ABSTRACTS OF PAPERS

1. On the Use of Design of Experiments in the Cluster Sampling

B.S. Bhullar and B.S. Arora

Punjab Agricultural University, Ludhiana

In the present study, an attempt has been made to carry out the analysis of cluster sampling by applying the standard technique of split-plot design. The main assumption was that a sample of 'n' clusters, each having M units (a multiple of number of investigations assigned) was selected from a population of N clusters. Each of the 't' investigators was asked to collect the data on an equal number 'r' of units in each of the selected clusters. Under this situation, the cluster sampling had a direct correspondence with the split-plot design with 'n' main plots, 't' sub-plots and 'r' replications.

An unbiased estimator for the population mean and its variance was obtained. Analysis of variance was used to test the significance of cluster effects, investigator's bias and the interaction between investigations and clusters. The expectations of various mean sum of squares were also derived. An empirical study with the data pertaining to crop cutting experiments of the paddy crop for the year 1991-92 was undertaken to actually carryout the analysis of the cluster sampling with the help of split-plot design. The cluster effects were found to have significantly different effects whereas the investigator effects and the interaction between the investigators and the clusters were found not to be significantly different.

2. Comparison of Some Biased Estimators with Least Squares in Linear Regression Analysis

U.C. Jaiswal

CCS Haryana Agricultural University, Hissar

Least squares method yields unbiased and minimum variance estimates of regression coefficients in multiple linear regression analysis, but under certain assumptions. Unfortunately, a serious problem arises when there exists a near-linear dependency or multicollinearity among the set of explanatory variables. In the presence of multicollinearity least squares estimators tend to unstable and have large variances. In such situation it is desirable to estimate the parameters by some alternative method which is less sensitive to

multicollinearity. In the present investigation, a comparison has been made between ridge regression, latent root regression and ordinary least squares with the help of live data. Results reveal that ridge regression method is as good as OLS with equal mean square error and negligible loss in R^2. Latent root regression method is slightly worse than either of the two with negligible increase in mean square error and very little loss in R^2.

3. A Note on Constructing a Class of Neighbour Designs

N.K. Chaure
RARS, Sarkanda, Bilaspur

Rees (1967) introduced the concept of neighbour designs which are of use mainly in Serology but one can use it for animal husbandry experiments too. In this paper author has described two methods for constructing a class of neighbour designs through arranging the treatments systematically in the initial blocks for any odd number of treatments $v = 2t + 1$, t, a positive integer and let v^* be any odd, then we can construct a series of complete block neighbour designs for any even number of treatments $v = v^* + 1$.

4. A Correlated Random Model of the $GI^{Xn}/G/\infty$ System with Vacation

S.S. Mishra and N.K. Pandey
Dr. R.M.L. Avadh University, Faizabad

Previous works, in this series, concentrated on the study of such queuing models which did not consider vacation. Also, these works did not attempt to discuss randomly correlated model which are of high potential in the fields of communication system, computer networks and inventory system etc. Present paper introduces the concept of vacation in the $GI^{Xn}/G/\infty$ system in which rates of busy and vacationing of servers are randomly correlated. Various important and useful theorems and lemmas have been established in explicit form which are believed to be quite new and finally particular cases of the model have also been discussed.

5. Genetic Parameters of Fitness Characters in Jamuna Pari and Black Bengal Goats

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

Procedure for estimating genetic parameters of fitness traits having only two categories has been explained with the help of data on Jamuna Pari and Black Bengal goats. Studies revealed that stayability characters are highly heritable for Jamuna Pari and not heritable in respect of Black Bengal breed. Investigations have also shown that there is high rate of multiple births in Black Bengal as compared to Jamuna Pari goats. Stayability is higher in respect of both the sexes for Jamuna Pari as compared to Black Bengal. It is also observed that stayability for male animals in both the breeds is more than females which may be due to higher mortality rate in female kids.

6. Effect of Sample Size and Structure on the Bootstrap Estimate of Variance of Heritability

S.D. Wahi and N. Okendro Singh
IASRI, New Delhi

The bootstrap estimates of heritability using half-sib analysis was obtained by drawing samples of size - 200, 500 and 800 for different family structures to study their effect on the variance estimate. It was found that stable bootstrap estimate of standard error of heritability required about 200 bootstrap replications for low heritability except for small sample size 200 for which at least 400 bootstrap replications were required. The optimum family size and structure for low heritability was 10 sires and 50 progenies per sire. The optimum number of bootstrap replication required to get the stable estimate of standard error of moderate and heritability was 200 for all sample sizes. The optimum sample size and structure for getting the accurate estimate of standard error of heritability were 25 sires and 20 progenies per sire and 40 sires and 10 progenies per sire for moderate and high heritability respectively.

7. Power of a Mixed Model ANOVA Test Procedure for Nested Classification with Unequal Sub-class Numbers : A Theoretical Investigation

S.R.J. Singh and S.S. Gautam[1]
College of Agriculture, Rewa

A test procedure based on two preliminary tests of significance for a mixed model analysis of variance of three level nested classification with unequal subclass numbers was developed by Kripa Shankar (1990). In this paper, integral expression for power components and the series formulae for different power components of the above test procedure are derived.

