ABSTRACTS OF PAPERS*

1. A NOTE ON JIPS ESTIMATORS OF GHOSH AND GOMEZ

S. SAMPATH
Department of Statistics, Loyola College, Madras-34

Ghosh and Gomez (1986) have considered two Jackknife Interpentrating Subsample (JIPS) estimators for the population ratio $R = Y/X$. They have also proposed estimates for the bias and variance of the estimators to the second degree approximation. The estimators have been compared on the basis of the expected bias and variance by assuming an intraclass model when samples are drawn using SRSWR. In this paper the true bias and mean square error have been obtained for the JIPS estimators to the second degree approximation and some comments are also given.

2. ON CERTAIN ALTERNATIVE ESTIMATORS FOR MULTIPLE CHARACTERISTICS IN VARAYING PROBABILITY SAMPLING SCHEMES

T. J. RAO
Indian Statistical Institute, Calcutta

Bansal and Singh (1985) and Amahia, Choubey and Rao (1985) developed alternative estimators for probability proportional to size with replacement sampling scheme when some characteristics under study are poorly correlated with selection probabilities. In this paper, we extend these results to other varying probability sampling designs.

3. USE OF SAMPLE SURVEYS IN BIOLOGICAL OCEANOGRAPHY

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

Biological oceanography deals with primary productivity, phanktono-

logy, benthic biology, aquaculture, mangroves, seaweed ecology etc. Biologist arrive at the primary and secondary productivity estimates. They further select a small sample for detailed studies of congregations of bioluminescent ostacods, swarming of copepods etc. Since these are not generally based on sound sampling methodology, nothing can be said about the precision of these estimates for primary productivity etc. Two-fold stratified unistage random sampling while for further detailed studies two-fold stratified two stage random sampling designs are suggested. For studying the variability of the estimates over the occasions some plans based on successive sampling technique has also been suggested.

4. SOME CONTRIBUTION TO SUCCESSIVE SAMPLING— A CASE OF DYNAMIC POPULATION

S. S. SHASTRI, S. K. RAHEJA
I. A. S. R. I., New Delhi

The paper deals with dynamic population i.e. population structure is changeable and a typical case of matching and unmatching units on three occasions have been considered. A sample of n' units is drawn at time t_1 say $S_t(n)$ with SRS. At time t_2 the sample of n'' units is partitioned into three parts, $n_{12(m)}$ units are drawn with SRSWOR from S_{t_1} (n_{12}), n_{12u} units are drawn with SRSWOR from $N_{12}-S_{t_1}$ (n_{12}) and n_2 units are drawn with SRSWOR from N_2 units. At time t_3 the sample of n'' units is partitioned into three parts $n_{23(m)}$ units drawn with SRSWOR from S_{t_2} (n_{23}), n_{23u} units are drawn with SRS from $N_{23}-S_{t_2}$ (n_{23}) and n_3 units are drawn with SRSWOR from N_3 units. A linear estimator for the curren' occasion utilizing the entire information along with its expression foi variance has been obtained.

5. SOME CONTRIBUTION TO GRAPHICAL PRESENTATION

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

Although two/three dimensional graphs are in common use, many times the practicle situation demands the use of number of independent characters influencing the dependent variable and its graphical presentation posses a problem. The present note deals with some methods and their comparisons. To illustrate the methods, the percentage gain in efficiency of the third year's estimator based on cyclic design of third order in successive sampling has been considered. Under the scheme the efficiency of the estimator depends on $Q_j, j = 1$ to 4. Or the matching proportions M_j/n (i.e. units matched on all the three occasions, units matched on first two or first and third or second and third occasions).

