ABSTRACTS OF PAPERS

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1. A Note on Midzuno Scheme of Sampling

By C. Asok* and B.V. Sukhatme**

Maharashtra Association for Cultivation of Science, Pune.
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The main advantage of Midzuno scheme of sampling besides of course its simplicity, is the fact that it is possible to compute a set of revised probabilities of selection p_i^l such that the inclusion probabilities resulting from the revised probabilities p_i^l are proportional to the initial probabilities of selection p_i, whenever the $p_i s$ satisfy a particular condition. RAO (1963), following Brewer and Undy's method has shown for samples of size 2 that the Horvitz-Thompson estimate of the population total under Midzuno scheme of sampling with revised probabilities is always more efficient than the customary estimate in the case of sampling with varying probabilities and with replacement. The same result has been proved in this note for arbitrary sample size.

2. Use of Auxiliary Information in Estimating the Coefficient of Variation of a Finite Population

By Ajit Kumar Das and T. P. Tripathi
Indian Statistical Institute, Calcutta.

The problem of estimating coefficient of variation $C_y = (\sigma_y / \bar{Y})$, of a variate y, for a finite population is considered in the situations where population mean $\bar{X}$ or population variance σ_x^2 or coefficient of variation C_x of an auxiliary character x is known. The main sampling strategies proposed consist of simple random sampling with replace- (SRSWR) together with ratio and product type estimators. Some other sampling strategies with difference (regression) type estimators are also considered. The properties of the sampling strategies are studied, for large samples, comparison among themselves are made and the situations in which the proposed sampling strategies are better than usual strategy (SRSWR, $s_y / \bar{y}$), where $s_y^2 = \sum_{i=1}^{n} (y_i - \bar{y})^2 / (n-1)$, are identified.

3. On Some Unbiased Product Type Estimators
By P.C. Gupta & Dhiresh Adhvaryu
South Gujarat University, Surat

Murthy (1964) proposed product estimator for the situation when the character under study is highly negatively correlated. The estimator suggested by him is a biased one and the extend of bias may not be negligible. An attempt has been made in this paper to suggest two unbiased product type estimators for the population mean and hence total of the character under study, following the approach of Hartly and Ross (1954). A comparision with conventional product estimators has been made under a finite population model. The study has been, however, confined to sample random sampling, but it can directly be generalised to varying probabilities as discussed by Gupta (1978).

4. On a Use of Varying Probability in Unbiased Ratio Estimation
By P.C. Gupta
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The unbiased ratio estimator was suggested by Hartley and Ross (1954). The exact variance of which was given by Hartley and Goodman (1958). They also obtained a condition for it to superior to conventional ratio estimator. In this paper we propose to compare the Hartley & Ross's estimator with the conventional ratio estimator under a given finite population model. Further the use of varying probability with replacement has been also made, to improve the efficiency of the Hartley & Ross estimator.

5. Ratio-cum-Product Estimators for Estimating Ratio (Product) of Two Population Parameters
By S.M. Shah and D.N. Shah
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A new ratio-cum-product estimator for estimating the ratio (product) of two population means using auxiliary information of two other variables is suggested. Its bias and mean square error to the order of n^{-1} are obtained and the efficiency of the estimator is compared using optimum and simple weight with the conventional ratio (product) estimator and the estimators suggested by Singh (1965, 1967, 1969).

It is interesting to note that the expressions of minimum mean square errors of the suggested estimator and two of Singh's estimators become identically equal even though their biases differ. Multivariate extension of the estimator is also considered. An empirical comparison is provided for illustration.

6. A Note on Use of Coefficient of Variation in Successive Sampling
By B.V.S. Sisodia and Rajendra Singh
I.V.R.I., Izatnagar, U.P.

Use of coefficient of variation for increasing the efficiency of the estimator is appeared to have started with work of Searl (1963) and is well recognised. In many populations, a change in conditions under which measurements are made on successive occasions, alters standard deviation in the same proportion as it alter the mean so that the coefficient of variation remain unchanged over the occasions. It is well known that the partial replacement of the units over occasions from previous occasions helps us in formulating an efficient estimators for the population mean on the current occasion. However, the partial replacement of the units, some times, may not be possible in sampling from dynamic populations for example, populations regarding wildlife, biological and even in plant population. In such situation, a substantial gain in efficiency may be obtained by utilising the accurate value of coefficient of variation. The accurate value of coefficient of variation may be determined on the basis of large sample drawn on the previous occasion or by experience gathered during the survey over various occasions.

Sen, A.R. *et al* (1975) have attempted in this direction and obtained an estimator for the population mean on the second occasion using the information on the first occasion in terms of coefficient of variation. The esimator proposed by them is not always efficient than $\bar{y}$, the sample mean on the second occasion. We have obtained an estimator for the population mean on the second occasion by combining Searl (1963) estimator and s_y/C where

$$s_y = \sqrt{\frac{1}{n} \sum_{i=1}^{n} (yi - \bar{y})^2}$$

and C is coefficient of variation. The proposed estimator is found to be always efficient than $\bar{y}$ and even than the estimator proposed by Sen, A.R. *et al* (1975) and Searl (1963). The properties of the estimator have also been studied for some common population encounter in practice, *viz*, normal, poisson and negative binomial.

7. On a Method of Using Multiauxiliary Information in Sample Surveys
By O.P. Srivastava, K.C. Goyal and S.C. Gupta
Haryana Agricultural University, Hissar

Olkin (1958), Rao, *et al* (1967), Singh (1967), Srivastva (1965, 1966), and Tripathi (1976, 1978) have suggested composite type of

estimators using multivariate auxiliary information by combining several estimators linearly with suitable weights. Generally the optimum values of these weights are functions of population parameters and are to be estimated from the sample. This introduces lot of sampling error. In the present work an estimator in the form $t=t_1 (t_2/t_3)^\alpha$ where t_1, t_2 and t_3 are consistent and asymptotically unbiased estimators based on two auxiliary characters x and z of population parameters, has been introduced. This estimator depends on a single weight and thus the sampling error is reduced even if the optimum weight has to be estimated from the sample. The expressions for optimum weight, bias and minimum mean square error of the composite estimator have been derived. In particular let $t_1=\hat{\bar{Y}}$, $t_2=\hat{\bar{Y}} (\bar{X}/\hat{\bar{X}})$ and $t_3=\hat{\bar{Y}} (\bar{Z}/\hat{\bar{Z}})$. Then a new estimator $\hat{\bar{Y}}^*=\hat{\bar{Y}} (\hat{\bar{Z}}\bar{X}/\bar{Z}\hat{\bar{X}})^\alpha$ has been defined and properties studied. We note that gain in precision will be maximum when ρ_{xz} is positive and high but not equal to one and ρ_{xy}, ρ_{zy} are of opposite signs. However, if ρ_{xz}, is negative a new estimator slightly different in from $\hat{\bar{Y}}_*=\hat{\bar{Y}} (\bar{X}\bar{Z}/\hat{\bar{X}}\hat{\bar{Z}})^\alpha$ has also been defined and properties studied.

It is observed that the ratio-cum-product estimators defined by Singh (1965, 1967) are particular cases of this class of estimators with $\alpha=1$ and the estimators $\hat{\bar{Y}}^*$ and $\hat{\bar{Y}}_*$ are identified to be in the same class and has minimum mean square errors.

