estimators of the class have been obtained.

13. A Note on the Proposed Model for Finite Population

By
S.G. PARBHU AJGAONKAR
Marathwada University, Aurangabad

Avadhani and Sukhatme (1970) have proposed a model for finite population, which is subsequently utilized by others. The

present payer points that it is not a model in the usual sense of the word

14. Use of Auxiliary Information in Estimation of Domain Parameters

By

DHIRENDRA V.S. SISODIA AND O.P. KATHURIA

I A.S.R.I., New Delhi-12

In a sample survey one not only needs estimates of the population parameters but also separate estimates for different segments of the population. Such parts or segments of a population for each of which estimates are required constitute the domains of study or sub-populations.

The problem of estimation of domain parameters such as mean or total has been examined using double sampling approach. It is assumed that besides the character under study, it is also possible to obtain information on an auxiliary character highly correlated with the main character under study. When the population values of auxiliary character in each domain is not available it may be estimated by taking a larger sample from the population. Thereafter a sub-sample is drawn for estimating the main character in each domain. Ratio method of estimation has been followed to built up estimator of sub-population parameters in each domain. It has been observed that this estimation can be as efficient as the one obtained earlier by Kathuria and Tewari (Survey Statistician No. 6, 1981) using regression method of estimation if the population correlation between main and auxiliary character is equal the ratio of C.V.'s of auxiliary character to the main character in each domain.

Similarly for sampling on two occasions when there is a partial matching of units on both (first and second) the occasions, estimates of means of each of the domain under study have been obtained on the second occasion by making use of the information available from the previous occasion. The theory, thus, developed corresponds to the well known theory of sampling on two occasions. The results of a sample survey conducted by the Indian Agricultural Statistics Research Institute, New Delhi have been utilized for the purpose of illustration.

15. On Unbiased Estimators of Regression Coefficient And Their Stability in Sampling from Finite Populations

By

PRANESH KUMAR AND S.K. MAHAJAN

I.A.S.R.I., New Delhi-12

The problem of estimating regression coefficient, using some available auxiliary information, is considered. Some unbiased estimators are developed and their properties are studied. A comparison of these estimators with those available in literature, is made with the help of data collected under the surveys conducted by the Indian Agricultural Statistics Research Institute. Some regression or regression type estimators using the estimated regression coefficient are also studied.

16. Imputation in Panel Surveys Using Two Dimensional Data

By

RANDHIR SINGH

I.A.S.R.I., New Delhi-12

In panel surveys or longetudinal surveys the same units selected in the sample have to be observed a number of times at specified time interval for arriving at the suitable estimator of the population mean or total. In such surveys it is not uncommon that some of the observations for some of the sampled units may not be available resulting in lot of gaps in data. In the present investigation some suitable methods of imputation are examined which make use of available observations for the same unit as well as observations for the same time interval for all other units.

17. Estimating From Samples From Outdated Frames

By

RANDHIR SINGH AND N.K. SINGH

I.A.S.R.I., New Delhi-12

The Planning of any sample survey or census requires the existence of a sampling frame. But unfortunately, frames are generally not available in the form desired by the sampler. Most often some units newly added to the target population are not listed in the frame where as some other units which no more belong to the

target population are contained in the frame. In the present investigation suitable estimators are proposed in two situations namely (*i*) when a separate frame of newly added units is available, and (*ii*) when only the out-dated frame is used for sampling.

18. Modified Ratio And Regression Estimators Obtained by Scalar Multiplication

B\

M.N. PATEL

SIR P.P. Institute of Science, Bhavnagar (Gujarat)

For improving the estimator $\bar{y}$, Searls –(1964-1967) suggested an estimator $\lambda \bar{y}$ where λ is a scalar and is obtained by minimizing the mean square error of $\lambda \bar{y}$. The optimum value of λ obtained was in terms of coefficient of variation. Hendricks (1964) presented an excellent example of the use of a prior information. An estimator with a smaller mean squared error (MSE) can be obtained by utilizing a prior information. An estimator with a smaller mean squared error (MSE) can be obtained by utilizing a prior information. Thus, utilizing prior information on coefficient of variation, it was possible to improve the estimator. Sometimes prior information is available to the experiments either from past data on past experiment. This information can be utilized in obtaining better estimators. In this paper following the technique of searls, two estimators are suggested which utilize prior information on S, C_x and C_y. These estimators are

$$t_1 = \lambda \bar{y} \quad -\frac{\bar{X}}{\bar{x}}$$

$$t_2 = \lambda [\bar{y} + b (\bar{X} - \bar{x})]$$

where λ is some constant. Their properties regarding bias and mean squared error (MSE) and efficiency are investigated.

19. Distribution and Variation Between Samples of Leaf Spot Disease in Sapota

By

S.D. WAHI* C.L. SUMAN AND R.D. RAWAL

I.I.H.R., Bangalore

Distribution behaviour and sampling variation of leaf spot disease in sapota (*Achras Zapota*) caused by *Phaeophleospera indica*

*Present address : IASRI, Library Avenue, New Delhi-110012

was studied. The results indicated that for sampling of tree, entire height of the crown is important and should be given proper representation in the samples. The significant differences among the dates indicated change in rate or infection overtime and hence the need for different sample size. The differences among quadrants were non-significant for all the sampling dates under study. The amount of sampling required (i. e. the no. of leaf clusters/tree and no. of trees) for 10 and 15 percent of standard error of means were worked out by using the formulae of sample size in two stage sampling given by Cochran and Cox (1957).

20. Methodology for the Estimation of Yield of Some Fodder Crops

By

SHIVTAR SINGH AND MOHINI DAS

I.A.S.R.I., New Delhi

The methodology for the estimation of cereal crops based on crop cutting experiments is available. However, this methodology is not applicable to some of the fodder crops. A cereal crop is harvested at one time, whereas a fodder crop is harvested over a period of time. The farmer cuts the fodder according to the requirements of the animals maintained. Thus it may not be feasible to insist upon a fixed plot size as is done in the case of cereal crops. Moreover, the selection and demarcation of a random plot in the case of high growing fodder crops such as bajra, Jowar and maize etc may not be practicable. In the present investigation an attempt has been made to develop procedures for estimating the yield of green bajra, utilising the data collected in a survey 'on cost of cultivation of fodder crops' conducted by IASRI during 1983-84. The average yield of bajra crop was estimated to be 247 ± 7.6 Quintals per hectare. Estimates obtained by different methods have been compared.

21. Generalisation of Mood's Theorem on the Dependence of Sampling Inspection Plans Upon Population Distribution Using the Concept of Polya Sequence W.R.T. Cost

By

A. GHOSH

Dept. of Statistics, V.M.V., Amravati (M.S.)

Under the basic assumption, "When production is statistically controlled, there exists a probability, P(N, X) that a lot of size N

will contain X defective items", A.M. Mood (6) has proved through his famous two theorems (known as Moods's theorems), that when the inspection of lots is regarded as having being drawn from a Statistical population and as the inspection proceeds, there is a real opportunity to explore and to use a population distribution. Mood has clearly shown that sampling of lots drawn from a Binomial Population will provide no basis whatsoever for an inference concerning the remainder of the lot. In the present study, the author has tried to generalise the concept of Mood, which leads to the fact that, one should continue the sampling procedure for the remaining items in the lot.

But suppose, that the inspection plan is costly or inspection is destructive or there is no scope of replacement of the bad items, then in that case we can substitute Binomial assumption with Polya sequence. It is subsequently proved that x and s are not independent, where x and s represent the defectives in the sample and remainder of the lot respectively. It is therefore concluded that, on the basis of the size of s, one can predict about the remaining lot. That is, if there are greater # defectives, in the sample, i.e., if s is greater than s_1 (a fixed acceptable value), then there is every possibility that x will be greater and so we reject the lot and conversely. In this case the author feels that one can reduce inspection cost.

22. On the Autocorrelation Functions of Some Stationary Stochastic Processes in the Context of Human Metabolic experiments

By

C. Asok

MACS, Pune

Paranjpe (1980) has observed that the weekly averaged energy intake series can be adequately described by one or other of the three stationary processes AR (1), MA(1) and ARMA (1, 1). She has also observed that quite ofted the autocorrelation of the first order increases by averaging the daily series over a week. Asok (1983, 1984) has studied the effect of averaging and the effect of non-sampling errors on the autocorrelation function of the stationary AR (1) processes. The same aspects have been studied in this paper for the stationary MA (1) and ARMA (1, 1) processes.

23. A Class of Asymptotically Distribution-Free Two Sample Tests for the Star-Equivalence of Two Probability Distributions

By

SUBHASH C. KOCHAR

Department of Statistics, Punjab University, Chandigarh

Based on independent random samples from two absolutely continuous distributions, asymptotically distributions free tests have been proposed for testing the null hypothesis that two distributions are identical except for an unknown scale parameter against the alternative that one is star-ordered with respect to the other. Tests are based on U-statistics.

24. Probability of Negative Estimate of Variance Component Under The Violation of Normality Assumption

By

R.A. SINGHAL

IVRI: Izatnagar-243 122

The probability of negative estimate of between-blocks variance component for balanced one-way Model II in samples from non-normal populations is insensitive to the skewness and kurtosis of random effects. The normal probability rapidly decreases for increasing block and replicate sizes, and for the ratio of between-blocks variance component to within-blocks variance component.

25. Explicit Minque Formulae for Unbalanced Two Way Nested Random Model

By

S.C. AGARWAL

IVRI, Izatnagar-243 122

C.R. Rao's MINQUE (1972) for estimating variance and covariance components from unbalanced data has desirable properties of optimality. But it has not been used in practice due to its computation stigma involving inversion of matrix as high in dimension as the total number of observations. Accordingly there need to formulate simpler MINQUE formulae, modifying the general algorithm, for the specific Models in common use

1977). In animal genetic studies, the two models namely unbalanced (1) one way and (2) two way random models are very common for estimating genetic parameter-heritability from half-sibs data respectively. In literature explicit MINQUE formulae are available for one way random model (Ahrens, 1978) but not for unbalanced two way random model. Here we derive explicit MINQUE formulae for unbalanced two way random model.