1   Chitrakoot Gramoday Vishwavidyalaya, Chitrakoot

8. Some Aspects of Statistical Design for Planting System of Guava

S.R.J. Singh
College of Agriculture, Rewa

Guava (Psidium guajava L.) the apple of the tropics, is one of the most common fruits of horticulture crops in India. Some aspects of statistical design for planting system as square system, single hedge row system, double hedge row system, paired planting and cluster system were made in eight years with old guava variety 'Sardar' during the experimental period 1996-97 at Regional Research Station, College of Agriculture, Rewa, M.P. for yield and economic return. Results of the study revealed that the number of fruits/plot was significant while, number of fruits/plants was non-significant. Maximum number of fruits/plot (7496.95) was obtained in double hedge row planting system, whereas minimum fruits/plot (4213.79) was obtained in square planting system. Average yield/plant and yield/plot differed significantly with different testaments. Slight inconsistency in the estimates of yield attributes was observed in five planting systems. Single hedge row and cluster system of planting prove more or less similar information regarding growth parameters while double hedge row system of planting is though equally efficient for higher yield, ultimately resulted in maximum return.

9. A Window Based Application for Estimation of Multi-trait Selection Index

V. Geethalakshmi, J. Jayasankar and B.P. Kushwaha
CSWRI, Avikanagar

Selection index method is finding increasing use in recent years because of relative ease in its calculation with high-speed computers. Traits, which are to be improved, are considered for incorporation in the selection index after they are appropriately weighted depending on their economic values, heritabilities and genetic and phenotypic correlations among them. Multi-trait selection is used when more than one trait is to be selected simultaneously. The need for a ready-to-use package was felt by the breeders of Central Sheep and Wool Research Institute, Avikanagar for selection of breeding rams for more than one trait at a time. Hence a Window-based computer application was developed and data on Avivastra sheep was used for calculating the selection indices.

10. Yield Maximization of a System of Cropping by Optimum Combination of Input Use

Ajit Kaur Bhatia
IASRI, New Delhi

To maximize the yield and profit from a given system of cropping by optimum combination of input use and crop management, an experiment was conducted on a fixed experimental site since 1993-94 at Bhubaneswar with rice-rice cropping system. The treatments adopted are different combinations of 3 levels of chemical fertilizers (F) - 100, 125 and 150%, 2 levels of manure (M) - 0 and 10 t FYM/ha and 2 levels of plant population (P) - 100 and 125%. The results pooled over years indicated that maximum yield can be obtained with 25% increase in recommended fertilizer, 10 t FYM/ha and 25% increase in plant population.

11. Evaluation of Relationship Between Two Rice Varieties

Rajinder Kaur
IASRI, New Delhi

Crop performance depends on the variety used which must be controlled by the researcher. In long term experiments, it is necessary that variety which if not possible to keep same for the whole duration it should be kept same

for at least 3 consecutive years. In this study a case where the change in variety has been observed even between replications is undertaken to see whether the effect of treatments on yield is same for two varieties or not and whether the regression coefficient in the linear relationship between grain yield and other auxiliary characters are the same for two varieties or not. The results indicated the similar performance of both the varieties.

12. On Balancing in Repeated Measurement Designs

Manjit Singh Virk and Amrit Kaur Mahal
Punjab Agricultural University, Ludhiana

An introspection of different balancing criteria in Repeated Measurement Designs (RMD) was carried out. It was observed that in designs balanced according to Hedayat and Afsarinejad, all the elementary contrasts of direct effects and first order residual effects are not estimated with the same variance. On the other hand, in designs satisfying the definition of balancing in RMD by Patterson all the elementary contrasts of direct effects and first order residual effects are estimated with the same variance. It was further observed that the 7th condition given by Patterson for defining balanced RMD was not required as the remaining six conditions are sufficient for defining a balanced RMD.

13. Operation Flood : A Moment of Celebration But...

R.K. Shukla
NCAER, New Delhi

On the whole, the functioning of cooperatives was found satisfactory. However, members felt that animal health care services, particularly artificial insemination facilities at DCS level, and supply of balanced cattle feed were the areas that needed further improvement through updating the existing infrastructure at grassroots level and effective use of extension services.

Non-members who did not wish to join the cooperative bandwagon, accounting for about 14 per cent, ascribed their action to a host of reasons such as the existence of a better alternative, unfair functioning of DCs and social/caste factors. Since the so called "better alternative" was open to members who had been attracted by it, NCAER surveys concluded that this was due to the poor economic status of these households which should be kept in view while developing future strategies to bring in a greater number of such households under the cooperative fold.

14. A Statistical Investigation on the Long-term Effect of Fertilizers on Productivity of Cereal Crop Sequences

V. K. Sharma and Rajinder Kaur
IASRI, New Delhi

The study utilizes the data of Akola Centre from 1984-85 to 1997-98 of the permanent plot experiment on integrated nutrient supply system in cereal based crop sequences being conducted by the PDCSR, Modipuram. The experiment has 12 treatments of fertilizers in combination with organic manures. The design adopted is randomized complete block design with 4 replications. At Akola Centre, sorghum-wheat crop sequence is included in the experiment. Analysis of variance indicated that treatment T6 (50% recommended NPK dose through fertilizers + 50% N through compost/FYM/Gobar gas slurry in the kharif season and 100% recommended NPK dose through fertilizers in the rabi season) is the most appropriate choice for obtaining the highest grain yield of the sequence. Long term effect of treatments was studied by regressing yield on polynomials of appropriate degree in time along with other variables viz. date of sowing, amount of rainfall during the crop season and number of fallow days before sowing of the crop. The yield of wheat under the treatment T6 showed maximum rate of linear increase over the years whereas this treatment showed no definite trend in the yield of sorghum. To determine economically optimal fertilization practice an unbiased estimator of the mean returns over the fertilizer cost from both the crops at constant prices has been proposed under a specific error structure. The variance of this estimator has been given along with the unbiased estimator of the variance. The application of methodology suggested that under the considered price structure, maximum returns of Rs. 17,187/- per hectare per annum can be realized from the treatment T5 (100% recommended NPK dose through fertilizers in kharif as well as in rabi season) with a coefficient of variation of 12.2%.