8. Exponential Ratio Estimator for Double Sampling

By K.C. Goyal,
Haryana Agricultural University, Hissar

Srivastava (1967) proposed an exponential ratio type estimator of the form $\hat{\bar{Y}}=\bar{y} (\bar{X}/\bar{x})^\alpha$ which had been found to be efficient than simple ratio estimator. In this paper we extend this estimator to double sampling scheme. The proposed estimator is $\bar{y}_e=\bar{y}_m (\bar{x}_n/\bar{x}_m)^\alpha$ where $\bar{y}_m$ and $\bar{x}_m$ are the sample means based on the sample selected as a sub-sample of the pilot sample and $\bar{x}_n$ is the sample mean based on the pilot sample. The optimum value of α for MSE of $\bar{y}_e$ to be minimum is given by

$$\{E_1C_2 (\bar{y}_m\bar{x}_m)/\bar{Y}\}/\{E_1V_2 (\bar{x}_m)/\bar{X}\}$$

and minimum MSE is given by

$$V(\bar{y}_n)+E_1V_2 (\bar{y}_m)-\{E_1C_2 (\bar{x}_m\bar{y}_m)\}^2/E_1V_2 (\bar{x}_m).$$

In particular if the pilot sample and the sub-sample are selected with simple random sampling, the optimum value of α for MSE of

$\bar{y}_e$ to be minimum is given by $\rho_{xy} C_y/C_x$ and the optimum MSE is given by

$$(1/m-1/N) S_y^2 (1-\rho_{xy})+(1/n-1/N) S_y^2 \rho_{xy}$$

9. A Ratio Type Estimator for Estimating Population Mean: Efficient than Regression Estimator

By K.C. Goyal

Haryana Agricultural University, Hissar

It is well known that use of any information about the population parameter in estimation technique, improves the efficiency of the estimator. In this paper a ratio-type estimator is proposed when it is known that population mean is not zero and auxiliary information about a character x highly correlated with the character of interest y is available. The proposed estimator is

$$\hat{\bar{T}}^*=(\bar{y}/\bar{x})\bar{X}+\alpha(1/\bar{y})$$

where α is the optimizing constant to be determined, $\bar{x}$ and $\bar{y}$ are the sample estimators of population means $\bar{X}$ and $\bar{T}$ respectively. The optimum value of α for MSE of $\hat{\bar{T}}^*$ to be minimum is given by

$$\bar{T}^2 \{V(\bar{y})/\bar{T}^2-V(\bar{x})/\bar{X}^2\}/\{1+3V(y)/\bar{T}^2\}$$

and minimum MSE is given by

$$\text{MSE} (\hat{\bar{T}}^*)=\text{MSE} (\hat{\bar{T}}_R)-\bar{T}^2 \{V(\bar{y})/\bar{T}^2-V(\bar{x})/\bar{X}^2\}/\{1+3V(\bar{y})/\bar{T}^2\}$$

where

$$\hat{\bar{T}}_R=(\bar{y}/\bar{x})\bar{X}$$

It is observed that the estimator $\hat{\bar{T}}^*$ is always efficient than simple ratio estimator in the sense of smaller MSE unless coefficients of variations in x and y, C_x and C_y are equal and gain in precision will be maximum when difference between C_y and C_x is maximum. The efficiency of ratio estimator coincides with that of regression estimator when the line of regression of y on x passes through origin.

In this situation, the estimator $\hat{\bar{T}}^*$ is efficient than even that of regression estimator.

10. On Horivitz and Thompsons Estimator

By M.N. Deshpande

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Expressions for $V(e_{HT})$ due to Horvitz and Thompson, and Yates and Grundy are well known. Recently Wynn (1977) proposed another expression for $V(e_{HT})$. In the present paper a more general expression for $V(e_{HT})$ has been obtained. Expression due to Yates and Grundy, and Wynn are special cases of this general expression. Further its use in obtaining estimator of $V(e_{HT})$ is also discussed,

11. Use of Auxiliary Information in Cluster Formation—Unequal Clusters

By B.B.P.S. Goel and Savita Garg

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

In any sample survey one is concerned with the problem of estimation of population mean or total for the character under study. The estimates obtained from a sample of clusters formed on the basis of nearness of units alone are generally less efficient. From the efficiency point of view, units within clusters should be heterogeneous and mean square between cluster means or totals should be as small as possible. Thus, it would be better to take into account both the concepts, *viz.* nearness of units as well as that of homogeneity of cluster means or totals. A procedure has been suggested for forming clusters with the help of auxiliary information so that cluster totals become more or less equal. The suggested method also takes into account the aspect of nearness of units and is simple, objective and convenient. The clusters formed by this method will have unequal number of elements in general but the unbiased estimator is more efficient than the other estimators available for unequal clusters. It is also more efficient than the estimates based on simple random sampling of elements or on clusters of equal size or on clusters selected with probabilities proportional to their sizes for a fixed sample size. For such clusters the efficiency of the estimates further increases when cost is taken into account. For a fixed cost the unbiased estimator may be even more efficient than the estimator based on *ppswr* sampling.

12. Bias Reduction by Jackknifing

By G.C. Tikkiwal

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An important technique 'Jackknifing' for reducing the bias of an estimator, in general, was given by Quenouille (1949, 56). The utility of this technique, for the reduction of bias of classical ratio estimator, was examined by Durbin (1959) under certain models. Durbin's results were further generalised and their utility was examined empirically. This paper discusses the bias reduction, by using the said technique, of the ratio type estimators of the measures of different types of wastage, given by Nageswara Rao and Tikkiwal, B. D. (1960). It is shown that the bias reduction does take place ; while mean square of the resultant estimator remains the same,

13. Application of Ratio Estimator with Post-Stratification

By A. S. Sethi
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and
A. K. Srivastava
I. A. S. R. I., New Delhi

One of the glaring limitations of the usual ratio estimator is that all possible sample means of the auxiliary character should be positive and less than twice the population mean of the character. This assumtion is required for obtaining the approximate expressions of bias and variance of the estimator. In populations where the auxiliary character is highly variable, this condition is not likely to be satisfied, posing thereby a serious constraint towards the application of ratio estimator in such populations. One way out for such situations may be a proper stratification in which the above assumption is satisfied within each stratum. In situations where this type of prior-stratification has not been done, a resort to post-stratification at the estimation stage may be worthwhile. The use of ratio estimator with post-stratification has been dealt with in this paper. An empirical comparison showed that the proposed estimator could lead to substantial gains in efficiency over the simple random sampling estimate.

14. Estimation from a Bivariate Population in Cluster and Two Stage Sampling

By Randhir Sihgh
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From a bivariate population when estimates are required for the two characters it may not be always advantageous to observe same set of units for both the charactors. In the present paper discussions have been made on the efficiency of two sampling schemes, such that data on one character is observed for a number of clusters and data on the second character is observed for a sub-sample of these clusters or for a sub-sample of second stage units for all the clusters for which the first character is observed.

15. Comparison of Systematic Sampling with S.R.S. Without Replacement and Stratified Sampling for Certain Populations

By R.S. Yadav
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A comparison of systematic sampling with Simple Random Sampling without replacement and with stratified sampling is made under two well known models : (*i*) Super Population model described by Foreman and Brewer (1971) in their paper and (*ii*) under the

model which was considered by Avdhani and Sukhatme for comparing different sampling strategies. It is observed that systematic sampling is less efficient than stratified sampling under both the models, and systematic sampling is better than Simple Random Sampling only under certain conditions.

16. Sampling on Successive Occasions for Clusters of Units
By R.R. Chandak and O.P. Kathuria

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

In the present study an attempt has been made to find the estimates of mean and its variance for two occasions, the sampling scheme being that a fixed proportion of the clusters taken on the first occasion are retained on the second occasion and supplemented by clusters of units drawn afresh from the remaining units of the population.

A cost function for the sampling design has been obtained and the problem of optimum allocation of sampling units between matched and un-matched samples has been studied, for varying sample sizes at each occasion. The optimum value of replacement fraction in terms of intra class correlation coefficient as well as *g* has also been obtained under the assumption that sample sizes remain same on each occasion. Then a comperative study has been made by obtaining the efficiency of the estimator so obtained in relation to the estimator obtained through simple random sampling.

17. A Conditional Test Criterion for Judging Internal Spread of Diseases Among Plants
By N. Sundararaj and H.S. Rajeshwari
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A conditional test procedure for judging the internal spread of the disease among plants is proposed.

A random sample of M plots, each having exactly n plants is selected in a field. The number of diseased plants and also the number of 'doublets' are computed for each plot as described by Van der Plank (1960) ; a doublet being defined as two adjacent diseased plants and a run of three diseased plants being counted as two doublets and so on.