26. Factor Analysis for Plant Genetic Resources Evaluators

By

R.L. SAPRA

National Bureau of Plant Genetic Resources, New Delhi-12

Plant Genetic Resources Evaluators record data on large number of discriptors to characterize their genetic resources. Some times it becomes necessary to reduce the number of discriptors so that the huge amount of labour involved in taking observations on large number of accessions is saved and to some extent their aim of characterization of the germplasm in addition to the determination of the yield components is served. Factor Analysis is a statistical technique for reducing large number of correlated variables to a small number of main factors. The technique has also been utilized effectively by the plant breeders in improving yield of crop plants by overcoming the limitations of the Correlation, Path-coefficient and Regression analysis. As the factors are uncorrelated, it is possible to study them in isolation from others for arriving at valid conclusions. The object of the present study was to determine the relationship between the characters by extracting minimum number of factors and to determine the yield components in various crops by adopting the most commonly used factoring methods.

27. Minimum Discrimination Information : An Approach for Analysis Dichotomous Data

By

B. SINGH

Central Institute for Research on Goats Makhdoom, Mathura (UP)

Some research workers have reported the analysis of data on mortality/conception rates in livestock by using the least square procedure ignoring the fact that the procedure is not robust under

these situations. Therefore, an approach for analysis of such data using minimum discrimination information (MDI) procedure, is suggested. The MDI estimates are best asymptotically normal (BAM) and in many situations they are maximum likelihood estimates. The MDI statistics are additive, as the associated degrees of freedom, and provide method of analysis analogous to least square method. The MDI statistics under various sub-hypotheses follow asymptotically chi-square with appropriate degrees of freedom.

28. Certain Generalized Discrete Distributions and its Computational Aspects.

BY

M. BORAH

Chemical Engg. Divn. Computer Section Regional Research Laboratory Jorhat (Assam)

An easier procedure has been described for the computation of probabilities in the fitting of certain generalized discrete distribution which are supposed to be free from the accumulation of errors due to the dependence of the preceding probabilities. It is observed that one can handle higher order generalized distributions in a straightforward way by this method. Certain distributions are fitted to some agricultural data by estimating the parameters by the method of moments and also some simple modified methods of estimation. It is found that these distributions provide more satisfactory fit compared to the parent distributions.

29. Regression Method with Dummy Variables in linear models for unbalanced data

BY

R.P. GOSWAMI AND UMED SINGH

HAU, Hissar

The analysis of unbalanced data has been discussed using several techniques. A unified regression approach using dummy variables for unbalanced data has been discussed of which analysis of variance techniques are special cases for unbalanced data. Regression methods with dummy variables in linear models are criticaly examined in case of unbalanced data using three coding schemes. It has been observed that the reduction in sum of squares R (μ, α, β, γ) fitting the model μ, α, β and γ is same using any linear method or any coding scheme. S.S. error is also not affected by using different schemes. Considering S.S. (adj) for factor A and

S.S. (unadj) for x another B and vice versa, the total S.S. for factor A and B is found same. It is found that R $(\alpha/\mu, \beta, \gamma)$ and R $(\beta/\mu, \alpha, \gamma)$ using coding scheme B (1, 0) are considerably smaller than using any other scheme. Measure of extent of the non orthogonality has been proposed for unbalanced case through the concept of eigen values of the correlation matrix for the design matrix X which is a thumb rule only. The non orthogonality index was generally higher in case of coding scheme B (1, 0) than coding scheme A (1, 0, −1) it is, therefore, recommended that one should use regression method with dummy variables using coding scheme A (1, 0, −1) for appropriate analysis of linear models for unbalanced data.

30. Study of Pre-Harvest Forecasting by the Application of Growth Curve Models

By

MARKAND OZA AND G.K. SHUKLA

Indian Institute of Technology, Kanpur-16

An area of interest in agricultural statistics is the preharvest forecasting of the yield. On the basis of data of previous years, one is expected to provide a prediction rule so as to be able to forecast the yield of a crop after observing various biometrical characters over a period of growth on an individual. The most commonly used method for obtaining such a rule is to fit a multiple regression equation. One can also view this situation in a growth curve setup with some modifications. An empirical comparison of these two methods on a real data set has been presented. In the prediction study, the samples are all of observations except the one being predicted. The yield of omitted individual is predicted given the first few observed measurements of various characters on the omitted individual. The predicted values are then compared with the actual observed values.

31. Generalised Stochastic Survival Model

By

B. ROY CHAUDHURI
Directorate of Veterinary Services, W.B.

AND

B.C. SASMAL
Jute & Agricultural Research Institute, Barrackpore

In prospective studies of various diseases, especially of prove-ly degenerative diseases, it is important to consider survival

functions of individuals for understanding the demographic consequences of the diseases. The survival functions are stochastic in nature. Chiang (1968), Johnson & Johnson (1981) & others introduced certain survival functions which adjust for each individual's covariate informations on diseases. Considering only two health & two death states, Beck (1979) have developed a stochastic survival model with competing risks and covariates and derived the survival probabilities.

From a practical viewpoint, it is possible to include several states of health and corresponding states of death. In this paper, an attempt has been made (i) to present an extended survival model (ii) to derive survival probabilities and (iii) to find out the unconditional as well as conditional expected time to survive.

In the present investigation, three major cases are considered as below :

(a) it is assumed that an individual in any health state (state of ailment) S_i at time $t=0$ may be absorbed to either R_o or R_i or R_{i-1}

(b) It is assumed that an individual in state S_i at $t=0$ may be absorbed to either R_o or R_i or R_{i-1} or R_{i-2}

(c) In the general case, an individual in state S_i at $t=0$ may be absorbed to either R_o or R_1 or R_3 or R_3 or......or R_i. $i=0, 1, 2, ..., k$. where R_o=a disease unrelated death state. S_o=state of normal health. & for $i \neq o$, R_i=state of death corresponding to ailment state S_i.

32. A quick estimator for Linear regression models

By

K.K. SAXENA AND O.P. SRIVASTAVA

H.A.U., Hisar

One of the most widely used techniques in applied fields is the estimation of a linear relationship between two variables. Although the assumption of normally distributed error appears to be appropriate for most of the situations, yet situations do exist when this assumption is far from true. The usual least squares estimator, although unbiased, is vulnerable to gross errors and is also inefficient for some distributions. As a distribution fr

technique, Theil (1950) initiated the problem of estimation of β by taking the median of all possible slopes. It was further studied by Brown and Mood (1951), Hodges and Lehman (1963), Adichie (1967) and Sen (1968). The estimator based on median is particularly useful in case of outliers but it fails to have optimum large sample properties. An estimator is considered as the mean of all possible slopes as

$$\frac{1}{\binom{n}{2}} \sum_{i<j} \frac{y_j - y_i}{x_j - x_i}$$

This estimator unbiased for β in $Y = X\beta + e$. Defining conditional probability measure in the sample space X, the statistic is identified as a U-statistic and has all the nice properties. The variance of this estimator is also calculated for finding relative efficiency.

33. Testing Equality of Growth Rates in Time Series Data

By

P.R. WAGHMARE

Marathwada Agril. University Parbhani

An alternative procedure has been suggested to test the equality of intercept and regression coefficient in two variable relationship in time series data (i.e. when one of two variables is necessarily time or trend variables). Chow (1960) suggested a general method for testing equality of intercept and regression parameter, but in order to know whether the shift in two distinct samples is due to intercept or regression parameter, one is required to use the technique of Dummy variable in multiple regression analysis. In the present paper an alternative two variable regression analysis is suggested instead of multiple regression analysis without using dummy variable for the time series data.

34. Comparison of Various Sampling Schemes in Two-Stage Sampling

By

RANJIT SINGH AND JAI P. GUPTA

Punjab Agricultural University Ludhiana

The efficiency of ratio estimator and linear regression estimator with simple random sampling without replacement and Rao-Hartley

Cochran's (RHC) scheme and Midzuno scheme used at first stage and SRSWOR used in second stage is compared with the usual SRSWOR estimator used in both the stages. The data on availability of milk has been collected in three seasons (winter, summer and rainy) in 1983-84 in a selected tract of 70 key villages in Ropar and Patiala districts of Punjab State selecting key villages at first stage and households at the second stage. It was observed from the data that the ratio estimator is most efficient with efficiency 1393.03, 852.3 and 1742.09 followed by RHC estimator with efficiency 210.24, 126.69 and 174.27 and the third preference goes to linear regression estimator with efficiency 102.33, 102.08, and 102.25 percent in winter, summer and rainy seasons, respectively. However, Midzuno scheme was computed to be inefficient in comparison to usual SRSWOR estimator.

35. Intrinsic Rates of Natural Increase for Some Breeds of Female Bovines

By

U.G. NADKARNI AND T. B. JAIN

I.A.S.R I., New Delhi-12

Age-specific current birth and death rates for some breeds of bovines prevailing in the four agro-climatic regions of the country have been estimated on the basis of data collected in a series of surveys conducted by I.A.S.R.I. From these surveys age-specific survivorships of bovines were also obtained. Using these estimates for Andhra Pradesh, Punjab and Gujarat regions, intrinsic rates of natural increases have been calculated for non-descript, Hariana and Sahiwal breeds of cattle and non-descript, Murrah, Nili and Surti breeds of buffaloes, separately for animals found in Intensive Cattle Development area (I.C.D.) and adjoining area (non-I.C.D.). Various comparisons of these were made. These rates give measure of asymptotic growth implied by the current age-specific fertility and mortality rates.

36. On the fitting of a Growth Model to Wheat Emergence in Relation to Time, Temperature and Soil Moisture

By

A. S. SETHI

P.A.U. Sugarcane Research Station, Jalandhar

This paper aims at developing a stage wise estimation methodology for an expectedly complicated model relating emergence of wheat to time, soil moisture and temperature. Emergence percentage (p) may be related to time (x) as a Mitscherlich equation,

whereas its relationship with temperature (y) and soil moisture (z) at a fixed time may be expressed through an interactive logistic growth model, viz. $p = k/(1 + fe^{-\sigma_1 y - \hat{\sigma}_2 z + \sigma_{12} yz})$. A difference equation method involving Nair's (1954) approach has been suggested to estimate parametres of this model. The estimation may be done by using data for the period, as determined from the p—x relationship, which results in a value of p of interest (say, $\bar{p}$). Various combinations of y and z for which $p = \bar{p}$, may be obtained from the fitted logistic model. The so obtained pairs of (y,z) may be related again through a Mitscherlich equation, thereby providing a temperature-moisture schedule which is expected to furnish a crop stand of desired density after a known time. Results from an empirical study using experimental data lead to the fairness of the proposed methodology.