15. Identification of Dominant Traits for Plant Growth Using Multivariate Statistical Procedures

G.R. Maruthi Sankar, D. Narasimha Murthy and M. Vanaja
CRIDA, Hyderabad

Different traits contribute to plant growth in different magnitudes and directions. A statistical assessment has been made to identify most dominant traits for sunflower crop growth using different multivariate statistical procedures. The data of 8 different plant traits viz., stomatal conductance, photosynthesis, leaf nitrogen, stem nitrogen, leaf weight, stem weight, leaf

number and leaf area observed at vegetative (30 days after sowing), flowering (45 days after sowing) and seed formation stages (60 days after sowing) have been examined for 7 genotypes of sunflower grown during kharif 1997 and 1998 under rainfed conditions in an alfisol. The different statistical procedures explored for identification of dominant traits for plant growth are based on (a) an analysis of variance of traits; (b) correlation analysis of traits; (c) rank analysis of performance of traits; (d) principal component analysis of traits; (e) regression analysis for prediction of traits at seed formation stage through the values as observed at vegetative and flowering stages; and (f) genotype × trait mapping analysis based on magnitude and direction of loadings of traits. Based on the study, leaf area, stem weight, leaf weight and stomatal conductance were found to be dominant for sunflower grown under rainfed alfisols.

16. Autoregressive Integrated Moving Average (ARIMA) Modeling for Monthly Potato Prices in Bangladesh

Md. Ruhul Amin and M.A. Razzaque
University of Rajshahi, Rajshahi 6205, Bangladesh

This study is an attempt to construct a single equation autoregressive integrated moving average (ARIMA) model including seasonal behaviour of wholesale potato price (Y_t) in Bangladesh. Since the condition of ARIMA modeling is a stationary time series data either in original form or after one or more differencing, so we first tested the stationarity of our data series using graphical representation, correlogram analysis and unit root test. Completing identification of the nature of data we constructed a single equation ARIMA model forn Y_t after the necessary diagnostic checks. Further, we made forecasts for nine future points by using the derived model and the forecasted values are analysed.

17. Modifying Ratio Estimator by Location Shift

Sunil Kumar, B.V.S. Sisodia and P. Singh[1]
N.D. University of Agriculture & Technology, Faizabad

It is well known that the usual ratio estimator turns out to be almost unbiased estimator when regression line of study variate (y) on size variable (x) is linear and passing through the origin (or the absolute value of the intercept is close to zero). When such a size variable is not available, a location shift is suggested to get a modified unbiased ratio estimator in the present paper. The modified unbiased ratio estimator is compared with other similar estimators

available in literature and it has been found that this provides appreciable gain in precision in most of the situations.

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1   U.P. College, Varanasi

18. Analysis of Trend, Growth and Technological Impact on Oilseeds Production in Uttar Pradesh

B.V.S. Sisodia, Anupam Singh and Sunil Kumar
N.D. University of Agriculture & Technology, Faizabad

One of the major components of Indian Food-stuff is oilseeds which are rich sources of protein and fat essential for balance diet of the people. India holds a premier position in the global oilseeds scenario accounting for about 19 per cent of the total area and 9 per cent of total production in the world. The oilseeds yearly contribute about 11 per cent towards national economy. The oilseeds are generally raised in almost all parts of the country but major producing states are Gujarat, Andhra Pradesh, Rajasthan, Maharashtra, Karnataka and Madhya Pradesh accounting for 73 and 70 per cent respectively of total area and production in the country.

Uttar Pradesh is the most populous State in the country accounting for 7.39 and 7.10 per cent of the total oilseeds area and production respectively in the country during the year 1997-98. The rapeseed & mustard and groundnut are major oilseeds crops of the State. The rapeseed & mustard in the State accounts for 20.87 and 21.12 per cent of its total area and production in the country during 1997-98. The oilseeds scenario in general has changed recently in India due to continuous efforts made by Technology Mission on Oilseeds (TMO) since during May, 1986. An attempt has been made in the present article to analyse the scenario of oilseeds production in Uttar Pradesh in terms of growth and technological impact in view of TMO.

19. Web-enabled Data Dissemination from Primary Stage Units in Agriculture Sector

L.R. Yadav
National Informatics Centre, Lucknow

The advent of Information Technology (IT) has redefined the fundamentals and has the potential to change the institutions as well as the mechanisms of delivery of services forever. The objective of Electronic Governance (EG) goes far beyond than mere computerization of standalone back office operations. This

paper discusses about existing Government Statistical System, IT infrastructure in U.P. In government the flow of information is generally from Village/Gram Sabha to CDB/Tehsil, CDB/Tehsil to District, District to Division, Division to State and State to National level and vice-versa. The most important annual publication of Planning Department at district/division level is SP. This contains information on more than 4000 parameters at CDB, District (Total/Rural/Urban), Town and Division levels on the 17 sectors of economy. Village level information is maintained in the CDB since the year 1973.

Visualising to create databases at different levels of administration computerization of SP along with village level information was initiated jointly by NICUPSU and Planning Department, GOUP in the year 1993. Databases are available for the years 1994, 95, 96 and 97 and updation for the years 1998 and 99 is in progress in the districts. A web-enabled access of SP along with some queries can be done from any node of INTERNET after its release with the web-site of Planning Department.