6. ESTIMATION OF AREA UNDER PONDS/TANKS AND STUDY OF PISCICULTURE PRACTICES

H. V. L. BATHLA, O. P. KATHURIA and S. S. WALIA
IASRI, New Delhi

A study was undertaken in Patiala district of Punjab state for studying the prevailing practices of pisciculture and also to develop a suitable sampling methodology for estimation of area under ponds/tanks and catch from them. The estimates of average area under ponds/tanks on per village basis using Des Raj ordered estimator were obtained from four types of data collected from revenue records, at the time of visit of the enumerator, during monsoons and summer season. The estimates obtained were 1.0329 ha., 0.9564 ha., 1.0711 ha and 0.9129 ha. respectively with corresponding per cent standard errors as 8.90. 9.49, 8.57 and 9.74. About 39% of the ponds selected in the sample were of size less than 0.30 ha. and the remaining of bigger size 84% of the ponds/tanks were exploited and area per pond/tank in this case was 0.83 ha. The survey revealed that about 88% of the ponds/tanks were perennial in nature and the remaining seasonal. 98% of the ponds had depth less than or equal to 2 meters at the time of visit. 76% of the ponds were used mainly for fish cultivation, while 6.66% were used mainly for other purposes but also used for fish cultivation. 12% of the ponds were not used for fish cultivation at all. It was observed that 86.7% of the ponds had no floating weeds, 9.3% had less than 25% of the area under floating weeds while only 4% of the ponds had more than 25% of the area under floating weeds. In 36.8% of the ponds lack of capital was the reason for non-utilisation of ponds/tanks while in 26.32% of the ponds/tanks weed trouble was the reason for non-utilisation. In 60% of the ponds mustard oil cake was not used at all while in 26.67% ponds mustard oil cake used was less than 0.5 kg. daily. Only in 13% ponds mustard oil cake used was more than 0.5 kg. daily. Similarly in 32% of the ponds rice bran was not used at all while in 25.33% less than 0.5% kg. was used. In 16% of the ponds rice bran used was from 0.5 kg. to 1.5 kg. and in about 15% ponds it was from 1.5 kg. to 2.5 kg.

7. ESTIMATION OF FISH CATCH FROM A RESERVOIR

H. V. L. BATHLA, O. P. KATHURIA and K. K. KHER
IASRI, New Delhi

Periodical records of the fish produced from the reservoir are generally maintained by the State departments of Fisheries. The authenticity and completeness of these records may however be doubtful which may give

rise to non-sampling errors. By recording of catch on a sample of days by following a suitable sampling design and by ensuring strict supervision over the recording of catch data it may be possible to control the non-sampling errors.

In the present study, the date-wise fish catch data collected from the cooperative society records of Budhabudhiani reservoir (a minor reservoir) in Puri district of Orissa state for the years 1981-1985 have been utilised to examine the feasibility of estimating the fish catch with a reasonable degree of precision by following alternative sampling procedures. The total number of netting days in different years was 60, 86, 94, 118 and 190 respectively showing an increasing trend. The average fish catch per day in different years was 4.55, 5.08, 4.49, 2.80 and 4.01 kg. respectively. The standard deviation for mean catch varied from 6.61 in 1984 to 13.94 in 1983. The coefficient of variation in different years varied from 50.06 to 113.49. The days on which netting is done are not known in advance, therefore, a simple random sample of 35 days was taken from all the days in a year irrespective of whether the netting was done or not on a day. This procedure when repeated five times in each year revealed that in a sample of 35 days the actual number of netting days were 4 to 6 in 1981, 7 to 8 in 1982, 6 to 9 in 1983, 11 to 13 in 1984 and 18 to 23 in 1985. The estimates of mean fish catch in kg. per day obtained in different years were 3.51, 4.14, 4.07. 2 91 and 4.38 with corresponding per cent standard errors 37.52, 33.51, 34.66, 25.81 and 17.35 respectively. Alternative sampling procedures for estimating the mean catch per day have been tried and estimates alongwith their per cent standard errors calculated. Relative efficiency of these procedures have also been obtained.

8. SIMULTANEOUS ESTIMATION OF YIELD AND YIELD STABILITY

G. S. V. SUBRAHMANYAM
CTRI, Rajahmundry

Stability parameters such as environmental variance, ecovalence, coefficient of regression, deviation mean square from regression, mean rank difference and variance of ranks are correlated with yield. The indices and non-parametric methods proposed by HUHN (1979) show considerable and nearly equivalent correlation to yield and yield stability measures. An example on tobacco is discussed.