37. Methods for Estimating Current Mortality Rate in a Bovine Population

By

U.G. NADKARNI AND S.N. ARYA
I.A.S.R.I. New Delhi-12

In view of the lack of vital statistics for bovines in rural areas of our country, sample survey technique was adopted for getting age specific current mortality rates in four different animal husbandry regions. The data collected through a suitable sampling design were analysed. The population of bovines in the sample was exposed not only to births and deaths but also to purchases and sales. Taking these factors into account, two estimates of the denominator in Deaths/Populations were obtained by (i) mid-population method and (ii) fractional exposure method. The latter involved reckoning the number of days for which the animal remained in stock, taking into consideration the date of arrival and date of disposal. Methods for estimating current mortality rate from animal-wise records for (i) complete one year and (ii) half-year or more are discussed and illustrated with the data relating to two surveys.

38. A Probability model for open Birth Interval regardless of Parity

By

R. N. SINGH
Rajendra Agricultural University, Patna

A number of probability models for open birth interval have been proposed in recent years. Srinivasan (1967, 1968) has propo-

unded a set of analytical models for studying the mechanism of the open birth interval and obtained its mean and variance in terms of preceding closed birth interval Leridon (1969) has given some comments on the srinivasan's Model and suggested some improvements over his expressions for mean and variance of open interval. Sheps *et al* (1970) have attempted to derive some general continuous time distributions for the same and raised some important issues regarding the use of open birth interval. Singh *et al* (1982) derived a parity dependent model for open birth interval. In the same line, a probability distribution has been derived for open birth interval of woman irrespective of birth order fixed marital duration. The suitability of the model has been demonstrated by comparing the theoretical means of the open birth intervals with the corresponding means of the observed distributions taken from "A Demographic survey of varanasi (Rural)"

39. Problems of Multi-collinearity in Soil Test Crop Response Models

By

G.R. MARUTHI SANKAR, M. VELAYUTHAM, AND

K.C.K. REDDY

All India Co-ordinated Soil Test Crop Response Correlation Project, Hyderabad

The soil and fertiliser nutrient contributions to the yield are usually direct and positive, but in some situations they were found to be indirect and negative, due to high and significant inter-relationship among soil-fertility parameters. The quadratic function with multi-nutrient soil fertility parameters has been identified to be the best model for marking crop-wise yield predictions in a given soil-crop situation. Using a method based on Frisch's confluence analysis, the significantly correlated soil-fertility variables have been identified and dropped from the model. The coefficents in the reduced model were found to be more meaningful than the complete model for making yield predictions and optimisation of fertiliser nutrients for varying soil test values. The models have been calibrated and compared for the data of a Soil Test Crop Response field experiment conducted under the Project.

40. Fitting of Probability Distribution Functions to Annual Maxima of Daily Rainfall for Chandigarh

By

Y. AGNIHOTRI

Central Soil and Water Conservation Research and Training Institute, Resarch Centre, Chandigarh

Four distributions viz. normal, log normal, gumbel extreme value and log pearson type III have been fitted to the observed values of annual maxima of daily rainfall at various percent chances. Daily rainfall data for 26 years (1958-1983) recorded at Chandigarh have been used for the analysis. The study show log pearson type III distribution to give the best fit to the observed values. Log normal, normal and gumbel extreme values distributions do not provide overall fit to the observed data as confirmed by χ^2 test. The later 3 distributions however show divergence of the probable values with the observed ones only at 80 percent chances and above.

41. Growth in Annual Production of Marine Fish

By

H.V.L. BATHLA AND O.P. KATHURIA

I.A.S.R.I., New Delhi-12

The development of fishing and allied industries has a special significance because :

(i) this sector is eminently suited to assist a large mass of backward and economically weaker sections of the rural community ; (ii) it provides a high quality protein subsidiary food at reasonable prices, and (iii) it has a large export potential.

By the declaration of the 200-mile Exclusive Economic Zone (EEZ) by the country in 1977, the marine fisheries has become all the more important. More mechanised boats and auxiliary facilites have aided overall growth in the total landings of marine fish in India.

Various maritime states and Union territories have experienced differential growth rates over the past years. Although some states had larger share of the total catch, their rate of growth (compound) has been very low. In this paper, the rate of growth of marine fish landings in different maritime states and Union territories between 1966-1981 have been worked out. Species-wise growth rates of marine fish landing have also been calculated between these years.

42.   Application of Seinhorst's Equation for the Estimation of Host Tolerance Levels Against the Reniform Nematode, Roty Lenchulus Reniformis

By

U.C. SUD, K.S. VARA PRASAD AND GOPAL SWARUP
I.A.R.I., New Delhi-12

Nematode population level beyond which noticeable damage to host occurs is referred to as tolerance level. To describe the relationship between tolerance level (T) and crop yield (Y) Seinhorst gave the equation, where, $Y = m + (1-m) Z^{p-t}$. Later, Ferris, developed an algorithm which allows the estimation of 'm' minimum yield, 'Z', a constant and 'T' for any given data set with known values of initial population (p) and corresponding crop yield. Presently different tolerance levels against the reniform nematode has been estimated.

'T' values for root weight, shoot weight and total plant weight of cotton, cowpea, tomato, urid, and moong at two stages and at one stage caster (100 days) and *bhendi* (60 days) were estimated. Root weight showed minimum tolerance in all the seven hosts with damage noticeable beyond the level of two young females of *R. reniformis* in all cases except castor, where the 'T' value was ten. Taking the total plant weight (shoot and root weights), the 'T' values generally did not very much between the two stages of the same crop. However, in some cases like in tomato (5.24 and 2.00), cowpea (17.00 and 2 00) and urid (12.85 and 2.00), the 'T' values differed at the two stages but the minimum was inveriably at the later stage. Thus, root parameters apparently are very sensitive to nematode infestation with notieable damage at very low population levels suggesting this as an ideal one for estimating 'T' values.

43.   A Post Control Model for Sorghum

By

B.S. KULKARNI AND H.S. ACHARYA
Marathwada Agri. University, Parbhani

Sorghum yield is affected by two major pest incidences : Shoot fly during the germination stage and Midge fly during the flowering stage. Sorghum data recorded at Sorghum Research Station. MAU,

Parbhani revealed that the shoot fly incidence had significant corre-lation with AM-Humidity, and can be expected whenever the daily humidity exceeds 81.5 per cent. Taking this as the threshold value, the transition probabilities and other paramenters of the Markov Chain model were estimated from the twenty years daily Humidity data of Parbhani to study the chances favourable to incidence and no incidence. Results revealed that chance of no incidence are less in October and June and that in these months after an initially no incidence situation, shoot fly incidence can be expected to occur only after 15 and 21 days respectively. This information and that suppli-ed from the probabilities of various outcomes can be made use of scheduling pest control measures as well as planning of sowing time.

44. Growth Pattern of Nilagiri Lambs

By

V. Mani. D. Ganesakale and M. Iyue

Sheep Breeding Research Station Sandynallah-643237.
The Nilgiris.

Mean and S.E. for body weight at various stages of growth for ramlamb and ewe lamb of Nilagiri Sheep were presented. The best fit of regression equations of average body weight on age for both ram lamb and ewe lamb were worked out. The best fit for ram lamb and ewe lamb was found to be $Y = 2.7856\,769 + 4.0368736\ x - 1.2421614\ x^2 + 0.259092\ x^3 - 0.018341\ x^4$ and $Y = 2.895213 + 3.097868\ x - 0.461029\ x^2 + 0.048166\ x^3 - 0.001870\ x^4$ res-pectively. Formula for correction factor to predict body weight at later stages of growth was also furnished. The Association between body weight and age for both the sexes was found to positive and significant.

45. A Study on Estimates of Yield of Vegetable Crops in Delhi

By

D.C. Mathur, Jagmohan Singh and S.C. Sethi
I.A.S.R.I. New Delhi-12

Generally the estimates of yield of agricultural commodities are obtained by crop cutting experiments. Other methods of esti-mating the yield of crops are by enquiry method of eye estimates. A study is carried out to highlight the difference between the esti-

mates of yield of vegetables got by the usual methods. The study
pertains to vegetable crops in Delhi state and is based on the data
collected by I.A.S.R.I on 1978-81.

**46. Frequency Distribution of Plot Yields in Natural grasslands in
Agra Ravines**

By

M.C. AGARWAL AND RAM BABU

*Central Soil and Water Conservation Research and Training
Institute, Dehradun*

An attempt has been made to find out the nature of the frequ-
ency distribution of plot yields of various sizes and shapes in natural
grasslands of Agra ravines at three different locations (i.e. ravine top,
slope and bottom). The frequency distribution of yields from plots of
size $1m^2$ to $12m^2$ of all possible shape on ravine top, slope and bottom
have been examined separately for the average yield of two consecu-
tive years because one to one correspondence between the sampling
unit was maintained in both the years. The plot size had been
restricted to $12m^2$ as few cases of bigger size were available for study.
The four parameters viz the mean, the standard deviation, the
measure of skewness and the measure of kurtosis were estimated and
their significance tested. The theoretical normal curve was also
fitted and χ^2 test for goodness of fit also carried out.

The results indicate that there is a minimum plot size below
which the assumption of normality is not followed in the natural
grasslands of Agra ravines. The results also indicated that bigger
plots (more than $12m^2$) may follow the assumption of normal law on
ravine top. At ravine slope the plot of $12m^2$ and at ravine slope the
plot of $6m^2$ follow the assumption of normal law. Hence it may
be concluded that a plot $12m^2$ on ravine slope and bottom and a
plot of more than $12m^2$ be taken on ravine top for conducting the
field experiments.

**47. Studies in the Yield Forecasting of Cotton and Efficiency of
Different Plot Sizes**

By

LATE D. S. RANG RAO, LATE V. G. SHARMA
AND S. G. PATKI

Department of Agriculture, Maharashtra State

An attempt at forecasting of cotton yield was done on the
basis of the count of bolls (burst) and their weight at the time of

picking in a random stripe of 6 rows of 11 feet length each in estimation survey on cotton during the two years 1955-56 and 1956-57 in East Khandesh district to Maharashtra by trained statistical supervisors.

For this purpose, all the pickings of the selected plots in the subsample were supervised and record maintained of (a) number of bolls and (b) weight of 100 bolls at each picking

The main indications emerging from the analysis are.

(i) The ratio of the total number of bolls picked in the two seasons was in fair agreement with the ratio of the yield rates of the crop in the two seasons at the district level.

(ii) Irrespective of the time taken for the crop to attain maturity the average number of bolls bursting at each picking in relation to the total number of bolls during the entire season expressed in percentage remained practically the same under different field conditions.

(iii) The average weight of 100 bolls at any one picking was fairly uniform under different field conditions.