20. A Study of Rainfall Data at CRS, Masodha (UP)

Bhim Singh and M.K. Sharma
NDUAT, Faizabad

A study was conducted on rainfall data of 25 years (1975-99) at CRS, Masodha, NDUAT, Faizabad. The study includes the characteristics and variation in rainfall with weekly, monthly and annual at different productivity levels.

21. Statistical Analysis of Production and Resource Use in Broiler Production

S.P. Bhardwaj, R.K. Pandey and V.K. Mahajan
IASRI, New Delhi

The poultry production is increasing at a very fast rate. The present study was undertaken in Ambala district of Haryana to examine the resource use efficiency and constraints in broiler production.

The result of production function indicates that in case of broiler production quantity of feed and labour together could influence the output level significantly. Study indicates that quantity of feed remained the only factor which has direct bearing on poultry production. It has also observed that in case of broiler farms marginal productivity of feed is very low on different

farms and it ranges between 0.004 to 0.073 farms. Whereas labour productivity farms remained less than 0.5 on all farms.

The existing and optimum level of resource use reveal that funds have to be curtailed on feed consumption on almost all farms in three seasons. The optimum level of resource use indicates that input may be enhanced on poultry farms *i.e.* funds may be diverted to labour as the existing level of labour use is significantly low. The study indicates that poultry showed a high and positive marginal product of labour. This can provide more opportunities of employment. The constraints faced by the poultry producers are :

(a) Non-availability of good quality one day old chicks and cheap health care facilities.

(b) Farmers have to go a long distance to purchase inputs.

(c) Institutional credit facilities are not easily available and farmers have to depend on contractors for their bulk sale of poultry products.

22. Assessment of Performance of Design Strategy

Jagbir Singh and H.V.L. Bathla
IASRI, New Delhi

The design effect (deff) sometimes also called a binomial factor is a measure which is used to assess the overall performance of the design strategy as compared to the simple random sampling. While estimating the percentage foodgrain losses along with the variances thereof at the stages of harvest, threshing and storage and for total loss at farm level, the design effects and the respective effective sample sizes of the sampling design used in an IASRI project have been obtained by Projective Geometry Approach. Also for estimating the percentage foodgrain losses at the above mentioned stages due to different causal factors, the sample sizes at specified levels of precision (δ, say) in terms of percentage standard error permissible in the estimator have been estimated in respect of psu, only.

23. Nonparametric Trend Analysis

C.T. Jose
*Central Plantation Crops Research Institute, Regional Station,
Vittal-574 243*

The use of nonparametric techniques has a long tradition in time series analysis. Running mean, a very simple type of smoother has been used since

the early 1900's for determining trends is time series. The increased data availability and the explosion of computing power have made it possible to use a wide range of other modern nonparametric techniques in time series analysis recently. The nonparametric estimation of trend and growth rate has been discussed in this paper. Kernel weighted linear regression method has been proposed to estimate the trend and growth rate nonparametrically. The method is applied to the data of area, production and productivity of arecanut in India.

24. Resampling Procedures in Survey Sampling - An Emperical Study

V.P.N. Singh, Anil Rai and V.K. Jain
IASRI, New Delhi

In the present study trivariate normal population of size 5000 has been generated and is divided into 5 strata each of size 1000 on the basis of increasing order of the one of the auxiliary variable. Five independent univariate populations each of size 1000 (strata wise) have been generated following uniform, gamma and beta distribution of size 5000 each. Then two hundred samples of sizes 25, 50, 75 and 100 respectively have been selected with the help of designs D_1 (self weighting design), D_2, D_3, D_4 and D_5 (probability proportional to size) and (U-shaped designs, *i.e.* balanced type of sampling design). It can be observed that in case of self weighting designs, although all the estimators are almost unbiased for estimation of mean irrespective of sample size, sampling designs and type of population but the performance of BRR and TSL found to be superior. Further the % bias of JRR method in case of estimation of mean is highest irrespective of sample size, sampling design and type of population. The coefficient of variance in this case is least for JRR followed by GRPS irrespective of sample size, sampling designs and type of population. Also the % bias and CV decreases as there is increase in the sample size for different estimators. The distribution of mean is almost symmetrical and mesokurtic for all the cases.

In case of estimation of variance of the parameter of interest *i.e.* population mean, it is found that the performance in terms of % bias is comparable for BRR & TSL method whereas the GRPS performs poorly in most of the cases. It has been also observed that the % bias of GRPS technique increases by increasing sample size while estimating variance of sample mean. This trend clearly indicates towards inconsistency of this variance estimator. Further, % bias of all the estimators considered in this investigation increases as design effect increases. In terms of coefficient of variance JRR technique followed

by GRPS performs better irrespective of type of population. Further, it has been also observed that performance of TSL detoriates as design effect increases for estimating variance of sample mean. The BRR & TSL variance estimators of sample mean are not found to be symmetrical and mesokurtic in all the cases.

In case of non-linear statistics the JRR method is found to be superior in terms of % bias for estimation of regression coefficient and correlation coefficient whereas in case of estimation of ratios BRR has an edge over other techniques. Although in case of self-weighting designs all the methods are equally good. The possible reason of superiority of BRR in case of estimation of ratio is the lesser extent of non-linearity due to clubbing the adjoining units of the parent sample to get two units per strata.