9. ON COST OF CULTIVATION OF GRAM IN VIDISHA DISTRICT

V. K. JAIN, A. K. BANERJEE and O. P. KATHURIA
IASRI, New Delhi

Of the various pulse crops gram is the most important crop in India. It accounts for about 34 per cent of area and 46 per cent of production of all the pulses. India grows gram on about eight million hectares and produces about six million tonnes per year. It is known that for the past few years the area and production of pulses have virtually remained constant which in turn has pushed upward the prices of these crops. It is in this context that an attempt has been made to work out the cost of cultivation of gram in Vidisha district where currently the Indian Agricultural Statistics Research Institute is conducting study of cost of cultivation of oilseeds and pulses. For working out the cost of cultivation of gram crop the usual cost components have been analysed using cluster sampling approach. Appropriate approach for apportioning of area and physical and material inputs has been developed chiefly on account of the fact that (i) the crop is generally sown as a mixture crop and (ii) the season overlaps with the previous season. The result of analysis of the data revealed the following cost components at the district level with fairly high degree of precision.

— The paid out cost including the imputed value of family labour worked out to Rs. 1175/- per hectare;
— Imputed rental value of land was Rs. 285/- per hectare;
— Interest on the present value of fixed assets worked out to Rs. 217/- per hectare, and
— The yield of gram was 11.75 Q/ha.

10. DISTRIBUTION OF INDIAN WOMEN CORRESPONDING TO AGE GROUPS IN A FAMILY PLANNING PROGRAMME

M. B. JOSHI[1], S. P. PANAT[2] and S. G. PRABHU AJGAONKAR[3]

The present paper examines data collected at the post martum centre, the Govt. Medical college and Hospital, Aurangabad during the year 1983-84. A pearsonian system of curves, Gram charlier series of Type A, and Edgworth probability distribution, were fitted to the age pattern by order of live births of women whose husbands accepted vasectomy.

[1,2]Govt. Medical College & Hospital, Aurangabad.
[3]Marathwada University, Aurangabad.

11. SOME STUDIES ON MIXED FARMING

R. L. RUSTAGI and SHIVTAR SINGH
I. A. S. R. I., New Delhi

Mixed farming generally denotes a system of farming combining field crop production with other enterprises like raising of cattle, sheep, goat, pigs, poultry and fishery etc. The various components of mixed farming are complementary to one another and provide the cultivator and his family extra and remunerative self employment. The average size of holding is decreasing due to the fragmentation. Subsidiary occupations at the farm have become a necessity for the farmer to make the maximum use of their limited resources and labour capacity in order to supplement their present income. Although mixed farming in one form or the other is prevalent all over the country, the way it is being practised, does not give them the optimum benefit desirable. A comprehensive, well balanced system of mixed farming can undoubtedly be the source of strength.

In this paper an attempt has been made to study some aspects of mixed farming utilising the data collected in a sample survey carried out by IASRI in Cuttack district of Orissa State during 1985-86. The data were recorded at fortnightly intervals from 288 households engaged in crop farming with one or more subsidiary occupations involving livestock, poultry and fish. The average size of producing unit per household was 1.3 hectares for crop farming, 2.0 milch cows, 4.3 poultry birds and 0.06 hectare of fish-tank area. The extent of labour utilised per year in the above mentioned farming units was of the order of 400, 180, 30 and 30 days respectively. A producing unit provided per household *3110* kg. of grains (cereals and pulses) and *530* kg. of Jute from crop farming, *455* kg. of milk from dairying, *625* eggs and *80* kg. fish per annum. Other studies attempted include return per unit of expenditure, return per day of labour, and employment available per year etc.