(iv) Another approach for predicting yield peracre of the crop was based on regression method of estimation in view of the high correlation noticed of the yield of first two pickings to the total yield of all the pickings.

(v) During the course of the investigation an efficiency of different plot sizes was also undertaken.

48.   On the Limits of Genotypic Correlation Coefficient

By

G.C. Misra, R.K. Agrawal and R.M. Singh

Institute of Agricultural Sciecnes, BHU, Varanasi

The expressions for the limits of genotypic correlation coefficient showed that its nature was quite different from that of

phenotypic correlation coefficient and it would not lie between -1 and + 1, as assumed earlier, but it may have any value between-∞ and +∝. Due to lack of suitable procedure for testing the significance of genotypic correlation coefficient, use of phenotypic correlation coefficient alongwith coheritability estimates have been suggested in plant-breeding programmes.

49. Construction of Composite Agricultural Productivity Indices and Deflation of Growth Rates-An Inter-State Analysis

By

S.W. JAHAGIRDAR, B.G. SAPATE AND R.K. KOLHE

Punjabrao Krishi Vidyapeeth, Akola

The methodology has been proposed to construct the composite indices of agricultural productivity so as to simplify the relative comparisons of different regions with regard to aggregate growth. Moreover, in order to get more realistic picture of the growth on the back ground of initial standing of the region the construction of deflation indices for deflating the growth rates have been proposed. An inter-State analysis for cereals, pulses and oilseeds has also been done on these lines.

50. Estimation of Stalk to Grain Ratio and Availability of Jowar Fodder for Dharwar District of Karnataka State

By

D.L. AHUJA AND SATYA PAL

I.A.S.R.I., New Delhi-12

As jowar stalk is used as cattle feed in India, the estimate of its availability with reasonable precision will be useful. Grain yield being estimated with very high precision, can be used to estimate availability of Jowar stalk with sufficient accuracy if precise estimate of stalk to grain ratio in Jowar can be obtained. The stalk to grain ratio for Jowar was estimated using conventional ratio estimator and Hartley-Ross estimator. The data used pertained to "Sample-Survey for Methodological Investigations into H.Y.V.P." for Dhar-

war district in the Kharif seasons in 1977-78 and 1978-79. It was found that conventional ratio estimator performed better than the other estimator and the ratios inthe two years were found to be 2.67 and 2.68 with estimated variances as 0.015 and 0.014 respectively. The estimated fodder (Jowar stalk) as bye-product of HYP-Jowar was estimated as 491892 tonnes and 463520 tonnes respectively in the two years.

SECTION : B

51. On Row-Column Designs

By

A. DEY AND V.K. BHATIA

I.A.S.R.I., New Delhi-12

A structural property, called C_3—property in row-column designs is introduced. This property is analogous to the C-property of block designs. It is seen that the analysis of designs having C_3-property is extremely simple. Necessary and sufficient conditions are derived for a row-column designs to have C_3-property. Designs having C_3-property are termed as C_3-designs. Some classes of C_3-designs are constructed.

52. Incomplete block designs for Parallel line assays

By

P.D. PURI

Haryana Agricultural University, Hissar

Bio-assay is one of the important fields where Partially effi- ciency balanced designs (Puri and Nigam, 1977) are used quite effectively. In bio-assays the contrasts of interest are other than ele- mentary contrasts and, therefore, the conventional incomplete block designs may be quite inappropriate for bioassays. In parallel line (PL) assays preparation (L_p), the combined regression (L_1) and the parallelism (L_1) contrasts are of major interest.

In present paper necessary and sufficient conditions for orthogonal estimate of L_p and odd order contrasts has been derived. A desirable pattern of incomplete block designs for parallel line assay which estimate these contrasts free from block effects have

been given. Some series of incomplete designs satisfying this pattern are presented. The designs considered are PEB and have very simple analysis.

53. On Incomplete Bio-Assays

By

M.V.R. PRASADA RAO AND M.N. DAS

Data collected from incomplete block designs are usually analysed by testing the equality of the effects of number of treatments. But there are occasions where incomplete block designs are adopted but the hypothesis is to be tested is not the equality of the treatment means but instead the hypothesis is that certain contrasts of the treatments is Zero. Such situations are encountered in factorial experiments adopting confounded designs and bio-assays adopting incomplete block designs. If the treatment are estimated from the data collected and then the required contrast is estimated and tested by t or F test, it does not provide valid results which is obtainable only when the hypothesis is made involving the contrast in the question alone and not involving all treatments. A new method of analysis of the data from incomplete block designs for providing the solution to the above problem has been given in the paper. The method has been illustrated by analysing slope ratio assays with missing observations.

54. A Series of Balanced Ternary Change-Over Designs

By

G.C. CHAWLA AND A. DEY
I.A.S.R.I., New Delhi-12

The paper deals with balanced change-over designs in which a treatment symbol appears in a given sequence at most *twice*, the same treatment however, does not appear in two consecutive periods. Such designs are termed as 'ternary' change-over designs. Analysis and conditions for balance are derived and a series of balanced ternary designs in constructed.

55. Incomplete Block Designs for Slope Ratio Assays

By

LAJPAT RAI & P.D. PURI
Haryana Agricultural University, Hissar-125004

Some systematic procedure of construction of incomplete block designs for slope ratio assays are given. These designs are

obtained by supplementing every block of equi-replicate parallel line assay PEB designs constructed from singular/semiregular G Ddesign. The designs constructed fall in the category of supplemented block designs of Puri et al (1977). The bia-assay designs proposed in this paper are more advantageous than the existing ones in the sense that the analysis of the present designs are extermely simplified. Moreover the important bio-assay contrasts i.e. intersection (L_1) and Blank (L_b) required for the validity tests are estimated free from block effect.

56. Analysis of A Complete Diallel Cross when One Cross is Entirely Missing

By

S.P. SINGH AND M. PRATAP

J.V. College, Baraut.

If one parent is entirely missing in a complete diallel cross (C.D.C.) having p parents, then available data can be analysed as a C.D.C. with (p-1) parents. But the case is not so simple if, however any cross is entirely missing. The latter situation needs some modification in the analysis. In the present investigation attempts have been made to develop such a modified analysis. The estimates of g's and their variances-covariances have also been obtained.

57. Analysis of Variance by Ranks for a Factorial Experiment

By

KRISHANA, G.V.S.R. AND MATHUR, B.K.

Central Arid Zone Research Institute, Jodhpur

In laboratory experiments, sometimes it is difficult to have more number of observations because of scarcity of material or lengthy procedures of estimation of different characters under observation. In such situations valid conclusions cannot be drawn with any parametric test. For comparing a set up of treatments Krushcal-Wallis one way analysis of variance test can be applied. In this paper a method of analysis of variance for an experiment where the treatments are in a factroial set up and with equal or unequal number of replications for each treatment is discussed. The method is demonstrated with the help of an example.

58.   Symmetrical Factorial Split Type Switch Over Designs

By

S.B. AGARWAL

NDRI, Karnal

Cross over designs are adopted for controlling the animal to animal variation. These designs however remained limited to the study of single factor ever since they were evolved. In this paper an attempt has been made to obtain symmetrical factorial type switch over designs involving two factors each at v levels. These designs involve v main periods for switching over the levels of main treatment and v^2 sub-periods distributed equally over main periods for switching over levels of sub treatments. Situation is same as split plot type in agricultural experiments. Hence the design is called symmetrical factorial split type switch over design. Method of construction of such designs along with a method of their analysis for the situations (i) With the assumption of residual effects of the factors and (ii) Without any assumption of residual effects of the factors has been described.

59.   Least Squares Approach to Estimation of Variance Components Based on Diallel Mating Design

By

K.N. PONNUSWAMY AND M.S. SRINIVASAN

Department of Statistics, University of Madras

Several procedures like ANOVA, MINQUE, ML and REML etc., are available for the estimation of Variance Components relating to linear Models. Among them ANOVA procedure is the most commonly used. Cheng Hsuan Yuan (1977) has suggested a least squares approach for obtaining Quadratic Least Squares Unbiased Estimators and Invariant Estimators for the Variance Components relating to Mixed Models. In this paper it is demonstrated that the Anova Estimator of Variance Components based an Diallel Mating Design is infact the Quadratic Least Squares unbiased estimators as well as the Invariant Estimators.

60.   Least Squares Approach to Estimation of Variance Components Based on Triallel Mating Design

By

M.R. SRINIVASAN AND K.N. PONNUSWAMY

Department of Statistic, University of Madras

Several procedures like ANOVA, MINQUE, ML and REML etc., are available for the estimation of Variance Components rela-

ting to linear Models. Among them ANOVA procedure is the most commonly used. Cheng Hsuan Yuan (1977) has suggested a least squares approach for obtaining Quadratic Least Squares Unbiased Estimators and Invariant Estimators for the Variance Components relating to Mixed Models. The Quadratic Least Squares Unbiased Estimators of Variance Components based on Triallel Mating Design have been obtained.

61. A Criterion for Classifying Partial Diallel Circulant Plans in Relation to their Efficiencies

By

A.S. ARYA AND O.P. SRIVASTAVA
Haryana Agricultural University, Hissar-125001

For a given material, a large number of partial circulant plans can be constructed but they differ in their efficiencies (Curnow 1963, Arya 1983), some of them may possess the same efficiency while others different. Hence one requires some simple criterion of identifying and enumerating plans having different efficiencies so that the best one can be chosen with least efforts.

Starting with the definition of a partial plan as in Arya 1983 and making use of set relations, the paper utilizes the property of mutually generalized (MG) sets to establish the equivalence of two comparable plans. The procedure has been explained through an example.

62. Alternative Models for Repeated Measurements

By

P.S. GILL AND G.K. SHUKLA
Indian Institute of Technology, Kanpur-16

The standard method of analysing data from repeated measurements design assumes independence of successive observations from an experimental unit and additivity of direct and residual treatment effects. However, alternative models have been proposed from time to time, where,

(i) residual effects are proportional to the direct treatment effects:

(ii) the possible correlation among observations from the same experimental unit is taken into account:

(iii) the response in the current period depends on the current treatment applied and the response in the previous period.

The method of maximum likelihood is suggested to estimate the parameters of these models. In the present study design and analysis implications are investigated for these models. Various situations arise depending upon the availability of experimental units and time at the disposal of the experimenter. An attempt has been made to find optimator near optimal design for each situation. Some real and simulated data have also been analysed to study the performance of estimation procedures.