The distribution of the average number of doublets is derived under the assumption that each plant has the same chance of being attacked by the disease, the incidence being random and Poisson in nature. If $\bar{X}$ is the average number of doublets over all the M plots it is shown that $\bar{X}$ is asymptotically normal with mean and variance

given by

$$E(\bar{X}) = \frac{t(t-1)\pi^2}{n}$$

$$V(\bar{X}) = \frac{t(t-1)\pi}{n^4(n-1)} \left\{ (t-2)(t-3)\pi^2 - 2[(n-2)(t-1)+1]\pi + n(n-1) \right\}$$

with $\pi = \frac{1}{M}$, $\quad \sum_{1}^{M} d_i = t$

which are functions of known quantities n, M and t where d_i is the number of diseased plants in plot i ($i = 1, 2, \ldots M$), provided the value of t is fixed at the observed value.

The test criterion requires the computation of the test statistic T defined as

$$T = \frac{\bar{X} - E(\bar{X})}{\sqrt{V(\bar{X})}}$$

which is approximately $N(0, 1)$. When the hypothesis of spread from 'within' is true, there will be a nest of diseased plants so that the number of doublets will be much larger than may be expected on chance factors under the hypothesis of random mode of incidence so that the Null Hypothesis may be rejected whenever the observed value of T is larger than $Z(1-\alpha)$ where $Z(1-\alpha)$ is the $100(1-\alpha)$th percentile point in the standard normal table at 100α per cent level of significance ; otherwise the Null Hypothesis is retained.

18. Chi-Square Goodness of Fit Test for Equilibrium Markov Renewal Process

By Y.P. Gupta and Sunita Gupta
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It is proposed to obtain a Chi-square goodness of fit test for testing the hypothetical transition probability matrix of an E.M.R.P. based on $N_{jk}(t)$, the observed number of one step transitions from state j to state k in $(0, t)$ when the holding time distributions are known or unknown. Test for comparison of two or more independent realisations of E.M.R.P.'s. have also been discussed.

19. Fitting of an Orthogonal Polynomial in Presence of Missing Observation

By S.P. Singh and M. Pratap
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For applying the technique of fitting orthogonal polynomials for regression analysis, it is necessary that the values of independent

variate should be equidistant. Thus if some observations are missing from data which are otherwise suitable for orthogonal polynomial fitting this method cannot be adopted as such In the present paper an attempt has been made to exploit the simplicity of the method of orthogonal polynomial fitting by estimating the missing observation and thus completing the data. The method has been described below.

Let there be following n pairs of values, where the value of y corresponding to $x = \alpha$ is missing.

$x : 1, 2, 3\ldots\ldots\ldots\alpha\ldots\ldots\ldots n$

$y : y_1, y_2, y_3\ldots\ldots y_\alpha\ldots\ldots\ldots y_n$

The orthogonal polynomial to be fitted is of the form

$$y = a_0 + a_1\xi_1 + a_2\xi_2 + \ldots + a_p\xi_p, \quad u = 1\ldots\ldots n$$

where the values of $\xi's$ can be taken from Fisher and Yates tables. The estimate of the parameters and y_α are obtained by minimising the error sum of squares. $\hat{y}_\alpha$ is obtained as a linear function of the known $(n-1)$ observations, where the sum of compounding coefficience is unity. Using the estimate of the missing value the estimates of the parameters are obtained in the usual way, but the variances and covariances get modified. The regression sum of squares based on all the n observations including $\hat{y}_\alpha$ has a positive bias which is equal to

$$\hat{y}_\alpha^2 - \left[\frac{\left(\sum\limits_{1}^{n} y_u \right)^2}{n} - \frac{\sum\limits_{u \neq \alpha}^{n} y_u}{n-1} \right]$$

20. Some Likelihood Ratio Tests

By P.V. Dabli

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Let μ and σ be respectively the mean and the standard deviation of a normal distribution. Let $\theta = \mu/\sigma$. Using the Kuhn-Tucker sufficient optimality criterion, the likelihood ratio tests for the one sided hypotheses $H_o^{(1)} : \theta \leqslant \theta_o$ and $H_o^{(2)} : \theta \geqslant \theta_o$ where θ_o is a known constant, are derived.

The tests are such that $H_o^{(1)}$ is rejected for larger values of u while $H_o^{(2)}$ is rejected for smaller values of u, where $u = \bar{x}/S$, $\bar{x}$ and S being the mean and the standard deviation of sample observations from the normal population. The tests coincide with the uniformly most powerful invariant tests for $H_o^{(1)}$ and $H_o^{(2)}$.

21. **An Indicator for Measuring Change in Cropping Pattern**
By M.N. Das and B.S. Mittal
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With the increase in irrigation facilities and advent of technological development in Agriculture Cropping pattern, that is, distribution of area under different crops in a region is undergoing change in different regions of the country. It appears that there is, at present, no index to give a quantitative measure of change of cropping patterns. Using irrigated or total area under different crops in a state, say, for several years a method has been developed to build up an index of change in cropping pattern. Like-wise an index has also been built up to give a quantitative measure of change of intensity of irrigation taking into account areas under individual crops.

Such indexes have been obtained for Andhra Pradesh from 1952-53 to 1974-75.

22. **Trend of Yield of Wheat in Pre-HVY and Post-HVY Periods**
By S.D· Bokil and Hakim Singh
Indian Agricultural Statistics Research Institute, New Delhi

Keeping in view the rate of increase in Indian population, it is very essential to examine continuously the prospects of growth of production of foodgrains. It is the objective of this paper to examine the prospect for wheat. The trend of yield of wheat is examined for important wheat producting states. A comparative study, on compound growth rate has been made and it is observed that the growth rate of yield in post-HYV period is less than in pre-HYY period in the most important wheat producing States and in fact, both the growth rates are less than the growth rate for the entire period in all the States other than M.P. and Rajasthan. This is due to the fact that much of the increase in yield took place between 1964-65 and 1967-68, the last year of pre-HYV and first year of post-HYY period respectively.

23. **Study on Trends in Yields of Jute in Important Jute Growing States [West Bengal, Bihar, Assam (plain), Tripura, Orissa and Uttar Pradesh] During the First Four Five Year Plans**
By B.K. Samanta
Jute Agricultural Research Institute, Barrackpore

An attempt has been made to study the trends in yields of jute in West Bengal (excluding Darjeeling district), Bihar, Assam (plain), Orissa, Tripura and Uttar Pradesh for the first four-five year plans and pre-plans period (1946-47 to 1950-51) with a view to finding out

the extent to which these plans have made their impact on the yield of crop in the States.

The results of statistical analysis showed that in state level there was not any significant increase in the yield per hectare of jute in first, second, third and fourth plan period (each plan period tested against the previous) in West Bengal and Assam (plain). In Bihar there was a significant increase in yield per hectare of jute in second plan which showed 25·11% increase in yield rate compared to that in first plan. In Uttar Pradesh, significant increased yield per hectare was found in second plan and third plan which showed 37·84% increase compared to first plan and 19·76% increase compared to escond plan respectively. In Tripura there was constant increase in yield per hectare of jute through all plan periods but significant increase was only in second and fourth plan which were 13·11% compared to first plan and 36·00% compared to third plan respectively. But all India picture was different from the States Bihar, Orissa, Tripura and U.P. as there was no significant increase in yield rate in any plan period.

24. Measurement of Stability in Productivity on Drylands

By C.K.R. Chetty

All India Co-ordinated Research Project for Dryland Agriculture, Hyderabad

Starting from 1971, the Co-operating Centres of All India Co-ordinated Research Project for Dryland Agriculture have developed a package of practices suitable to their respective areas for increasing the productivity of drylands. The yield data collected from 1971-76 over seasons, crops and locations showed that the 'Improved Technology' has in fact significantly increased the yields compared to 'Traditional Method'. However, a question arose whether the 'Improved Technology' has also imparted stability in production. The paper shows that this question reduces to a test of the equality of coefficients of variation. Application of non-central 't'-test lead to the conclusion that the 'Improved Technology' has given stability to production on drylands.