With the obvious reason the performance of TSL is worst while estimation of non-linear statistics. In terms of CV the performance of JRR is better than other techniques with few exceptions in case of U-shaped allocation. Bias and CV decreases by increasing sample sizes and increases by increasing designs effects.

In case of estimation of variance of non-linear statistics *i.e.*, ratio, regression and correlation coefficient, it has been observed that JRR & GRPS are found to be superior in terms of % bias than other techniques in all situations except in case of self weighting designs where the performance of BRR is better. In terms of CV, *i.e.* stability, JRR & GRPS are performing better than the other variance estimators. Further CV decreases as sample size increases. The JRR is almost symmetrical and mesokurtic whereas other methods are generally positively skewed and leptokurtic.

25. Preliminary Test Estimator of Average Life for Exponential Population Based on Unbiased Estimators

V.N. Rai
NDUAT, Faizabad

The paper presents a method of estimating the average life based on unbiased estimators using preliminary test of significance for time censored data. The bias and mean square error of the proposed estimator have been discussed. The procedure is explained by an empirical example.

26. Comparison of Usual Systematic and Modified Systematic Sampling for Estimation of Lactation Yield of Crossbred Cows

Shiv Prasad, Ram Karan Singh[1] and Rajendra Singh
Indian Veterinary Research Institute, Izatnagar

The data on daily milk yields of 35 first lactating 5/8 Holstein Friesian cows were used to study the comparative performance of two sampling procedures viz. usual systematic sampling and modified systematic sampling for estimation of lactation milk yield of crossbred cows. The sampling was done at sampling intervals of 7, 14 and 28 days with different starting days. The systematic sampling estimates presented higher percentage of actual lactation yield with lower error of estimation than modified systematic sampling irrespective of sampling interval and starting day. The average absolute errors and average per cent absolute errors (APAE) corresponding to systematic sampling were also smaller than modified systematic sampling and in no case APAE exceeded 2.5%. Therefore, usual systematic sampling should be preferred to modified systematic sampling for estimation of lactation milk yield of crossbred cows.

1   Lucknow University, Lucknow

27. Yield Gap Analysis Using Path Coefficient Technique

Satya Pal, R.M. Sood, T. Rai and A.K. Gupta
IASRI, New Delhi

The aim of the present study is to the effect of feed intake, housing conditions and other management practices on yield gap. The secondary data of the survey conducted during May 1983 to October 1984 under the village conditions of Gurgaon district of Haryana State are utilized. The statistical procedure viz. Path coefficient analysis is used to identify factors and also to estimate the contribution of each factor to the gap. During the period of the survey the milking buffaloes are fed green in the form of chopped grass, berseem, jowar, guar, bajra etc. and dry fodder as bajra karby, jowar karby and wheat bhoosa. Besides these maintenance ration, concentrates are also given as production ration which are crushed wheat, crushed jowar, crushed gram, wheat floor, cotton seed, mustard cake, methi, bajra and gram churi. To enrich these feeds guar is also fed as a supplement. The parameters under the management practices are of qualitative nature. These parameters are floor condition, stall condition, feeding practices and housing conditions. Path

coefficient analysis revealed that the direct effect of green and concentrate on milk yield is positive whereas dry feed fed to the animal contributed negative towards milk yield. The overall direct effect of green is 0.1276, that of concentrates is 0.6534 but the effect of concentrate on milk yield is positive whereas the dry feed fed to the animal contributed negative towards milk yield. The overall direct effect of green is 0.1276, that of concentrate is 0.6534 but the effect of dry fodder is − 0.0222. All these factors together account for 52.19% variation in milk yield. This technique is further employed on the same data set in which the nutritive values of the feed fed to buffaloes are computed in terms of DCP, TDN and DNN and are replaced for feed consumption along with the other included feeds. DCP contribute 0.6387 to the maximum towards milk yield. The contribution of TDN other than DCP is found to be negative indicating that increase in it may have adverse effect on milk yield. All these variables explained together about 47.93% of variation in it.

28. Effect of Fertilizer and Insecticides & Pesticides on the Yield of Vegetables

A.K. Gupta, A.K. Mogha and Satya Pal
IASRI, New Delhi

The study is based on the data pertaining to the cost of cultivation studies under the project 'Pilot Sample Survey for Estimation of Losses, Price Spread at Various Stages of Marketing and Cost of Cultivation of Vegetable Crops, Pune (Maharashtra) conducted by the Indian Agricultural Statistics Research Institute, New Delhi during 1986-88. Regression coefficients for different input components have been estimated by using the least square method. Statistical package PCCARP is used for statistical analysis. Linear and double-log models have been fitted to the data for yield and two input variables namely; fertilizer and insecticides and pesticides to study the functional relationship on the yield of the vegetable crops cauli-flower, lady's finger and onion. Double-log model has been confined to be the best fit on the yield and two input components of the vegetable crops under study for the years 1986 and 1987. The effect of changing levels of fertilizer and insecticides and pesticides has been studied on the yield of vegetables under study. From the study, it is observed that fertilizer and insecticides and pesticides have the significant effect on the yield of cauli-flower and lady's finger. However, the effect of these inputs is not observed significant on the yield of onion except fertilizer in 1986 only. The estimates of elasticity were observed positive and significant for cauli-flower and lady's finger in both the years under study. It implies that a positive response on the yield of cauli-flower and lady's finger would be expected to the changing

levels of fertilizer and insecticides and pesticides. It indicates that with an increase in fertilizer and insecticides and pesticides separately, an increase in the yield of vegetable crops is expected under the normal conditions.