63. Some Improved Bounds on Number of Blocks in BIB Designs

By

C.C. GUJRATHI

Sardar Patel University, Vallabh Vidyanagar

In a Balanced Incomplete Block (BIB) design with parameters v, b, r, k and λ, the bound for minimum number of blocks is given by the well known Fishers inequality $b \geqslant v$ where equality is attained when the design is symmetrical and the bound for maximum number of blocks is given by Shah (1963) as $b \leqslant \dfrac{r^2-1}{\lambda}$ where equality is attained when $r=k$ and $r=\lambda+1$. In this paper, this bound is improved and many bounds for number of blocks in a BIB designs are obtained. By putting artificial parametric restrictions infinite number of bounds are possible to be obtained. In the present paper, upon putting very simple and reasonable restrictions we are getting good improvements.

64. A Critical Review of Pot Culture and Other Laboratory Experiments

By

K.C. BHATNAGAR,

N.D.R.I., Karnal

AND

D.K. MEHTA,

I.A.S.R.I., New Delhi

A critical review of 73 thesis at IARI, New Delhi and 56 thesis P.A.U. Ludhiana based on pot culture and other laboratory

experiments showed that maximum number of such experiments (40% at IARI and 32% at PAU.) were planned in the disciplines of soil science/Agri. chemistry followed by Botany (32% at IARI) and Plant Pathology (21% at PAU). There was more emphasis of these expts through Ph.D. Progamme at IARI but M. Sc. level at P.A.U. The characters normally studied were grain and straw weight, plant parameters, uptake of NPK, by the plant etc.

C.R.D. was the obvious design adopted in a majority of pot experiments while in laboratory experiments no such design was adopted. Statistical analysis was limited to finding out the ANOVA and mean table and C.Ds. were reported only where significant results were obtained. Coeff. of variations seemed to be not calculated & reported. Due to non-reporting of ANOVA table and basic data it was not possible to isolate the magnitudes of components of variation. Further, there seems to be little scope of adopting any complicated stat. design in planning such experiments.

65. Evaluation of Groundnut Production Technology for Operational Research Project Area in Puri District (Orissa)

By

SHANTI SARUP AND R.K. PANDEY
I.A.S.R.I., New Delhi-12

Attempts have been made to estimate the extent of yield improvement feasible in the project area through adoption of recommmended technology of groundnut production. The economic analysis of the technology has also been undertaken. The study utilizes the data of six field trials on groundnut crop conducted under farmers' environment in the project area during the rabi season of 1978-79.

The analysis reveals that the yield rate of groundnut crop can be increased by 80 percent on the acidic soils through adoption of the recommended level of improved practices viz. application of fertilizers, agronomic practices and plant protection measures. The application of proper doses of fertilizer can enhance the yield upto 40 percent. The economic analysis of improved technology suggests it is economically viable and can yield an extra profit of 100/- per hectare to cultivators. The analysis further indicates adoption of chemical pesticides in isolation should not be nded as it involves more expenditure without appreciable

relative increase in the yield levels. Farmers, in general, with limited resources and financial constraints should be advised to use the recommended levels of fertilizers as it will fetch them a net earning of 526 percent of the additional cost of about Rs. 150 per hectare.

66. A Study of Controlable Factors Influencing the Yield of Wheat Crop

By

G.S. BASSI, P.C. MEHROTRA AND A.K. BANERJEE
I.A.S.R.I., New Delhi-12.

The preformance of high yielding variety is governed to a large extent by local factors like size of holding, soil, climate and management practices adopted, leading to sharp variations between region to region and even between district to district in a region as against more or less stable yield level observed for indigenous variety. A study of the behaviour of yield of wheat, a stable crop, vis-a-vis the controlable factors influencing yield like time of sowing, seed rate, levels of fertizer inputs etc. was undertaken. The study was carried by utilizing the data collected under the project "Sample Survey for methodological investigations into high yielding varieties programme" conducted by IASRI in the districts of Jullundur, Amritsar and Patiala of the Punjab state for rabi season of 1978-79 for wheat crop. The main findings of the study were as follows :

(i) The yield is independent of holding size classes in each of the districts (ii) the optimum rate of sowing worked out to 85 Kg/ha (iii) The optimum time of sowing was found to be 16th to 23rd November and (iv) The results of group of experiments revealed that the treatment effect (levels of fertilizer inputs) do not differ significantly from district to district.

67. A Study on Fertilizer—Yield Relationship for Sonalika Wheat in Midnapur District

By

G.S. BASSI, P.C. MEHROTRA AND A.K. BANERJEE
I.A.S.R.I., New Delhi-12

Fertilizers play an important role is ascertaining the expected production level of a particular crop yield. A proper choice of efficient combination of different fertilizer components is the criteria to be fulfilled in general to expect an economic benef

pr⟨   ⟩   ⟨ta collected under the project "High Yielding
V⟨..   ⟩⟨rogramme", undertaken by the Indian Agricultural Statis-
tics Research Institute during 4th and 5th plan periods in Midnapur
district of West Bengal for Sonalika variety of wheat have been
utilized to obtain the relationship of yield with fertilizer. Cobb
Douglas, Linear and Quadratic regression models have been studied
to find out a proper relationship between input and output factors.
The results for both the plan periods were similar. The main
findings give both the linear and quadratic models significant. In the
quadratic model as the utilized range of doses covered limited
range, the optimum dose here also could not be determined.
However, from the study of regression models, it may be inferred
that the soil composition in Midnapur district of West Bengal may
be deficient in potash as the response to potash was found to be
significant.

68. Yield Response of Kharif Jowar to Differential Adoption Levels of New Innovations Under Cultivators Field Conditions in Vidarbha Region

By

NILIME CHOUBE AND CHHAYA BARHATE
Punjabrao Krishi Vidyapeeth, Akola

An attempt has been made to assess the yield response
and net additional returns to varying levels of adoption of new
technology under cultivators' field conditions utilising data collected
during 1981-82 from the cultivators in nine districts of Vidarbha
Region of Maharashtra State by cost accounting method under
three stage cluster sampling design, that any two of the four package
of practices, namely hybrid variety, recommended seed rate, fertilizer
and interculture, could not achieve any additional gain in yield of
jowar or net return, over traditional technology of not adopting any
practices.

69. Production of Weekly Weight of Indian Rock Broiler Energized with Different Feed Supplement—A case study

By

R.K. KOLHE, A.A. ZANGAD, B.R. KOLTE AND
D.N. DHARMADHIKARI
Punjabrao Krishi Vidyapeeth, Akola

The present study was undertaken to assess the growth rates
of Indian Rock Broilers whose feeds were supplemented with

commonly available feed supplements, namely Livoymn and Liv-52 in varying percentage to estimate the weights of the Broilers attained by the end of 9th week. The study indicated that the male birds of Indian Rock Strain are expected to attain the maximum weight of 1312.68 grams by the end of 9th week when the regular feed is supplemented by 0.3 per cent Liv-52 and are followed by male birds getting 0.1 per cent Liv-52 or Livoymn and female birds not getting any feed supplement In general, feed supplementation is helpful to only male birds for attaining more weights.

70. Trends in Acreage Under Vegetable Crops in Eight Districts of Vidarbha Region (Maharashtra State)

By

CHHAYA BARHATE AND N.S. GANDHI PRASAD

Punjabrao Krishi Vidyapeeth, Akola

An attempt has been made to work out the growth rates and to asses the quantum of changes occurred in the acreage allocation of principal vegetable crops grown in eight districts of Vidarbha region from 1964-65 to 1978-79. The study revealed that the pattern of growth of area under vegetable crops in all the districts is more or less similar. In respect of certain crops like cabbage, ladyfinger, brinjal and tomato in Nagpur district, brinjal in Bhandara district, onions in Buldana district etc. have attained positive and substantial growth rates. However, it is not imperative from the positive and substantial growth rates that these districts have attained a saturatedlevel of acreage as the levels in the beginning of period were very low. Besides this, it has been observed that most of the vegetable crops in some of the districts cover very low acreage even at the end of 1978-79.

71. Effect of Period of Sowing on Productivity of Wheat Crop

By

SATENDRA KUMAR, AND R.P. GUPTA

I.A.R.I., New Delhi-12

An attempt has been made to study the effect of dates of sowing of Wheat crop on its yield level. The results available from the experiments conducted during 1978-1982 at Hissar, Ludhiana, Kanpur, Sabour and Hyderabad centres of the I.C. A.R. All India Coordinated Rerearch Project on "Improvement of Soil Physical Conditions to Increase Agricultural Production of Problematic Areas" have been utilised for this study.

The study revealed that for Wheat crop the correlations were highly significant and positive between the number of days upto the end of vegetative growth phase and crop yield and the total day-degrees and maturity period. The highest yields were obtained for early sowing at all the centres and the late sowing invariably affected the crop yield adversely. A delay in sowing beyond the normal date would lead to drop in yield by 4-8 quintals/ha per weak. The application of additional doses of nitrogen to offset the ill-effect of late sowing was unsuccessful. The role of such factors assumes greater importance in the sense that they do not include any financial implications but only require alertness on the part of the farmer about the management of various form operations.

72. Production's Response to Rainfall and Irrigation—A Case Study of Wheat and Rice in Allahabad District of Uttar Pradesh

By

ASHOK KUMAR

K.A. Postgraduate College, Allahabad

The quantum of natural rainfall and the extent of area irrigated by various man made sources like tubewell, canal, play an important role as affecting the aggregate production of crops like wheat and rice. The relative contribution of these two factors along with crop hectareage and its perhectare yield to aggregate crop production, has been attempted for the crops wheat and rice; through multiple linear regressions, run overtime series (Indices with triennium average ending 1952-53 as the base value) data of Allahabad district for the period 1950-51 to 1977-78. While linear growth models run overtime, during this period recorded an average per annum increase in production, area, irrigated area and per hectare yield as 15.53 per cent, 10.14 per cent, 17.29 per cent and 1.60 per cent for wheat and 3.91 per cent, 0.46 per cent 15.77 per cent and 3.07 per cent for rice, respectivevly; the mutiple regression equations resulted to relatively more importance of irrigation by man made sources like tubewell, canal for wheat and the quantum of natural rainfall for rice.

73. A Study on Effect of Holding Size in Vegetable Cultivation

By

JAG MOHAN SINGH, A.K. SRIVASTAVA, A.K. GUPTA AND D.C. MATHUR

I.A.S.R.I., New Delhi-12

The present study has been carried out to compare the return from vegetable crops being cultivated in various holding sizes

utilizing the data from the survey 'Cost of vegetable cultivation in Delhi" conducted by I.A.S.R.I. New Delhi during the years 1978-80.