25. Projections of Nitrogenous, Phosphetic and Potash Fertilisers Requirements for the Different Districts of Vidarbha for the Period of 1978-79 to 1982-83

By N.S. Gandhiprasad and B.G. Sapate

Punjabrao Krishi Vidyapeeth, Akola

Any target for the increase of agricultural production cannot be practicable without proper assessment of inputs requirement. Fertiliser is one of the indispensable inputs of agriculture. Agricultural productivity undoubtedly depends upon the utilisation of fertilisers.

In this paper an attempt is made to project the future requirements of N, P, K fertilisers for the different districts of Vidarbha region for the period of 1978-79 to 1982-83. This study reveals that this region requires 1386, 913 and 659 thousands metric tonnes of Nitrogenous, Phosphetic and Potash fertilisers respectively for Rice, Jowar, Wheat, Cotten and Groundnut crops to grow as per recommended package of practices for the ensuing five years.

A further enquiry reveals that only 25%, 9%, and 8% of total requirement of N, P and K fertilisers were distributed during the year 1976-77 indicating the wide gap between the requirement and actual distribution. It is expected that the persons concerned with policy making and its implementation will give due priority for the production, distribution and marketing of these indispensible inputs of agriculture.

26. A Working Plan Model for Cropping Pattern and Crop Projections in Meghalaya, 1975-76 to 1988-89

By I.Z. Bhatty and V.V.N. Somayajulu

NCAER, New Delhi

This paper traces the cropping pattern and projects the acreage and production levels of food and commercial crops in Meghalaya from 1975-76 through 1988-89, keeping in mind:

—attainment of self-sufficiency, particularly in respect of rice (staple food), and minimisation of consumer goods produced in Agriculture;

—fuller utilization of land and water resources; and

—the hilly terrain, jhum cultivation practice and scope for replacement of jhum in Meghalaya.

Based on the available data and a few assumptions/promises, a working plan model is set for the purpose of projecting rice production for any future year.

The domestic production of rice available per head per day is worked out to be 380 grams by 1983-84 and 398 grams by 1988-89 from 330 grams in 1978-79 or 346 grams in 1975-76.

The food deficit will be reduced from 18,000-21,000 tons during 1975-76 to 1000 tons only by 1988-89.

Assuming a four year cycle of jhum on hill-slopes upto 50%, the yearly acreage of jhum land for rice cultivation is worked out to be 45,148 hectares in 1983-84 and 39,572 hectares in 1988-89 compared to 50,667 hectares in 1975-76. Of the total yearly acreage jhum land of 76,000 hectares, 60,800 hect. will be irrigated for rice cultivation by 1992-93. The balance of 15,200 hect. of jhum land will be the addition to acreage of other crops, whose outputs are essentially

consumer goods such as pulses, vegetable oils and wheat imported in large quantities. The four-year cycle of jhum might break down by 1992-93 on the mild hill slopes. Over 60% slopes, there will thus be an yearly acreage of 34,714 hect. of jhum land with a cycle of 7 years which can be utilised for oranges, other long gestation horticultural crops and plantations such as rubber, black pepper and coffee.

27. Estimation of Fibre Yield of Olitorius Jute Grown in a Field, Using Different Sampling Techniques

By B.C. Sasmal and V. Katyal

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Shukla (1965) found on the basis of a population of fifty plants of jute, that multivariate regression method is superior to Olkin's multivariate ratio method using SRSWR to estimate fibre yield involving the auxiliary variables—plant height and basal diameter together. Such a method may not be practically feasible and efficient for the purpose of estimation of fibre on the basis of data obtained on a field.

The present work is to estimate fibre yield using one variable on the basis of data of 50 distinct plots of size $9m \times 2m$ continued in a field of size 900m². Different sampling techniques such as SRS with and without replacement, systematic sampling, stratified sampling and PPS sampling, were adopted for estimation. Among them systematic sampling came out as more efficient. Ratio estimate alongwith SRS with and without replacement and systematic sampling are then compared in respect of their efficiencies. It is observed that ratio method of estimation with systematic sampling (where the plots are numbered sequentially) using green weight as auxiliary variable came out as most efficient.

28. Markov Process and Shifts in Cotton Area

By P.R. Waghmare, B.S. Kulkarni and B.S. Deshpande

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Cotton is the important non-food cash crop in Maharashtra. Maharashtra ranks the first amongst all the cotton growing States in India. Seven to eight lakh hectares of cotton area is grown in Marathwada region out of 26 to 28 lakh hectares area in Maharashtra. The Marathwada region which consists of five districts, Aurangabad, Nanded, Parbhani Bhir and Osmanabad has wide fluctuations in cotton area due to vagaries of Monsoon and other agro climatic conditions.

In the present paper, a 4-State Markov probability model has been fitted to a forty seven years (1925-26 to 1971-72) data of

area under cotton to each district as well as at aggregate level of Marathwada region. The four states of Markov model were classified according to first, second and third quartile and a transition probability matrix P was obtained. Further, the projections as well as the equilibrium state were estimated by powering the matrix P.

The analysis reveals a non-significant difference between the actual and the estimated area for the years 1972-73 to 1976-77. The equilibrium (steady) state of Marathwada region as whole will be attained after eleven years, i.e., in 1983-84 with an estimated area of 5,45,324 hectares. Aurangabad, Nanded, Parbhani, Bhir and Osmanabad districts have given the figures of equilibrium state after 17, 17, 16, 16 and 30 years respectively with an estimated area of 84,202, 187, 800, 1,20, 854, 24, 716 and 26, 574 hectares respectively from the base year transition probability matrix of 1971-72.

Thus the study would be of impetus use to planners, policy mokers and Economists to emphasize their policy and research to increase the productivity of the crop.

29. Supply Response of Wheat : A Case Study of Marathwada Region

By B.S. Kulkarni, N.Y. Palimkar and P.R. Waghmare

Marathwada Agricultural University, Parbhani

Wheat is an important semi-commercial cereal in Marathwada region of Maharashtra State. It covers a maximum acreage under irrigation (24 per cent of the total area under wheat) in the different districts. Supply functions are estimated for the period 1951-52 to 1974-75 for both irrigated and non-irrigated area relationships, of which the non-irrigated area response was non-significant. While the farmers are price responsive in allotting the irrigated area for the crop but their attitude towards the adjustment is very slow and more or less traditional.

30. Forecasting Rice Yield Using Climatic Variables

By Ranjana Agrawal, R.C. Jain and M.P. Jha

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

An attempt was made to develop a suitable statistical methodology for forecasting rice yield of Raipur district using 25 years data on yield and weekly weather variables namely maximum temperature, relative humidity, total rainfall and number of rainy days. Out of several yield prediction models tried, two models were found suitable. In the first one, weighted accumulations of weekly weather variables using powers of week number as weights were used while

respective correlation coefficients with yield in place of week number were taken in the second model. Stepwise regression technique was followed for obtaining the prediction equations.

Results of studies showed that 11th week after sowing (3rd week of August) is suitable period for forecasting as about 70 per cent variation in rice yield could be explained by weather variables including time trend. This indicates that a reliable forecast of rice yield is possible two and half months after sowing for a crop of about 5 months duration.

Two weighted weather indices using correlations and standardised partial regression coefficients as weights were constructed which can be used in prediction equations in place of weather variables. Principal components were obtained which can also be used as composite variables of weather.

31. On Construction of Balanced n-ary Designs

By M. L. Chandak
J. N. Agricultural University, Jabalpur

The purpose of the paper is to generalise one of the methods of construction given by Saha (1972) and to provide some new series of balanced ternary designs (BTD's) using method of differences, which covers the uncovered case, when $V=s(s+2)=4t+3$, $s=p^n$; p is a prime number. A relation between tactical configurations and balanced ternary designs is also established.

32. Construction of Symmetric PBIB Designs and Related Results

By B. L. Misra and M. L. Chandak
J. N. Agricultural University, Jabalpur (M.P.)

While constructing PBIB designs, using method of differences, Bose and Nair (1939) gave three examples of $(v, k, n_i, \lambda_i, p^i_{jk})$ difference sets for $v=15$, 29 and 31. In this paper the existence of such sets has been shown when the number of treatments is a product of twin power primes. The authors use these difference sets to construct series of symmetric PBIB designs of two and three associate classes. These sets are also utilised for providing a uniform method of construction of partially balanced Youden squares.