29. Strategies for Assessing the Incidence of Pests and Diseases on Coconut and Resulting Yield Loss

K. Muralidharan
CPCRI, Kasaragod

The sampling design adopted for a survey on the incidence and yield loss due to eriophyid mite on coconut conducted in Alappuzha district of Kerala is described. The estimator for per cent incidence of mite and resulting loss of yield were worked out. Some of the distinct features of the coconut plantations in state were discussed in this context. The experience from this survey suggests that it is always rewarding to follow a well-suited design and state the estimators at the beginning itself. Often, construction of the estimators will not be a problem but expression for the variance is not so. This makes the research workers to ignore the standard error of the estimates in many surveys. It may be possible to make realistic approximation to the standard error in many situations.

30. Impact of Technological Development on Food Grain Production

V.K. Singh, B.V.S. Sisodia and Ravinder Singh
NDUAT, Faizabad

No doubt that the State of Uttar Pradesh has made significant achievement in the agricultural production of the country. However, the State as well as the country will require continuing high growth rate of agricultural production in general and food grain production in particular to feed the over increasing months every year in the country. The Uttar Pradesh has been divided into five regions namely, the Eastern, Western, Central, Bundelkhand and Hilly regions. The main objectives of the study are the technological development of food grain production.

The entire period under the investigation was divided into two periods, Period-I : green revolution period (1965-66 to 1979-80) and Period II : post green revolution period (1980-81 to 1992-93). The technological changes have been investigated for food grain production by fitting the production function model. The model was fitted separately for period I and II examine whether

there has been any technological change in the production process of food grain during these two periods in different regions of the State and in the State as a whole.

The overall results of tables revealed that there has been a significant technological impact over time on the food grain production process in different regions during both periods except in Bundelkhand region and Eastern region and in the entire State where technological impact was not significant during period I. The land under the food grain crop has also contributed significantly towards food grain production during both periods in Western, Bundelkhand, Eastern regions and also in the entire State as well. Bundelkhand was the only region where significant structural changes in the food grain production process was observed between two periods.

31. Effect of Multicollinearity on Least Square Methods in Case of Two-stage Sampling Design

Y.K. Sharma and S.S. Verma
DIPAS, Delhi

In case of two-stage sampling, clusters used in sampling design almost always exhibit some degree of homogeneity with respect to variable under study. As variables under study are always dependent or correlated with the explanatory variable, therefore some amount of homogeneity or collinearity will be present in the explanatory variables. Therefore the aim of this study is to see the effect of multicollinearity on estimated regression coefficients in case of survey data. It has been observed that in a situation where matrix x of explanatory variable can be partitioned into sub matrix .. and .. such that ... is known by some previous study. The estimator of regression coefficient is unbiased in this situation and variance of the regression coefficient increases by a factor and the variance has to be adjusted by that factor.

32. Changes in Rice Production System in Eastern India and Their Implications

H.N. Singh, Abha Singh, V.K. Singh[1] and B.V.S. Sisodia[1]
IRRI-Liaison Office for India, New Delhi

In eastern Uttar Pradesh, rice grown on 2.90 million hectare area with low average productivity as compared to western Uttar Pradesh. Rice area increased manifold between 1970-80 to 1999 in Eastern Plain Zone (EPZ), North Eastern Plain Zone (NEPZ) and Vindhya Zone (VZ) along with productivity.

The areas under rice-based double cropping system also increased in these zones. Increased use of irrigation and fertilizer, shortage of male-labour, better technology options, pricing policies, and market support as well as extension services led to changes in soil quality, variety and other aspects.

Strategies to efficiently exploit the rice growing potential of eastern UP, include exploitation of favourable rainfed lowland and the created irrigation potential as well as available ground water resources. There is need to explore the aromatic rice germplasm for export and the possibility of growing long-grain basmati types in place of local aromatic rice. Besides, a sound seed production program, in the highly heterogeneous and risk-prone environment of eastern UP, farmers' participation in the program planning and implementation is necessary.

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1   NDUAT, Kumarganj, Faizabad, UP

33. On Study Relating to Formulating Long-term Mechanization Strategy for Each Agro-climatic Zone/State

K.K. Tyagi, S.D. Sharma, A.K. Srivastava and H.V.L. Bathla
IASRI, New Delhi

Modernisation of Agriculture is a felt need of the day. Equally important are reduction in cost of production, maximisation of returns, reduction in the drudgery associated with various agricultural operations; and improvement in productivity of land and labour. The mechanization has been well received world over as one of the important elements of modernisation of agriculture. In India, though there has been a considerable progress of mechanization in agriculture, its spread has been in the most uneven manner. Hitherto, governmental efforts have mostly been confined to the promotion of manual and animal-drawn tools and implements. Power-drawn equipments have also gained momentum due to the concerted efforts of the government, credit institutions and the industry. No sincere efforts have, however, been made for the identification of location-specific farm implements and machines and their promotion in the respective areas.

Modernization of agriculture should not only be guided by the goal of higher returns to the farmers and to the industry, but also by its contribution to the balanced agricultural development of different regions/areas having diverse socio-economic and agro-climatic conditions. Thus, considering the expanding needs of the agricultural mechanization in the country, it has become necessary to ensure that the needs of the farmers are duly met in terms of

local needs, quantity, quality and social benefits. This can hardly be accomplished without taking definite policy measures and the strategic planning. It is in this context that the IASRI has taken up a consultancy project from the Department of Agriculture & Cooperation, Ministry of Agriculture, Government of India to study various factors which have a bearing on agricultural production/productivity in different states/agro-climatic zones, and formulate appropriate farm mechanization strategies for them.