74. A Study of the Trend of Rice Production in Assam

BY

B.K. BHATTACHARYYA
Assam Agriculture University Jorhat

Assam is mainly a rice growing state. There has been a concerted effort to increase rice production in the state; but the outcome is not very encouraging. Area and production of rice have shown an increaring trend over past few years, but the average yield has not shown such a trend. Average yield is almost static. Larger areas have not come under high yielding varieties Fertilizer consumption in the state is very low. There are natural calamities affecting the crop at different stages of growth. Flood is a regular event in the state and it affects the rice crop. In the paper an attempt has been made to see the trend of rice production during the period 1968 to 1979.

75. Inter-Regional Growth Analysis of Pulses in Uttar Pradesh

BY

V.S. RUSTOGI AND SHANTI SARUP
I.A.S.R.I.. New Delhi-12

Uttar Pradesh is one of the most important pulse producing states of India accounting for more than one fifth of the total pulses production in the country. Gram and Tur (arhar) are the important pulse crops grown extensively in different regions of the State. Attempts have been made to study the variation in growth pattern of total pulses as well as of gram and tur separately in four important pulse producing regions viz Eastern, Western, Central and Bundel-khand during the period 1966-67 to 1980-81. The log linear models have been used to estimate the growth of pulses for different regions. To measure the variability in the pattern of production of these pulse crops, coefficient of variations have been calculated. Again to test the impact of various plan efforts on the yield rates of these crops in different regions of the State, analysis of variance technique has been utilized. Of the total pulse production of 2.01 million tonnes in U.P. during 1966-67, the four regions viz; Western, Eastern, Central and Bundelkhand contributed 38.7, 29.4, 18.4 and

12.4 per cent respectively. In 1980-81 the production improved to 2.49 million tonnes but the relative contribution of Western Zone decreased to 23.3 per cent while the contribution of Eastern, Central and Bundel Khand regions increased to 32.3, 21.3 and 23.2 per cent respectively. The growth analysis showed that the production of pulses declined significantly at the rate of 5.4 per cent per annum (compound) in the Western region, while in Eastern and Central regions, the declining trend at the rate of 1.6 per cent was observed to be statistically non-significant. In Bundel Khand region, the production of total pulses grow at the marginal rate of 0.44 per cent per annum resulting in an overall negative growth rate of 2.4 per cent per annum for the State as a whole. All the regions except Bundel Khand witnessed a highly significant negative growth in acreage, it being 5.7 per cent in Western region and almost of the same order (2.7 per cent) in the other two regions. Yield rates did not register significant growth in any of the four regions, though the trend was observed to be in the positive direction in all the regions implying that the negative growth in pulses production was mainly due to the declining trend in the area under the pulses in these regions. The production of the pulses was characterized by wide fluctuations in each of the four regions.

In respect of gram, all the regions except Eastern showed a negative growth rate in production which was mainly due to the significant declining trend in the acreage under gram in these regions. Tur crop production, however, indicated significant positive growth rates in the Eastern and Bundelkhand regions. The increasing trend in production of tur in those regions could be attributed to the significant improvement in the yield rate of the crop.

76. Weather Analysis and climatological Characterisation of Jalaun District of Bundelkhand (U.P.)

By

D.P. HANDA, C.R. HAZRA AND R.M. SOOD

I.G.F.R.I., Jhansi

The climate of Jalaun is highly variable with respect to rainfall. The coefficient of variation with respect to rainfall value varies between 43.4% for the month of July to a maximum of 251.2% in April. The coefficient of variation with respect to temperature is the least (below 6%). The average monthly potential evapotranspiration is minimum 16.20 mm in Jalaun and maximum 394.92 mm

in June when mean temperature too is the maximum 34.3°C. The probability analysis indicates that the maximum weekly rainfall which can be expected with 50% probability in the month of June, July, August and September is 34, 114, 122 and 95 mm respectively. It is observed that July, August and September are the only surplus months in the whole year period with water surplus counted as 13.38, 78.47 and 10.43 mm respectively and rest nine months are in deficit.

The climate of this place as could be characterised by different methods viz; Troll's classifications, Cocheme & Franquin's classification and also optimum moisture availability index (OMAI) are also based on certain relationship between rainfall availability and evaporation/evapotraspiration in a place. Thus the three methods indicating the type of climate in relation to period of moisture availability for crop growth and may be quite useful for crop planning. The other methods such as Guassen's dry month classification and de-Martonne's classification are based on the relationship between precipitation and temperature. Amongst these two methods, the former is more valuable from agroclimatological studies indicating the dry spell particularly in a month period, whereas the latter indicating a broad and general climate of a place and has little relevance from the point of view of crop planning. On analysing the merits and demerits of various classifications which have been attempted here, OMAI could be the most suitable method in characterising climatological classification of Jalaun for crop planning purposes because of probability of occurrence of assured rain at predetermined level to that of the potential evapotranspiration during the period well coincide with the major water availability of this place. Cocheme and Franquin's method could also be attempted with matching the duration of a crop's growth cycle to that of water availability period at selected growth intervals.

77.   Growth Rates of Area, Production and Productivity of Oil Seeds in Rajasthan

By

H.B. CHOUDHRY AND R.K. PANDEY

I.A.S.R.I., New Delhi-12

The nature and extent of growth rates of major oilseed crops for the state of Rajasthan from 1952-53 to 1982-83 have been analysed with the increased irrigation facilities the area under oilseeds have

risen from 543 thousand hectares in 1952-53 to 1326 thousand hectares
in 1982-83. Different types of functions have been attempted to
study the growth rates for oilseeds in Rajasthan. The important
oilseed crops grown in the states are Mustard, groundnut and linseed
covering more than 65% of the total area under oilseeds.

For linear growth rate models it is revealed that growth rate
per annum in area, production and productivity are 1.9 per cent,
5.2 per cent and 2.1 per cent for oilseeds. The growth rate per
annum in area and production is maximum for ground-nut as
compared to mustard and linseeds. The growth rates in produc-
tivity for ground-nut and linseed are negative while that of mustard
is positive. The growth rate per annum in area and production of
ground-nut is maximum as compared to other food crops.

Pattern of Rice Production in Tamil Nadu

BY

R.K. PANDEY AND A.C. KAISTHA

I.A.S.R.I., New Delhi

crop in terms of area and production in
it contributes more than 10.5% of rice
try. The contribution of the state to total
out 6.5%. The present paper aims at analys-
area, production and average yield of rice in
ate. For this purpose growth rates have been
to examine the fluctuations in production of rice
of variation have also been calculated. The study
util. secondary data for the years 1950-51 to 1979-80. For the
present study the state has been divided into three zones. Data for
the state as a whole has also been analysed. For the purpose of
analysing growth rates and coefficients of variation, the study has
been divided into two periods. 1950-51 to 1964-65 and 1965-66 to
1979-80.

The growth rates of area and production are higher during
the pre-green revolution period than the post green-revolution period
in all the three zones. The growth rates of average yield is higher
in two zones in 1st Period than in 2nd period.

79. Study of Supply Response to Rice in Tamil Nadu State

By

A.C.. KAISTHA AND R.K. PANDEY

I.A.S.R.I , New Delhi-12

. The present study aims at analysing the supply response of
growers in the case of rice crop in, Tamil Nadu. The effect of paddy
price and sugarcane price has been analysed on crop acreage. The
Nerlovian adjustment model has been used for the analysis. Data
related to acreage under paddy in the current year and previous year,
farm harvest price of paddy and sugarcane for the years 1950-51 to
1979-80 have been analysed.

The study showed that regression coefficients associated with
farm harvest price of paddy were significant in the pregreen revolu-
tion period (1950-51 to 1964-65) and non-significant in the post green
revolution period (1965-66 to 1979-80). The use of these limited
variables in the analysis has given a low value of R^2.

80. Changes in Agricultural Tenancy Structure in India

By

R.K. PANDEY AND SHANTI SARUP

I.A.S.R.I., New Delhi-12

The temporary transfer of land via tenancy is one of the oldest
institutional devices evolved in order to facilitate adjustments in
agricultural factor markets. But because of various land reform
measures adopted by the government in favour of tillers in associa-
tion with fast declining land/man ratios and technological improve-
ments, the tenancy structure has undergone a radical change. The
present paper analyses changes in some dimensions of agricultural
tenancy in India during the recent years with the help of data
available on land holdings from Agricultural Census Reports for the
years 1970-71 and 1976-77 and also a report of the National Sample
Survey for 1971-72. Comparison of data for the two censuses
indicates that the percentage of holdings wholly taken on rent was
4.4 per cent during 1970-71, while the same was reduced to 1.20
per cent during 1976-77. About 4 to 5 per cent of the marginal
and small holdings were wholly taken on rent in 1970-71. The
same had decreased to little more than one per cent during 1976-77.
The overall percentage of area wholly taken on rent was 2.45 and

0.9 during 1970-71 and 1976-77 respectively. It is evident from the analysis that the number of holdings which are wholly on rent is reducing gradually. According to terms of leasing during the year 1976-77, the percentage of area reporting payment of fixed cash rent was relatively higher on large farms while the percentage of area reporting fixed produce rent and proportionate crop rent was higher on marginal and small holdings.

81. Statistical Study of Factors Affecting Yield of Ground-Nut Crop in Chittorgarh (Rajasthan)

By

H.B. CHOUDHRY AND R.K. PANDEY

I.A.S.R.I., New Delhi-12

India is the largest ground-nut producing country in the world and it accounts for more than 34% of the total world production. But the average yield of this crop in India is very low as compared to other ground-nut producing countries. Chittorgarh is one of the ground-nut producing areas in Rajasthan. A survey was conducted in O.R.P. area Chittorgarh to study the constraints for raising ground-nut yield. The potential yield of this crop is 30 qt/ha while the average yield varies from 5 to 8 qt. per hectare. The main objective of this paper is to examine the important factors affecting the yield of ground-nut crop. The average yield of ground-nut is 5.02 qt/ha in small, 6.98 qt/ha in medium and 8.82 qt/ha in large holdings. Production functions using yield of groundnut as dependent variable and application of nitrogenous and phosphatic fertilizers, use of irrigation water and plant protection measures as independent variables have been estimated.