33. A Note on Partially Balanced Ternary Designs

By B. L. Misra
J. N. Agricultural University, Jabalpur (M.P.)

Two methods of construction of partially balanced ternary (PBT) designs have been presented. We consider a BIB design and a PBIB design obtained by method of differences through single

initial block with at least one element common and combine them as such to get an initial block for PBT design. Further, we get the incidence matrix of a PBT design by adding the corresponding rows of incidence matrices of a BIB design and a PBIB design both obtained through single initial block with $\theta \geqslant 1$ elements common, when $v = 4\lambda + 3 = p^n$ and odd prime power. Again from a PBIB design alone we have constructed PBT and PB n-ary designs making use of initial blocks.

34. Row-Column Designs With Several Non-Interacting Sets of Treatments

By N. P., Singh, A. K. Nigam & M. Singh
I. A. S. R. I., New Delhi

A theory of design and analysis of experiments with several non-interacting sets of treatments is given for the situations where the heterogeneity present in experimental material can be eliminated in two directions. The analysis of multistage balanced youden square introduced by Hedayat *et. al.* (1972) and other orthogonal structure turns out as a special cases.

35. Row-Column Designs with Two Non-Interacting Sets of Treatments

By N. P. Singh, A. K. Nigam & M. Singh
I. A. S. R. I., New Delhi

Row-column designs with two non-interacting sets are having potential applicability in horticultural and other perenial experiments. Hoblyn *et. el.* (1954) and Freeman (1959) have discussed principles relevant to such experiments and have given block designs for two non-interacting sets of treatments as has Potthoff (1962) Clarke (1963) Preece (1966) gave design and analysis of some simple row-column designs.

In this paper a rigorous procedure of analysis of designs eliminating heterogeneity in two directions with two non-interacting sets of treatments for a general non-orthogonal set {up has been developed. Several notion of balance on these situations is obtained. A number of series of balanced designs are given.

36. Fractional Replication of $s^3 \times t$ Experiment in s^3 Runs, $t \leqslant s^2$

By K. R. Aggarwal and Bishen Singh
Punjab Agricultural University, Ludhiana

Let $s^3 \times t$ be a factorial experiment in factors A_1, A_2, A_3 and B; A_i being at s levels and B being at t levels. Let $t \leqq s^2$ then it is possible to construct a main-effect plan for this experiment in s^3 runs,

37. Use of Ranks in Groups of Experiments

By S.C. Rai and P.P. Rao

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

The main object of the groups of experiments is to study the susceptibility of the treatment effects to places and climatic variations. When the error vaiances are heterogeneous and interaction is absent, the combined analysis of groups of experiments cannot be done by the usual analysis of variance test. As a way out for overcoming this situations, transformation of data into a suitable scale is suggested. But this also does not offer complete and satisfactory solution as it is very difficult to find out the right type of transformation for a set of given data. In this paper, we have proposed the method of analysis which depends upon the ranks of the individual responses of different treatments. The test statistic k follows x^2 distribution for large number of observations. The efficiency of this procedure as compared to analysis of variance is worked out by analysing the same set of data by the two procedures. This method uses solely information on 'order' and makes no use of the quantitative values of the variates as such. Since no assumption is required to be made as to the nature of underlying universe, this method is thus applicable to a wide class of problems to which the analysis of variance cannot validly be applied.

38. Incomplete Block Designs for Parallel Line Assays

By Kyi Win and A. Dey

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

In this paper, new incomplete block designs for parallel line bio-assays are proposed. Both symmetrical as well as asymmetrical assays are considered. These designs estimate all the three important contrasts, namely, preparation or materials (L_p), combined slope (L_1) and Parallelism (L'_1) free from block effects. The method of analysis of these designs also is indicated and illustrated with the help of data on a Riboflavin assay reported by Bliss (1952).

39. On The Optimum Amount of Experimentation in Animal Nutrition

By S.N. Bajpai & A.K. Nigam

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

Experimentation on animals widely differs from experimentation on crops in the sense that whereas there is more flexibility in testing input treatments to crops, there is limited scope of testing input treatments (quantitatively) to animals. Every planned

experiment in our country follows some standard, say, Morrison, N.R.C. or Sen & Ray. There are, however, few scientists who have allowed variation in above standards while planning their experiments. The results of study under the project "Optimum Amount of Experimentation on Animal Nutrition" of IASRI for the past fifteen years (1960-75) have revealed that additional information (other than what is available in above standards) is insufficient for deeper economic analysis. For example the experiments planned for estimating the amount of D.C.P. required exclusively for milk production from various feeds is not estimable. Whatever amount of D.C.P. is estimated for milk production, it also contains some part for maintenance. The information available on interaction of feeds is also scanty which adds to difficulty in estimating the optimum combinations of the feeds. There seems, perhaps, the lack of proper planning which resulted such type of confounded information whereby Scientists have drawn varied conclusions on the same aspect.

40. An Evaluation of the Reliability of a Scaling Technique for The Disease Assessment of Sapota Leaf Spot

By Gurumurthy and N. Sundararaj

University of Agricultural Sciences, Bangalore

In order to assess the sapota leaf spot, ten groups of participants developed their own scales and the severity of the disease was measured by them using those scales. The same set of 50 sapota leaves were assessed by the ten different groups. A sub sample of 10 leaves was reassessed by the same group. The data was subjected to two types of analysis (a) To estimate the extent of agreement among the ten groups who assigned percentage severity ratings to 50 sopota leaves according to their own scales of ratings initially developed by them, (b) To estimate the extent of agreement of the group with itself by the ratings of the severity assigned by the group on the first and second occassions. The Kendall's coefficient of concordance calculated for the 10 groups were 0.93 and 0.91 for the data on 50 leaves and a second sub sample of 10 leaves (second assessment) respectively, indicating a close agreement among the several groups in assessing the severity of the disease. The leaf that was considered severe by one group was considered severe by the other groups also. But the magnitude of the scores assigned by different groups were different. There appears to be a close relationship between the ratings of severity of disease assigned by a particular group on the first and the second assessment.

41. A Study on Effect of Spacing on Yield of Apple— Utter Pradesh

By Jagmohan Singh

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

It is well known that plant spacing has an effect on yield in most crops. To study this effect in case of the apple crop, data collected in a sample survey on cost of cultivation of apple in hilly areas of Uttar Pradesh were utilized. The spacing was measured inversely in terms of number of bearing trees per hectare. Some indication of decline in yield with closer spacing was noticed in districts where the crop had not suffered due to adverse season. When the yield in a particular district was very low on account of seasonal effect, the influence of spacing was found to be nonsignificant.

42. Generation Matrix Method of Studying Inbreeding Systems-II

By K. C. George

Haryana Agricultural University, Hissar

The problem of correlation between relatives in the case of sex-linked gene has been studied by several authors. Even though Fisher (1949), Haldane (1955) and Li (1955) devided the generation matrix for full-sib mating with sex-linked genes, it is infact, Korde (1960), who made use of this generation matrix in calculating the correlation between the different relatives. But the problem of studying the various full-sib and parent-offspring pairs under continuous system of full-sib mating in the sex-linked gene case has not been completely explored by any of these authors. In this paper a study of correlation between the various full-sib pairs *viz*. (*i*) brother-sister, (*ii*) sister-sister, (*iii*) brother-brother and the various parent-offspring pairs-*viz* : (*i*) mother-daughte1, (*ii*) mother-son, (*iii*) father-daughter, (*iv*) father-son, under full-sib (brother-sister) mating, by evolving the joint distributions of the relative pairs, has been made.