The broader objectives of the project are to study the soil types, land topography, to study the socio-economic conditions (financial status) of the farmers and farm labourers and assess their capabilities for acquiring and adopting the needed agricultural equipment/machinery; to study the present status, ultimate potential, the gaps, highlighting critical ones; for equipment used in various agricultural operations starting right from tillage to the post-harvest operations; to study the types and utility of various agricultural equipments, both conventional and improved ones, presently in use and those needed in future, for different crops/cropping system in the zones; to study the impact of farm mechanization on employment of labour, to study the cropping pattern, both agricultural and horticultural, in the zones, yields in relation to the national average, and their growth potential; to study and assess the use of farm power per hectare, ultimate requirement, ways and means to fulfill the gaps for various farm operations; to study the infrastructural facilities for the manufacture, marketing, after sale service/ repairs availability etc. of agricultural equipment; to study and assess the adequacy and the requirement of infrastructure at the central and state levels, for planning, promotion, execution and extension of the various plan programmes on agricultural mechanization; to identify new/improved farm equipment that may be needed by the farmers during the next 20 years *i.e.* by the year 2020, for carrying out different farm operations and to formulate strategies and programmes that may be required for mechanization of agriculture during the period 2001-2005, 2005-2010, 2010-2015, 2015-2020.

The programme envisages the conduct of an in-depth study, at micro level, of the socio-economic, agro-climatic, agronomic, infrastructural and other relevant factors prevailing in different agro-climatic zones of the country, which have a bearing on the spread of agricultural mechanization, agricultural productivity therein; and formulation of appropriate long-term farm mechanization strategies for the respective zones. It is likely that for a number of zones/states, a single set of strategy/programme may not be uniformly conducive to the spread of farm mechanization and all-round and sustainable agricultural development there. As such, appropriate packages of agricultural mechanization strategies and programmes for each agro-climatic different

zones/states need to be formulated according to the present status, potential and future needs of agricultural mechanization there.

The study shall be conducted for each agro-climatic zone/state covering at least 20% of the districts representing a mix of developed, developing and least developed pockets. The basic purpose is to have complete insight of the situation and future needs in the direction of achieving full mechanization in a suitable time-frame.

The sampling design will be one of the stratified multi-stage random sampling. The strata being the agro-climatic zones/states. At present, the total number of districts in India is 585, out of which a sample of 120 districts will be selected randomly with due consideration to different strata as well as development stage following proportional allocation. From each selected district, a random sample of about 40 villages will be selected. Accordingly, the total number of selected villages will be 4,800. Out of each selected village, a sample of 10 households will be selected. Hence, the total number of randomly selected households will be 48,000. The reference year shall be the year 1999-2000.

The study has been planned in three phases, which would be implemented simultaneously. Phase-I of the study envisages organization of seminar of crystallize approach and modalities of the study and to bring out a series of status papers on topics relating to farm mechanization on the basis of existing data sources and research material already available. A workshop will be organized for deliberating/finalizing various issues etc. During phase-II, a large scale sample survey with the farm mechanization in focus has been planned. During phase-III, organization of a workshop and the final preparation of the report will be taken up.

34. Estimation of Feed, Seed and Wastage Ratios for Foodgrains

D.L. Ahuja and K.K. Tyagi
IASRI, New Delhi

The apparent use of total foodgrains produced in any country is for the purpose of human consumption, animal feed and seed requirements. Despite all possible preventive efforts, large quantities are also wasted from the time the grain is harvested till it reaches the consumer. In order to arrive at the net availability of foodgrains for human consumption, it is necessary that reliable estimates based on scientific principles are worked out. These estimates assume critical importance in the implementation of a viable food policy.

While calculating the total quantity of foodgrains available for human consumption, a netting factor of 12.5% is being used to account for feed, seed and wastages. With a total production of foodgrains, being currently estimated at 204 million tonnes, it would mean that as much as 25.50 million tonnes of foodgrains are not available for human consumption. Since the present netting factor of 12.5% is not based on any empirical data, doubts have been raised from time to time necessitating re-examination of the basis for this conventional figure.

A regional study entitled "Feed, Seed and Wastage Rates in Foodgrains" was undertaken by Dr. P.C. Bansil covering Punjab, Haryana and Western Uttar Pradesh with financial support from the Planning Commission, to undertake a survey of the region so as to arrive at reliable estimates for the three components constituting the total quantity of foodgrains being not available for human consumption. It is from this region that practically the whole of wheat and over 60% rice is available to the central pool under the procurement policy of the Central Government.

The study revealed that in 1986-87, the seed, feed and wastage ratios and their total for Punjab, Haryana, U.P. and the entire region covered under the study were (2.67, 2.72, 2.83, 8.22), (3.46, 3.79, 4.03, 11.28), (3.40, 2.91, 5.70, 12.01), (3.16, 2.40, 4.70, 10.26) and corresponding figure for 1985-86 were (2.53, 2.63, 2.68, 7.85), (3.24, 3.54, 3.37, 10.15), (3.27, 2.80, 4.06, 10.14), (3.01, 3.24, 3.53, 9.78).

The survey results for wheat showed that seed rates in 1987-88 for Punjab, Haryana and U.P. and the entire region covered under the study were (107.61, 111.84, 122.64, 114.03). Requirement of seed as % of total production for U.P., Bijnaur, Muzaffarnagar, Badaun, Moradabad, Saharanpur, Bulandshahar, Pilibhit and Rampur were found to be 5.20, 5.89, 4.73, 5.02, 6.38, 7.54, 5.61, 5.91 and 3.92 respectively and average seed required was found to be 122.64 kg/ha.