12. EFFECT OF FLOOD PARAMETERS ON YIELD OF PADDY CROP

JAGMOHAN SINGH and O. P. KATHURIA

The immediate effect of floods in agricultural sector is damage to crops and loss of livestock. It is extremely important to assess the effect of different flood parameters (such as frequency of flood, its duration and depth of flood water) on productivity of cultivated crops. The impact of contribution of each flood parameter on yield of paddy crop is studied during the period in which it occurs and the overall effect on Wheat Crop in the following Rabi season. It is observed that the depth

of flood water adversely effects the production of paddy crop. The yield per hectare in flood-effected and unaffected areas came out to be 17.20 quintals and 34.23 quintals respectively, whereas that of wheat in the subsequent Rabi season turned out to be 20.27 quintals and 18.80 quintals in the flood-affected and unaffected areas respectively.

13. A STUDY OF MILK PRODUCTION FUNCTIONS FOR SAHARANPUR DISTRICT OF UTTAR PRADESH

BHUPAL SINGH and JITENDER KUMAR
National Dairy Research Institute, Karnal

The input-output data for this analysis have been obtained for rural areas of Saharanpur District utilising data collected in a survey for two months (October and November 1986). The bovine population in the study area is dominated by buffaloes. Therefore, the analysis of feed-milk relationship was confined to milking buffaloes In the estimation of milk production functions, the milk yield per animal per day (Y) of 156 milking buffaloes was regressed upon the quantity of green fodder (x_1), quantity of concentrates (x_2), order of lactation (proxy of age of animal) (x_3), stage of lactation (x_4) and management index (x_5). The linear and Cobb-Douglas form of production functions were tried and Cobb-Douglas type was used for further analysis. The magnitude of zero order correlation coefficients indicated that multi-colinearity did not pose any problem in estimating the parameters of the statistical models by employing ordinary least square method of estimation. The positive sign of milk production function in case of green fodder and concentrate feeding and management inputs indicated that milk yield can be increased by increasing these three inputs. Since the sum of the exponents for green fodder and concentrates is less than 1.0, the function indicated a diminishing feed to milk transformation. The estimates of marginal physical products indicated that for both (green fodder and concentrates) marginal productivity of milk increase with declining rates. For a combination of 1.75 kg. concentrate and 70 kg. green fodder, the rate of positive increase in marginal productivity reduces to constancy. This rate continues increasing upto 2.5 kg. concentrate and 80 kg. greens,

The isoquants for specific levels of milk yield revealed that the substitution rates decrease with increasing levels of green and milk yield. The least cost combination of feeds at a given price ratio (0.2) with every 0.5 kg. enhancement in milk production, the green fodder increase at 10 kg. in the first stage and about 14 kg. afterwards. The rate of concentrate increased at a declining rate. It may thus be infered that the decline in the concentrate use for increased milk production does not get strong-

ly substantiated. Also the gains in milk productivity at economically optimum level would be forthcoming if a minimum of concentrate is kept constant.

14. APPROXIMATE MLE OF REFLECTED GAMMA SCALE PARAMETER FROM CENSORED SAMPLES

K. ROSAIAH, R. R. L. KANTAM and V. L. NARASIMHAM
Nagarjuna University, Nagarjuna Nagar

Analogous to double exponential distribution, a new distribution called reflected Gamma distribution is considered. Its scale parameter is estimated from a Type II censored sample by adopting the approximation suggested by Mehrotra and Nanda (Biometrika 1974) to the log-likelihood equation of the scale parameter. The estimators obtained by us are linear functions of moduli of the order statistics. Their variances are compared with that of the optimum linear unbiased estimator of the scale parameter.