The following conclusions were made from this study. The correlation between all the seven relative pairs increases as the number of generations of the continued full-sib mating increases and ultimately attain the value unity in the limiting case. But among the full-sib pairs, the correlation between sister-sister pairs is very high even in the initial generation of full-sib mating, where as the correlation between the brother-sister pair is middle size and that of the brother-brother pairs is the lowest in the initial generations of full-sib mating. But the brother-brother pair correlation increases at rapid rate and overtake the brother-sister correlation in the fourth generation of full-sib mating. Among the correlations between the

parent-offspring pairs, the father-daughter correlation is the highest and the father-son correlation is the lowest in initial generation. Even though the mother-son correlation is the same as that of the father-daughter in the initial generation, the father-daughter correlation increases at a higher rate and over-take the mother-son correlation at the fourth generation of full-sib mating.

43. Relative Performance of Different Cenetic Groups of Crossbred Cattle at HAU, Animal Farm

By U. C. Jaiswal and S. C. Chopra
Haryana Agricultural University, Hissar

Crossbreeding of indegenous cattle with exotic breeds of high performance has been established to be the best and effective method for increasing the milk production. In this paper the relative performance of different genetic groups of crossbred cattle *viz.*, ½ Holstein Friesian + ½ Hariana, ½ Brown Swiss + ½ Hariana, ½ Jersey + ½ Hariana etc. in terms of production and redoroduction traits has been studied. Holstein Friesian half breds (HF × Hariana) have been found to be the most efficient animals for commercial production of milk. Jersey half breds have lowest age at first calving and higher fat percentage in milk comparison to other crosses.

44. On the Use of Regression Approach in the Analysis of Genotype-Environmental (G-E) Interaction

By G. K. Shukla
Indian Institute of Technology, Kanpur

In the last fifteen years the technique of regressing genotypic yield on the environmental mean, measured by mean yield of all the genotypes in that environment, proposed by Yates and Cochran, has been used frequently for the analysis and interpretation of G-E interaction. However, in the last few years some experimentors have observed some inconsistency of this technique by analyses of some data. In the present paper an analytical approach has been considered to examine the limitations of the above technique.

45. The Genetic Improvement in Poultry Through Crossbreeding Desi with Rhode Island Red; The use of Discriminant Function in Non-Orthogonal Factorial Experiment

By S. C. Agarwal and J. Kumar
Indian Veterinary Research Institute, Izatnagar

Advantage of crossbreeding Desi with exotic Rhode Island Red has been assessed by estimating the measure of genetic improvement based on economic characters (*i*) day old body weight, (*ii*) 12 week old body weight, (*iii*) age at first egg laying, (*iv*) rate of lay, (*v*) egg

weight and (*vi*) egg shape, using the technique of discriminant function in non-orthogonal factorial experiment. The genetic improvement thus abtained as 5%, which was highly significant, indicates that crossbreeding Desi chicken with exotic R.I.R. is quitadvantageous.

46. Assessment of Corriedale X Coimbatore Cross Bred Lambs in Respect of Their Growth and Wool Yield

V. K. Singh and Gurmej Singh

Central Sheep & Woll Research Institute, Mannavanur, Kodaikanal.

The data on 811, 561, 386, 281 and 182 records of body weights taken at birth and 3, 6, 9 and 12 months of age alongwith 308 first six monthly and 168 2nd six monthly greassy fleece weight of lambs Coimbatore and Corriedale×Coimbatore, F1, F2, 5/8ths, 5/8ths, interbred, 3/4ths and 3/4ths interbreds were analysed.

The average body weight of Coimbatore lambs at birth and 3, 6, 9 and 12 months of age was 2.113, 7.108, 10.624, 13.366 and 15.114 kgs. The 1/2 breds have shown 25.5, 32.4, 25.8, 18.6 and 16.9 % improvement in these weights over Coimbatore. These figures for 5/8ths were 35.7, 26.4, 20.2, 18.4 and 20.8 % respectively and for 3/4ths were 41.2, 40.8, 27.4, 22.9 and 21.5 respectively. 2 5/8ths Finterbred and 3/4ths interbred were superior to F1, 5/8th and 3/4th.

The gain in weight of Coimbatore lambs from birth to 3 months, 3-6, 6-9 and 9-12 months was 4.972, 3.259, 2.780 and 1.635 kgs. The half breds have shown 32.8, 15.3,−33.0 and 15.7 per cent improvement in gain in weight over native Coimbatore. These figures for 5/8ths were 21.2, 5.1,−7.1 and 30.6 per cent respectively and for 3/4ths 38.7,-6.7,−9.2 and 13.1 percent respectively. The interbreds were generally superior to original crosses. The first and second six monthly greasy fleece weight for Coimbatore were 0.269 and 0.313 kgs. The half-breds have shown 53.9 and 61.3 percent improvement. These figures for 5/8ths were 72.5 and 89.1 per cent respectively, and for 3/4ths were 71.4 and 78.0 per cent. The interbreds were generally superior to original crosses.

The effect of genetic group and sex was found to be statistically highly significant (P $\angle$ 0.01) on body weight at various ages, gain in weight and greasy fleece weight in 1st and 2nd clip.

47. Estimation of Milk Yield on the Basis of one Time Milk Recording in a Day

By Shivtar Singh & K.C. Raut

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

Sample surveys conducted by the Indian Agricultural Statistics Research Institute with a view to evolve a suitable sampling metho-

dology for estimation of availability of milk require the weighment of milk yield of milking animals in the selected households both in the morning and in the evening in a day at regular intervals. Operational difficulties are experienced in recording both time milk yield in some areas. An attempt has been made to examine the feasibility of adopting a sampling design in which data on milk yield can be recorded either in the morning or in the evening utilising data collected in a survey carried out by I.A.S.R.I. in I.C.D. area of Bikaner (Rajasthan) during 1975-77. There was high correlation between the milk yield recorded in the morning and in the evening of cows and the difference between the two recordings in a day was statistically significant. The findings suggest that one can plan the enquiry so as to record milk yield in one time in a day to get the estimates with a reasonable degree of precision. Different aspects of the study have been worked out and discussed in the paper.

48. An Economic Animal : Some Production Characteristics

By K. C. Raut, Shivtar Singh & Vimal Chandra

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

It is well-known that the average milk yield of milch animals in the country is very low and as a result these animals do not provide adequate net return to the farmers. Considerable emphasis is being given to improve the dairy development plans to increase the productivity of the animals and thereby to improve the economic status of the cattle owners in the rural area. In this context, it is desirable to know, at least in the milk collection areas, the production characteristics of animals so as to provide guidelines to farmers to decide the type of animals they should maintain for realising reasonable net return. With this aim in view, the present study has been carried out to determine an economic animal based on some production characteristics like lactation length, dry period, average yield per day of lactation and yield per day of calving interval. The study has been undertaken utilising data collected in a survey carried out in Bikaner area of Rajasthan. An economic animal has been defined as one which provides its owner some net return per day of calving interval. These economic animals have been further classified according to their, (*i*) calving interval ; and (*ii*) lactation yield. The results showed that the cows, maintained by commercial milk producers in the area, can be considered more economical if their calving interval is up to 360 days or having lactation yield more than 1500 kg.

49. On Least-Cost Feeding Schedules For Bovines

By Shivtar Singh

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

Dairy enterprise can be made both popular and acceptable among the rural community by providing them a compact plan of maintaining animals. One such plan involves formulation of appropriate feeding schedules. While the requirements can be specified in terms of the nutrients like Digestible Crude Proteins (DCP), Total Digestible Nutrients (TDN) and Dry Matter (DM) etc. the actual feeds and the quantities fed will depend on the availability of feeds in the area, their prices and their nutrient values. In this investigation least cost feeding schedules have been formulated using linear programming techniques utilising data from a survey conducted by I.A.S.R.I. on Economics of raising cattle and Buffaloes in a typical rural area of Haryana State. The results obtained on least-cost feeding schedules satisfying the current level of nutrient intake indicate that there is enough scope for saving some bovine feeds. These savings can be used to feed either more number of animals or alternatively to maintain the existing stock at a higher plane of nutrition.

50. Milk Production Functions and Least Cost Combination of Feeds in Zebu Cattle

By S. B. Agarwal & Kuber Ram

National Dairy Research Institute, Karnal

An attempt has been made to study the milk production functions and least cost combination of feeds in pure bred zebu cattle. A functional relationship between milk yield (y) as dependent variable and green fodder (x_1) and concentrate (x_2) as dependent variables was established using the model $y = f(x_1, x_2)$.