82. Seed Estimation And Abundance of Commercially Important Prawns-Penaeus Mododon Fabricius and Macrobrachium Resonbergii (De Man) in West Bengal

By

G.C. LAHA, P.B. DASS AND H.C. KARMAKAR

C.I.F.R.I., Calcutta

Total number of tiger prawn, *Penaeus monodon* Fabricius seed ranging from 9.92 mm to 12.0 mm in length and 2.9 mg to 4.1 mg

in weight, in West Bengal estuarine waters for stretches totalling about 460 Km. was estimated as 587.85, 740.69 and 621 million during the years 1979-80, 1980-81 and 1981-82 respectively. Total catch of giant freshwater prawn, *Macrobrachium rosenbergii* (De Man) seed with average length 13 mm at Ghatal, Midnapore, West Bengal and average length 21 mm at Andharmanik, 24-parganas, West Bengal was estimated as 26.6 t and 27.9 t during the years 1981 and 1982 respectively. Gears used to catch the seeds and Physio-chemical factors were discussed. The feasibility of the requirements in Brackishwater impoundments for prawn farming pragmatically in relation to abundance of seed in West Bengal has been assessed in view of the most important commercial prawn, P. *monodon*. Sources to utilize the estimated seed yield of both the aforesaid prawn in the light of their importance have been discussed.

83. Estimation of Productivity Losses in Bovines on Organised Farm

By

S.B. AGARWAL, K.C BHATNAGAR, BHUPAL SINGH AND KUBER RAM

N.D.R I , Karnal

The present study was conducted at N.D.R.I. farm during 1981-83 to estimate productivity losses due to diseases in bovines. The data relating to various diseases of animals and their milk yield were collected for karan swiss cows for the period 1977-78 A total of 262 milch animals of karan swiss cows were reported sick with one or more diseases at the farm dispensary during the period. The frequency distribution of animals according to disease and order of lactation revealed that the animals were found to be more prone to sickness during first lactation. The number of diseased animals decreased in subsequent lacations. Maximum number of animals suffered from wounds, followed by cowpox, Mastitis, Temperature, Lameness and Retention of Placenta. The milk yield for the afflicted period of sick animals was collected for Ist lactation to work out losses due to various diseases. The average loss per day per animal was estimated to be significant and highest due to temperature (1,393+0.679 kg.), followed by lameness (0.767+.154 kg.) and wounds (0.541+0.231 kg). The losses due to other diseases were not significant,

84. **A Study on Pre-calving Forecasting of Milk Yield of Dairy Cattle**

By

BHUPAL SINGH, S.B. AGARWAL, M. SINGH, J.S. SWAMY AND O.S. TOMER

N.D.R.I. Karnal

The present study was conducted at NDRI farm during the year 1980-82 to study the pre-calving fore-casting of milk yield of dairy cattle, on the basis of biometrical characters of animals viz., body weight, heart, girth, barrel capacity, height, body length etc. collected for freshly born calves of Karan Swiss/Brown Swis breed of cattle by actual measurements starting from birth to first calving. Information on the measurements of characters at birth was available for 132 calves which reduced to 87 due to disposal of 45 calves. Frequency distribution of calves in various age groups was prepared on the basis of which the average of biometrical characters of animals from birth to 2 years were worked out. Trends in the growth rates of biometrical characters of animals were studied. Correlation coefficients among various characters were also worked out.

It was observed that average body weight ranged from 26.5 ± 4.7 kg. at birth to 217.4 ± 24.3 kg. at 24 months. The body height ranged from 69.3 ± 4.5 cm to 117.1 ± 5.4 at birth to 24 months. While body length ranged from 64.4 ± 6.4 cm to 121.2 ± 6.9 cm at birth to 24 months. Further regression analysis for forecasting and to suggest an appropriate model for forecasting of milk yield on the basis of biometrical characters is being done.

85. **Effect of non-genetic Factors on the Performance characteristics of Bovines**

By

K.C. BHATNAGAR, S.B. AGARWAL, BHUPAL SINGH AND KUBER RAM

N.D.R.I Karnal

The present study on the effects of non-genetic factors viz., order of lactation and season of calving on the performance characteristics of bovines with special reference to lactation length, dry period and calving interval, was conducted during 1982-83 on the

crossbred animals viz, Karan Swiss and Karan Fries cows main-
tained at NDRI farm. Data were collected for the period 1977-82
starting from Ist to 6th lactations. The cows calved during April-
June, July-Oct, and November-March were taken as calved during
summer, rainy and winter seasons respectively. Analysis of variance
technique with unequal number of observations was used to study
the effects of non-genetic factors and adjusted means alongwith
standard errors were also computed.

It was observed that season of calving did not show any signi-
ficant effect on lactation length and intercalving period while order
of lactation had a significant effect on both these characteristics for
Karan Swiss as well as Karan Fries cows. Overall it was observed
that Karan swiss cows had longer lactation length as well as longer
calving interval than Karan Fries cows. The lactation length and
calving interval averaged over 1st six lactations was worked out to
355 ± 5 days and 428 ± 6 days for Karan Swiss and 327 ± 4 days and
392 ± 5 days for Karan Fries cows respectively. Changes in respect
of dry period for season of calving and for different orders of lacta-
tion were not significant for either of the breeds.

86. Employment Potential in Modern Agricultural Technology—A Case Study

BY

B.G. SAPATE AND S W JAHAGIRDAR
Punjabrao Krishi Vidyapeeth Akola

The study was undertaken to estimate the operationwise labour
utilization by the cultivators for local and hybrid/improved varieties
and to assess the generation of employment, if any, due to substitu-
tion of local varieties. The study was taken for Akola district on
only two crops, namely, Jowar and Cotton which occupy but 75 per
cent of the gross sown area of the district. The three stage cluster
sampling design was adopted and the cross-section data was collect-
ed by cost accounting method. The study revealed that for keeping
one additional labourer engaged for two months there needs a
substitution of 10 hectares of local Jowar by Hybrid/HYV where as
substitution of 4 hectares area under local Cotton by Hybrid/HYV
would engaged one additional labourer for the period of four
months. The study also indicated that 10 per cent of the yearly
increase in cultivator's population would be absorbed due to yearly

increase in area under Hybrid/HYV of Jowar but only for two months. Whereas 5 per cent of the yearly increase in cultivator's population would be absorbed by the yearly increase in Hybrid/ HYV of Cotton and that too for the period of 4 months during kharif season.

87.   Varietal Preference and Yield Performance of HYV Wheat in Relation to Size of Holding

By

V.S. RUSTOGI, P.C. MEHROTRA AND A.K. BANERJEE
I.A.S.R.I., New Delhi

Since the introduction of the high yielding varieties programme a number of varieties of various crops have been introduced from time to time. It would be of interest to investigate whether the yield performance of the different varieties and preference in their adoption are associated with the size of holding. With this end in view a study was carried out on high yielding varieties of wheat crop with the help of data collected under the project "Sample survey for methodological investigations into high yielding varieties programme" conducted by the Indian Agricultural Statistics Research Institute during the Vth Five Year plan. The results of the study showed that varietal preference was neutral to size of holding. Also the yield performance of different varieties did not generally show any specific association with the size of holding.

88.   Adoption of New-Crop Production Technology With and Without Credit-Facilities in Rice

By

SATYA PAL AND D.L. AHUJA
I.A.S.R.I., New Delhi-12

Impact of credit on the extent of adoption of new crop production technology have been studied in respect of Rice Crop in Shimoga district of Karnatka State, during the period 1977-79. The holding percentages of borrowing cultivators in the small medium and large in the year 1977-78 were 44, 53 and 67 while the corresponding percentages in 1978-79 being 43, 33 and 34 respectively. The average amount borrowed per borrowing cultivator increased with the size of the holding in both the years and worked out to Rs. 902/-, Rs. 1991/- and Rs. 3461/- in the small, medium and large holding respectively in the year 1977-78 while it was Rs. 1013/-, Rs. 2488/- and Rs. 3086/- in the year 1978-79. Pooled over different

holding size groups, 54 and 37 percent of the cultivators, look credit and the average amount borrowed were Rs. 2267/- and Rs. 2023/-in the two years. The main source of credit was co-operative societies in both the years. Almost all cultivators receiving credit, utilized it for the purchase of one or more of the HYV seed, fertilizers and plant protection chemicals. The set of cultivators not availing credit reported "lack of funds" as the reason for not using fertilizer and plant protection measures in (100,31, 0,) and (17,0,32) percent of the area in small, medium and large holdings respectively in the year 1977-78 while the corresponding percentage for the year 1978-79 were (100, 100,100) for not using fertilizers, however no serious attack of insectpest was reported during the year 1978-79.

The average yields of Rice for the two sets of cultivators viz. beneficieries and non-beneficieries of credit were respectively 30.9Q/ha and 23.8 Q/ha for the years 1977-78 while the corresponding figures for 1978-79 were 29.0 Q/ha and 22.2 Q/ha and these average yields differed significantly in the two sets in both the years. Average rates of application of fertilizers $(N+P+K)$ were estimated as 63kg/ Acre and 53kg/Acre in the two years for the beneficieries of credit while the corresponding figures for non-beneficieries were 39kg/Acre and 31kg/Acre respectively. Average rates of application were also significantly different for the two sets of cultivators.

The percentage of cultivators using irrigation and plant protection measures and improved implements were (91,65 and 75) in 1977-78 and (92,85 and 92) in 1978-79 for those availing credit while the corresponding figures for the cultivators not availingcredits were (50,27 and 33), (60, 38 and 44) in the two years. The proportions of fields irrigated, benefitted by plant protection chemicals and operated by improved implements also differed significantly in the two sets of cultivators.

The study reveals that credits have positive impact in the adoption of new crop-production Technology.

89. **Role of Efficient Use of Inputs in Cultivation of Vegetable Crops**

By

JAGMOHAN SINGH, A.K. SRIVASTAVA, D.C. MATHUR AND A.K. GUPTA

I.A.S.R.I, New Delhi-12

Increase in agricultural production mostly depends upon the optimum use of different inputs along with advanced techniques

applied for farm growth. Inspite of the fact that the farmers are conscious about the application of inputs more efficiently, all the cultivators are unable to use them efficiently. A study is carried out to investigate the efficient use of such factors like irrigation, fertilizers and manures, human labour (hired) and family labour by the cultivators growing vegetables in Delhi. The data utilized for the study is from the survey on "Cost of cultivation of vegetables in Delhi" conducted by I.A.S.R.I., New Delhi during the year 1978-80.