As indicated in the report, it was a pilot study and as such the results obtained cannot under any circumstances be considered as applicable to other parts of the country because of vast differences of agro-climatic and socio-economic and many other factors. They recommended that the study should be extended over other selected regions in India so as to represent the entire country. Survey should be planned so that data is collected on the basis of observation-cum-inquiry method.

For sound planning, it is of immense importance to know every year, out of the total foodgrain production, how much is available for human consumption, after deducting quantity of foodgrains required for feed fed to

animals, seed and quantity lost in storage, transportation etc. before coming to consumers. As all the three terms in reference above are percentages or ratios/rates, the methodology given in the study "A methodological study on estimation of straw to grain ratio in wheat crop" by S.K. Raheja, P.C. Mehrotra and D.L. Ahuja, can be made use of for estimation of ratios corresponding to feed, seed and wastage. In this study, straw to grain ratios for wheat crop have been estimated. Different estimators studied to provide independent estimates of the ratio are :

   (i) Conventional ratio estimator (biased) i.e. ratio of arithmetic means.

   (ii) Arithmetic mean of ratios (biased)

   (iii) Geometric mean of ratios (biased)

   (iv) Harmonic mean of ratios

   (v) The Hartley - Ross (unbiased) ratio-type estimator

It was found that arithmetic mean of ratios was consistently the most efficient one. So this estimator can be used for the above mentioned study.

An estimate of ratio is given by $\hat{R} = \dfrac{1}{n} \sum_{i=1}^{n} r_i$ where $r_i = \dfrac{y_i}{x_i}$

where y_i are the quantity of either feed, seed or wastage and x_i are the respective yields. The estimate of its variance is as given by

$$\hat{V}(\hat{R}) = \frac{1}{n(n-1)} \sum_{i=1}^{n} (r_i - \hat{R})^2$$

Once the average yield of the crop and ratios referred to above are estimated, the average seed rate can be estimated. Then total seed required can be worked out by multiplying it with the total area under the crop. Likewise quantity of feed as well as wastage can also be estimated.

Since information on seed rate and average yield is being collected and estimated regularly for all foodgrains and other important crops from all parts of India in the Yield Estimation Surveys, we can estimate the total quantity of seed required very easily and without much of additional efforts using the above methodology. Likewise, if needed, adding a few items of information in the Livestock Surveys schedules, the feed ratios can be easily estimated. Regular studies are being conducted for estimation of crop losses and utilising their results, estimate of the wastage ratios can also be obtained.

Once the above exercise is done for few years, these ratios can even be standardised. Thus the much needed estimates of foodgrains available for human consumption can be arrived at without diverting our precious resources for conducting a separate survey for estimating seed, feed and wastage ratios.

For illustration purposes, data of project entitled "Sample Survey for Study of Constraints in Transfer of Agricultural Technology under Field Conditions" for wheat crop for the year 1986-87 for Rae Bareily district of U.P. was utilised. The average Seed Rate was found to be 122.9 kg/ha and seed used as % of total production was found to be 8.1 with percentage standard error within permissible limits, which appears to be in close agreement with the results of earlier study.

35. Forecasting of Dry and Wet Spells for Agricultural Planning of Bhind District (M.P.)

V.B. Singh
College of Agriculture, Gwalior

An attempt has been made to investigate for agricultural management and planning of Bhind District of Madhya Pradesh. Markov chain model has been applied to know the probability of having different conditions of dry and wet weeks and also forward and backward accumulation of rain water suitable for crop production.

36. Unequal Probability Sampling for Two-variate Ratio Estimator

Narendra Kumar
Udai Pratap Autonomous College, Varanasi

Midzuno (1952) proposed an unequal probability sampling in which the probability of selection of samples is proportional to sum of sizes. Lahiri (1951) suggested a method of sample selection for which the ratio estimator using auxiliary variate X is unbiased. We extend the idea contained in Lahiri (1951) to the case where two auxiliary variates are available which are highly positively correlated with the study variate. We proposed an unequal probability sampling scheme under which a ratio estimator using two auxiliary variates X_1 and X_2 is unbiased. The variance of this estimator under the proposed scheme is derived.

37. Disposal Pattern of Milk in Farrukhabad District of Uttar Pradesh

Atul Chandra and S.B. Agarwal

National Dairy Research Institute, Karnal

The present study was conducted in Farrukhabad district of Uttar Pradesh with a specific objective to study the disposal pattern of milk for different category of milk producers. The data on production, consumption and disposal of milk were collected from 100 sample households of different categories of milk producers.

The average daily milk production per household was found to be 14.0 litres which ranged from 10.4 litres (landless) to 20.6 litres (large farmers). The overall marketed surplus of milk was worked out to 79.86 percent in study area. The marketed surplus of milk decreased with increase in the size of holding. Whereas milk production and its consumption per household increased with increase in size of holding.

It was further observed that the milk vendors collected the largest proportion (44.10%) of milk marketed followed by milk coopratives (41.95%), tea shops (9.66%) and consumers (4.29%). The largest percentage share of marketed surplus of milk went to milk cooperatives was from large farmers (50.59%) whereas to milk vendors it was from medium farmers (52.94%). The consumers and tea shops received the highest percentage of marketed surplus of milk from landless milk producers.