The linear, Cobb-Douglas and quadratic type of functions were tried by least square method. The Cobb-Douglas model was found most appropriate production function and was, therefore, used for further economic analysis. The marginal physical products for various input levels of green fodder and concentrate were obtained. The marginal Rate of Substitution of concentrate by green fodder was also estimated. The milk Isoquants and feed isoclines were derived. Least-Cost combination of feeds for a specified level of milk production under different price ratios of inputs were obtained from the point of intersection of the isoquants and isoclines. The study revealed that milk yield increased at diminishing rate incidental to variation of one factor holding other constant. In other words

each additional unit of feed input added less to the total output. The substitution of concentrate by green was feasible to a considerable extent at lower levels of milk production but the scope of such substitution was found to reduce with the increase in the level of milk production. It was observed that with the increase in the prices of green fodder and concentrate the profit margin also underwent a decline. The price ratio of green to concentrate being 0.0375, the maximum yield was estimated to be 14.30 kg. The optimum levels of feed inputs were 40.0 kg green and 4.10 kg concentrate. The margin of profit over feed cost was found to be Rs. 7.00 when the price of milk was Rs. 1.60 per kg.

51. Increase Milk Production by Better Management

By K. B. Singh & B. B. P. S. Goel
I.A.S.R.I., New Delhi

Milk yield of an animal depends upon characters which includes better feeding, proper housing, watering, grazing and servicing etc. (like species, breed, stage and order of lactation besides proper management). Studies indicate that production of milk can be increased considerably by looking after the animals properly. To study the effect of better management on milk production the data collected under the scheme 'Pilot investigations for developing an integrated technique for estimation of principal livestock products and study of attendant animal husbandry practices' conducted by the Indian Agricultural Statistics Research Institute in the northern region comprising Punjab, Haryana and Himachal Pradesh 1969-70 and in the southern region comprising Andhra Pradesh 1971-72, have been used. The design of the survey was of stratified multistage random sampling with villages as p.s.u.'s, households and animals in milk as the units of sampling at the subsequent stages. In these surveys *inter alia* information on milk yield and animal characters for the selected animals was recorded. It has been observed that the level of milk production of animals of a given species and breed in about two-thirds of the households was below of equal to the population average yield and that in the remaining households was much above the population average for the same type of animals, the deffe- rence in the average yields in the two groups being quite high. Further in these two groups of households since characters like order and stage of lactation were more or less at the same level the difference in yield was mainly due to management practices. So if the households in the first category take as much care of their animls as is being done by the second category of households the milk production in the northern region can be increased by 51 per cent and that in the

southern region by 96 per cent by infusing in the farmers the awareness of increasing the milk yield of their animals by adopting better management practices. This would need a small increase in the supply of feed to animals. Besides this would require creation of facilities of marketing and expansion of dairy industry for collection of the additional production, its processing and supply to the deficit areas.

52. Calf Mortality Among Different Crossbred Cattle in Different Fillial Groups

By K. N. S. Sharma and D. K. Jain
National Dairy Reserach Institute, Karnal

Crossbreeding of indigeneous Zebu cattle with exotic breeds from temporate regions is being widely practised to increase the productivity of Zebu cattle and thus increase the total milk production in the country. However, the adaptability of crossbred cattle to tropical climate needs through investigation, since animals adopted to a region show greater resistance to infection and better able to survive endemic diseases. Calf mortality is an important economic character and is associated with adoptability.

Crossbreeding work in going on since 1963 at National Dairy Research Institute, Karnal using Brown Swiss, Holstein and Jersey exotic bulls with Tharparkar, Sahiwal and Red Sindhi Zebu cattle. The present paper deals with calf mortality of crossbred cattle with different blood levels in different age groups (Birth-1 month, 1-3, 3-6, 6-12 months) upto one year of age.

The data for Brown Swiss crosses with Sahiwal and Red Sindhi was from 1963 to 1976 and that of Holstein, Brown Swiss and Jersey crosses with Tharparkar was from 1972 to 1977.

The mortality rate in birth-1 month age-group ranged from 4·00 to 20·61 per cent ; 0 to 9·62 pre cent in 1-3 months : 0 to 7·41 per sent in 3-9 months and 0 to 9·09 per cent in 6-12 months among male Brown Swiss crosses in different fillial groups. Similarly among female calves, the range varied from 4·72 to 16·67; 0 to 9·38, 0 to 2·70, 0 to 6·42 respectively. The mortality rates were significantly different among fillial groups in birth-1 month and 1-3 months age groups. In other age groups the mortality rates were observed to be of the same order. No sex differences were observed in all the fillial groups, and age groups. The mortality rate increased with the increase in blood level. Among the first three generation of half bred crosses, the mortality was observed to be of the same order. Mortality rates were observed to be significantly higher in winter season. In summer and monsoon seasoon, they were observed to be of the same order.

In Holstein, Brown Swiss and Jersey Crosses, the mortality rates were observed to be from 0·93 to 5·13 per cent in birth-1 month ; 0 to 4·07 per cent in 1-3 months ; 0 to 3·51 per cent in 3-6 months and zero in 6-12 months age groups among males. Similar range of percentages for females in different age groups were 1·22 to 5·66 ; 0 to 6·25 ; 0 to 2·38 and 0 to 3·39 respectively. The morality rates were of the lower order in Tharparkar crosses as compared to other Zebu crosses. There rates of the same order in different age groups and among sexes. The mortality rates of Tharpakar crosses with different exotic breeds were also observed to be of the same order. There were no seasonal differences as well. The extent of data being limited for six years, further confirmation is required.

The mortality rates were found to be highest in birth-1 month age group in all the fillial groups and other crosses. In other age groups, the mortality rates were comparable with purebred Zebu breeds. More care of the crossbred cattle is needed during the first month of birth and it is more so when the calf is born in winter season.

53. On the Estimation of Abundance, Mortality Rate and the Total Annual Stock of Sardinella Longiceps (Valenciennes)

By S.K. Dharma Raja and Dilip Kumar Ghosh

Central Marine Fisheries Research Institute, Cochin

Sardinella longiceps forms very important fishery on the west coast of India particularly in Kerala coast. An attempt is made to estimated the abundance, mortality rate and the total annual stock of oil-sardine on the basis of data on length measurements and the estimates of catch and fishing effort for three fishing seasons 1975-76 1977-78. Pooling the estimates of Z made by Banerji (1973) for the years 1955-56, to 1964-65 the estimates of average Z was updated and the current total annual stock of oil sardine was arrived at 412,000 tonnes off Kerala coast and 509,000 tonnes off west coast of India.

54. Effect of Organised Milk Supply Schemes on Some Aspects of Economy of Milk Suppliers

By D. K. Bhatia

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

With the introduction of any new technology in the existing system of production or management in an area it is desirable to know its effect on the economy of that area. The effect may be measured over-space or over-time. The new technology may effect the economy in the vicinity of the area chosen differently from the

area that is farther from the site. Non-availability of time series data leaves us with no option except to follow the space concept. Following the space concept an attempt has been made to find the impact of an organised milk supply scheme, on the economy of milk producer's families in supplying and non-supplying areas, utilising the data collected in a large survey "Impact of Milk Supply Schemes on the rural economy in milk collection areas of Delhi Milk Scheme" conducted by I.A.S.R.I., during 1966-67.

The study has revealed that by the introduction of milk supply scheme, the suppliers of milk to organised agencies have not uniformily scored above those who are not supplying their milk to organised agencies. It indicates that there are potentialities for further improvement of rural economy.