90. **Variability in Milk Yield of Buffaloes in Different Categories of Households and Resource Productivity in I.C.D Area. Bhopal**

By

A.K. SUDHANSHU

I.A.R.I., New Delhi

AND

K.C. RAUT

I.A.S.R.I., New Delhi

Study on the variability in milk yield of buffaloes maintained in different categories of households will help in formulation of programmes on sound lines for enhancing milk production in an area. An attempt has been made to study the level of production of buffaloes maintained in commercial milk producer households in I C.D. area, Bhopal, utilizing data collected in a sample survey carried out by I.A.S.R.I. in the area during 1975-77. The extent of data utilized was for 274 milch buffaloes in 112 commercial milk producer households. The average milk yield was about 2.4 kg for a buffalo in milk maintained by a landless labour of the same level of production in a cultivator household having land between 8-12 ha. In other categories of households the level of production was comparatively less. It was estimated that the production cost per kg. of milk was minimum when both family labour was included and excluded for those cultivator households possessing land between 8-12 ha. The estimates were 93 paise per kg when family labour was included and 71 paise when excluded. The production cost in the household of landless labour was Rs. 1.12 when family labour was included and Rs. 1.00 when family labour was ignored. The cost of production was maximum in the household of large farmers owning land 12-20 ha. The prevailing market rate of buffalo milk was Rs. 2.00 per kg. The relationship of milk yield with feed cost and labour cost was worked out fitting various production functions.

From the relationship it was observed that by spending 10. paise more on feed there would be an increase in milk yield of 133 gm per day keeping other input fixed. Utilization of additional labour would not provide any additional return in terms of milk yield.

91. Employment Generation in vegetable Cultivation

By

A.K. SRIVASTAVA, D.L. AHUJA AND D.C. MATHUR

I.A.S.R.I., New Delhi-12

It is well known that there is not much scope left to bring additional area under cnltivation beyond certain limits. Efforts are, therefore, needed to increase the vertical growth in agriculture by taking as many crops from the same part of land as possible. Also that majority of rural population in India has agriculture as the source of employment. In the search of finding some cash crops which can provide additional employment opportunities for the rural population and thus improve their purchasing capacity, one can think of vegetable crops which are known to be labour-intensive crops and also these can be grown in the period between the end of one season and start of the other season. In this paper, employment generation due to cultivation of different vegetables in man-days have been worked out using 1978-79 data of, "pilot sample survey to evolve sampling methodology for estimation of cost of cultivation of important vegetable crops at Delhi (1978-81). The man-days spent for cultivation of Tomato, Brinjal, Potato, Lady's finger, Cauliflower, Peas, Sponge Gourd (Tori), Squash Melom (Tinda) and Bottle Gourd (Lauki) were found to be 92, 146, 125,160,74, 50, 86, 46 and 54 respectively. The man-power requirement during different months have also been worked out. The study reveals that vegetable cultivation is an important source of additional employment generation.

92. Adoption of Recommended Practice of Fertilizer Use under field Condition

By

P.C. MEHROTRA, A.K. BANERJEE, S.K. RAHEJA

I.A.S.R.I., New Delhi

Use of high yielding potential seeds can help only when inputs are applied in optimum or near optimum quantities as per the prescribed time schedule. One of these crucial inputs is the chemical

fertilizers. It would be of interest to investigate the extent and intensity of adoption of fertilizers by cultivators adopting high yielding variety seeds vis-a-vis the recommended levels. Such a study would help in identifying areas where cultivation of HYV seeds is practiced under doses below the recommended levels and thus need special attention for popularisation of fertilizer use as per the recommended levels to exploit the full yield potential of new seeds. Such a study was undertaken with the help of data collected on wheat in 26 selected districts over major State of the country under the project-sample survey for methodological investigations into high yielding varieties programme' conducted by the Indian Agricultural Statistics Research Institute during 1977-78. The results of the study showed that although use of nitrogen was quite popular in almost all the districts, application of phosphorus and potash was confined to smaller areas under HYV wheat in majority of the districts. Further the doses of N, P and K applied were generally much below the recommended levels in a substantial number of districts. Thus even after 20 years of the introduction of HYV programme the farmers have not taken up the recommended package of practices of fertilizers. Hence, there is a need to make concerted efforts through extention agencies to convince the cultivators in the adoption of balanced doses of N, P and K as per the regional recommendations.

93. **Low Cost Alternatives for the Optimal Farm Business income on Small Farms—A Case Study of District Allahabad (U.P)**
By
S.L. GUPTA
K.A.P.G College Allahabad
AND
J.S. GARG
Ex. Emeritus Professor I.C.A.R. New Delhi

Some results of the village studies conducted during 1976-77-78-1979 in the six villages in C.D Block Soroan district Allahabad (U.P) have been summerised. The results may have a direct relevance for generating a new technology of low cost alternatives for the optimal Farm Business Income (FBI) under the existing peasant's technology. It follows therefore that any programme for improvement in the economic conditions of small farmers a liberal credit policy be introduced which they may choose as cost alternative for increasing their FBI. The present paper examines the results in detail.

94. Comparative study of Trends in Bovine Population in Orissa and All India

By

R.L. RUSTAGI AND SHRIKANT SHARMA

I.A.S.R.I, New Delhi

According to Livestock Census carried out in 1977, India possesses about 242 million bovines and of which 180 million are cattle and 62 million buffaloes. Comparing with the population in 1956, the bovine population, during the previous 20 years, increased by 18.9 per cent. Examining the growth for each species, it was observed that the increase was only 13.5 per cent for cattle as compared to 38 per cent for buffaloes, during these two decades The rate of growth during 1972-77 has been less as compared to that during 1966-72 both for cattle and buffaloes.

Orissa account for only 5.5 per cent of the total bovine population in the country. Out of 13.5 million bovines 90 per cent are cattle. As observed for all India, the rate of growth in Orissa both for cattle and buffaloes was less during 1972-77 than in previous years. There was fall in buffalo population in the state in 1977 as compared to 1972.

From the point of milk production, the trend in the population of breedable females is of interest. Although Orissa accounts for about 5 per cent of the total milch animals, it contributes only about 1 per cent of the total milk production. Milch animals in the country increased about 24.5 per cent in 1977 as compared to 1956 population. During this period the milch population in Orissa increased by 3.7 per cent per annum. As in the case of total bovines, the growth rate of milch stock declined during 1972-77 as compared to that in 1966-72.

95. Growth in Area, Production and Yield of groundnut—A Regional Analysis of Uttar Pradesh

By

D.R. CHANDRA

C.S. Azad University of Agriculture & Technology, Kanpur

Time series data of area, production and average yield of groundnut crop for the period 1960-61 to 1979-80 in different regions of Uttar Pradesh have been studied. Western, Central, Bundelkhand,

Eastern and Hill constitute five agro-economic regions of the state. The log-linear model have been used for different regions. The study reveal that acreage increased in all the regions during 1960-61 to 1979-80. Bundelkhand, Eastern and Hill regions showed significant growth in production during 1960-61 to 1979-80. All the regions except Bundelkhand region witnessed positive growth during 1960-61 to 1969-70. Significant decline in yield rates were observed in all the regions except Eastern region during 1960-61 to 1979-80. More than 4 percent decline was recorded only in Hill region during 1960-61 to 1969-70 period. Western, Central and Bundelkhand regions witnessed the same decline during 1970-71 to 1979-80 period.

96. **Growth Analysis of Area, Production & Average Yield of Sugarcane in Tamil Nadu State**

BY

A.C. KAISTHA

I.A.S.R.I., New Delhi

Tamil Nadu State stands fourth in acreage under Sugarcane among the States in India but it stands first so far as average yield per hectare is concerned. State's contribution to total Sugarcane acreage of India is 6%, while its contribution to India's total production is 10%.

The present paper aims at analysing the growth rates of area, Production and average yield of Sugarcane in Tamil Nadu State. The study utilizes secondary data for a period of 30 years 1950-51 to 1979-80. The state has been divided into three Regions and for two periods (1950-51 to 1964-65, 1965-66 to 1979-80).

The analysis revealed that area under Sugarcane increased at the rate of 5.51% while the productivity increased at the rate of 1.73% resulting in the growth of 7.33% in production in the State during the period 1950-51 to 1979-80. The growth rate of area and production at the State level were observed to be higher than that at national level. The growth rate of productivity was, however, marginally lower than that of all India level. Between different regions the growth rate of Sugarcane indicated almost an identical pattern of growth. The growth of production varying between 7.3% to 7.7%.

97. Agricultural Production and Productivity Status of Tamil Nadu

By

S. RAJAGOPALAN AND V. RAMAMURTHI
Department of Statistics, Madras

The package of various technological innovations. introduced in Tamil Nadu brought about a rapid transformation in the agricultural front, leading to high levels of production/productivity in foodgrains in general, and rice in particular, barring shortfalls during years of flood drought or when monsoon rains were deficient. The recently introduced Training and Visit programme in Tamil Nadu, takes scientific innovations in agricultural production right across to the door-steps of farmers. With clear correlation between rainfall and rice production, all indicators lead to the conclusion that the recent fluctuating trends in rice production are only passing phenomena and that with favourable weather conditions and timely coupious rains, the upward trends in rice-production and productivity in Tamil Nadu will occur again. The tempo of development generated by technological break through in the agricultural sector can, not only be maintained, but improved in the years to come, and Tamil Nadu can definitely hope to achieve its target produce 5 tonne per hectare of Paddy.

98. A Stochastic Model for Evaluation of Economic Loss Due to Foot and Mouth Disease in Bovine Population

By

RAJENDRA SINGH, S.K. NEGI AND C.B. TEWARI
I.V.R.I., Izatnagar (U.P.)

A stochastic model has been developed for evaluating the economic loss due to foot and mouth disease in bovine population. This model is developed following the Soper theory of epidemics and Martin's model on economic costs of dairy calf. This model will be helpful in estimating the benefit derived from introduction of vaccination against foot and mouth disease.

99. Use of Additional Information-an easy Task ?

By

B.K. SINHA
I S.I., Calcutta

We address ourselves to the problem of efficient use of additional information in the sense of increasing efficiency of the esti-

mator. The popular belief is that larger the sample size, more is the precision. This, however, is true only in a restricted sense viz., when sampling is srswor and the estimator used is sample mean. The general problem of determination of the initial sampling design P and the design Q for excess observations (possible due to enhanced resources) so as to ensure desirable regularity in the behaviours of estimators based on P on one hand and on (P.U.Q.) on the other hand, seems to be quite difficult. Various examples and counter-examples are discussed to highlight the complexities involved in the problem of efficient utilization of additional resources.