55. Cross-Breeding for Increased Milk Production—An Assessment of the Past Trends in Kerala.

By K. Narayana Nair
Centre for Development Studies, Ulloor, Trivandrum

An attempt is made to examine the contribution of cross-breeding programme to the increase in milk production in Kerala in recent past. The paper deals with two aspects namely, trend in milk production and assessment of the contribution of cross-breeding programmes to the increased milk production. An alternative estimate (other than the approach followed by N.S.S. and I.A.R.S.) based on milk consumption at the two points of time from an independent source namely, the consumer expenditure surveys condcted by the NSS has been suggested for obtaining the trend in milk production. The estimates of per capita consumption derived on the basis shows that between 1965-66 and 1975-76 per capita liquid milk consumption in rural areas increased by 40 per cent whereas in urban areas it increased by 90 per cent. Allowing for population increase during the decade the total milk consumption in the State as a whole is estimated to have risen by 65 per cent.

The increase in total milk production over the years can be due to (a) rise in total milch animal population and the proportion of animals in milk ; (b) increase in the proportion of cross-bred cows in the breedable population ; and (c) the rise in the average milk yield of non-descript stock mostly due to better feeding and management. The details about these aspects have been discussed in the paper. It was observed that the contribution of the increase in milch animal population to the total milk output was negligible. The two factors which are responsible for the increase in milk production

are the increase in the population of the cross-bred cows and increase in the productivity of non-descript animals, the cuntribution of the first one being of the order of 65 thousand tonnes that of the second about 64 thousand tonnes.

56. Intermating in Early Segregating and Characterisation of Genetic Paramaters in Self-pollinated Crops

By Subedar Singh
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Biparental progenies produced following North Carolina Mating Design III in F_2 populationg of two distinct bread wheat crosses (Sonalika x Norteno, Pusa Lerma x Shera) and the corresponding F_3s were analysed to characterise nature and magnitudes of genetic variances governing yield traits. Design III analysis revealed highly significance estimates of additive component of genetic variance for all the characters namely, plant height, spike length, grains/spike, grain yield of 3 spikes, test weight and yield/plant whereas dominance components were significant only for plant height and grains/spike in one of the two crosses. Also Design III progenies had higher means than the F_2 selfs (F_3). On the other hand, the genetic variance of F_3 progenies were higher than those of Design III progenies as expected theoretically. Since the estimates of additive variance were predominant, intermating of F_2 segregants would result in accumulation of favourable genes, resulting in higher means. Therefore, selected F_2 if intermated, the derived populations would have greater meants than the corresponding selfs. Besides the accumulation of favourable genes, intermating in early s egreganting generations would cause the breakage of undesirable linkages and help in exploitation of fixable epistatic effects.

57. Sampling Scheme Providing Unbiased Regression Estimator

By Padam Singh and A. K. Srivastava
I. A S R. I. New Delhi

Regression method of estimation is considered as an efficient technique of utilising auxiliary information for estimating population mean. When regression coefficient is estimated from the sample, the estimator is known to be biased. In the present paper, two sampling schemes have been proposed. For the first sampling scheme an unbiased regression type estimator has been suggested, while for the second sampling scheme, the usual regression estimator is unbiased. On comparing the efficiencies of the suggested sampling strategies, it has been observed tha the performance of the sampling scheme providing unbiased regression estimator is highly satisfactory.

58. On Use of Functions of Ancillary Information in Sample Surveys

By Padam Singh and H. V. L. Bathla

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

Many times the information on some auxiliary character highly correlated with the character of interest is available on all the units of the population. The ancillary information can be utilized for the efficient estimation of population parameters. The commonly used methods are namely, probability proportional to size selection, ratio-regression method of estimation etc.

In the present study a procedure for utilizing the auxiliary information for estimating the total of the character under study based on the idea of estimation through prediction has been suggested. The relative efficiency of the suggested procedure as compared to simple mean, ratio and regression methods of estimation has been examined and it has been seen that the suggested procedure is always more efficient than the regression method of estimation.

59. A Note on *Modified* Ratio Estimator Using Transformation

By Miss S. P. Kulkarni

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The use of the ratio estimator is advisable when the line of regression of y on x passes through the origin. Knowledge of the intercept made by the regression line with the y axis canbe utilized to modify the usual ratio estimator. The absolute biases of the modified ratio estimator and the usual ratio estimator are compared and the regions are abtained in which the modified ratio estimator has less absolute bias than the usual ratio estimator.

60. Estimation of Production of Hides and Skins Using Random Sampling Technique

By J. S. Maini & B. B. P. S. Goel

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

At present the estimates of annual production of hides and skins available in the country are those obtained from the market surveys conducted sometime back by the Directorate of Marketing and Inspection of the Ministry of Agriculture and Irrigation, Government of India. These estimates are based on the data on the number of hides and skins of animals slaughtered in registered slaughter houses. information collected from market surveys on the number of animals slaughtered privately and those fallen and dead. The data in respect of the later past were neither based on an

objective enquiry nor on a representative sample of households and butchers selected for the purpose. Thus the estimates given by the Directorate of Marketing and Inspection cannot be considered to be reliable and would not be suitable for formulation of various policies relating to the production and disposal of hides and skins etc. With a view to evolve a suitable sampling methodology for estimation of production of hides and skins the Institute conducted a pilot sample survey in 4 districts of Punjab *viz*; Amritsar, Ferozepur. Jullundur and Ludhiana during 1974-76. The sample size was 140 villages (30-40 villages per districts) and data were collected from 40 households in each selected village. The survey was the first of its kind. The estimate of number of skins from sheep and goats in the area covered was 2.97 lakh with a S.E. of 3.1 per cent. The important finding of the study was that over 80 per cent of the total production of skins was accounted for by registered slaughtered houses and of the remaining 20 per cent, the major contribution was from butchers. It is interesting to note that both households as also *chamars* contributed only 6 per cent of the total production of skins. The number of hides from fallen or dead cattle and buffaloes during the year was estimated at 2.41 lakh with a standard error of 4.9 per cent. It was thus observed that the sampling technique and sample size as adopted in the survey was adequate to obtain estimates of hides and skins with a good precision, the S.E. being less than 5 per cent.

This technique will be tested in other areas. After the methodology has been standardized the same will be passed on to the states for adoption.

61. **Cost of maintenance of Birds and Cost per egg in Commercial Poultry Farms of different categories.**

By U. G. Nadkarni, L. B. S. Somayazula, and T. B. Jain
I. A. S. R. I. New Delhi

The cost of production studies carried out in selected areas of Punjab and Delhi by the Indian Agricultural Statistics Research Institute provided the data for a comparative study of cost structure in different categories of commercial poultry farms.

The four caregories of poultry farmers were individuals and those with membership of cooperative societies in the rural and urban areas. It was found that of the selected eommercial poultry farmers in Punjab, 69 percent in rural area and 16 percent in urban area had membership of cooperative society. Whereas in Delhi the corresponding percentages were 13 and 2.

In both the States cost of maintenance of birds and cost per egg were found to be more in the individual farms than in the farms

with membeaship of cooperative societies. Similarly, the commercial poultry formers in the rural area incurred more costs than in those on the urban side. The paper further discusses quantitatively various comparisons in the cost structures over different categories of farmers.

62. Study of Labour Utilisation in Crop Production in Rural Area of Delhi.

By R.K. Pandey & H.B. Choudhry

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

Introduction of new technology in agriculture has provided scope for taking many short duration crops. This has resulted into the generation of additional employment for the labour force as well as additional income to the farmers. At occasions farmers experience labour shortage while some times there is a problem of providing jobs to the surplus labour. For better crop planning the knowledge of requirement of labour and its relationship with intensity of cropping is important. The objectives of this study are to examine the crop-wise labour utilisation and to study the impact of cropping intensity and related variables on labour use. Multiple regression techniques have been used to examine the relationship.

The data of the servey for studying the benefits of cost analysis of Tubewell irrigation in Najafgarh black of Delhi during 1976 have been utilised. Twelve villages were randomly selected from the Total Noumber of villages in Najafgarh block and from each village 24 cultivators were selected randomly for detailed study. Data regarding secio-economic conditions, Crop-wise operational holding size, crop production and disposal and other input data including the labour utilised in each operation for both family and hired labour were collected for detailed study. Study was made for small, medium and large holdings Total labour use was also analysed for all the holdings pooled together for different seasons. In multiple regression analysis, the dependent variable was labour utilisation of the farms while the independent variables were, cropping intensity, size of holdings.