15. PROSPECTUS OF EMPLOYMENT GENERATION IN LAC CULTIVATION IN TRIBAL AREAS

S. C. SETHI, O. P. KATHURIA, JAGMOHAN SINGH and
D. C. MATHUR
I. A. S. R. I., New Delhi

The cultivation of lac is an important source of livelihood for tribal population in many states. Lac cultivation is done by innoculation of brood lac on lac host trees, prunning, shooting of birds, harvesting and scrapping of lac from shoots encrusted with lac. A lot of human labour has to be invested in performing various operations in cultivation of lac. Lac host trees are invariably found in tribal areas of different states of India. It is, therefore, important to estimate the extent of human labour utilized in cultivation of lac. As mostly the family labour is employed in most of the operations involved in lac cultivation, it will help in bettering the lot of tribal people. An attempt has been made to estimate the man hours employed on various operations in cultivation of lac in Mirzapur district of U. P. The study reveals that for cultivation of lac on 7577 sampled lac host trees, 93746 hours are required. Thus about 12 man hours are required for cultivation of one lac host tree. For cultivation of lac on 5.21 lakhs estimated lac host trees in Dudhi tehsil of Mirzapur district (U. P.), 7.8 lakhs man days will be generated.

16. A SIMPLE METHOD OF CONSTRUCTION OF GROUP DIVISIBLE SECOND ORDER ROTATABLE DESIGN THROUGH A BIB DESIGN

K. C. CHENNA RAYUDU

RARS, Lam Farm, Guntur (A.P.)

P. RAMACHANDRA RAO

B.T. College, Madanapalli (A.P.)

and

V. L. NARASIMHAM

Department of Statistics, Nagarjuna University, Guntur (A.P.)

Das and Dey [4] were the first to introduce group divisible second order rotatable designs (GDSORD), Later several authors gave methods for the construction of these designs. Narasimham, Chenna Rayudu and Ramachandra Rao [9] suggested a simple method of constructing 2-GDSORD, using Balanced incomplete Block Design with $r > 3 \lambda$. In this paper the above method is generalised to evolve a new method of constructing m–GDSORD, using BIB Design along with some simple sets of points. The method is illustrated through examples.

17. INCOMPLETE BLOCK DESIGNS FOR MULTIPLE PARALLEL LINE ASSAYS

L. R. GUPTA

Haryana Agricultural University, Hisar

If several test preparations are to be assayed against the same standard preparation, it is economical to include doses of all the preparations in the same assay then having separate assays for each of the test preparation. Such assays are called multiple assays. If, further, the response is linearly related to logarithm of the dose, assays are called multiple parallel line assays. In multiple parallel line assays having p test preparations to be tested against one standard preparation, p preparation contrasts, a combined regression contract and p parallelism contrasts are of major importance for validity tests and for estimation of relative potencies.

Kulshrestha (1971), Seshagiri (1974) and Boopathy (1984) proposed some series of incomplete block designs for multiple parallel line assays having the same number of doses under each preparation. But sometimes, in biological assays, it becomes necessary to use different number of doses of standard and test preparations due to shortage of material, such assays are known as asymmetrical assays. No work is available in literature for multiple asymmetrical parallel line assays. In this paper syste-

matic methods for construction of incomplete block designs for multiple asymmetrical parallel line assays are presented which estimate important bio-assay contrasts free from block effects. These designs are partially efficiency balanced designs and have simple analysis.

18. A NEW TYPE OF SLOPE ROTATABLE CENTRAL COMPOSITE DESIGNS

B. Re. VICTOR BABU and V. L. NARASIMHAM
Nagarjuna University, Nagarjuna Nagar

Hader and Park (Technometrics, 1978) introduced Slope Rotatable Designs. They have constructed Slope Rotatable Central Composite Designs for $2 \leqslant v \leqslant 8$ (v stands for number of factors). Victor Babu and Narasimham (1987) have extended the above results for $9 \leqslant v \leqslant 17$ and also have given new methods for construction of Second Order Slope Rotatable Designs. In this paper another type of Slope Rotatable Central Composite Designs are introduced and these are called Type-II Slope Rotatable Central Composite Designs. These Type-II Slope Rotatable Central Composite Designs are constructed for $2 \leqslant v \leqslant 17$.

19. USE OF NEIGHBOUR PLOTS IN THE ANALYSIS OF FIELD EXPERIMENTS

D. V. SUBBA RAO and M. SUBRAHMANYAM
C. T. R. I., Rajahmundry

Near neighbour analysis technique (NNA) has gained much importance with the advent of computers. The use of this NNA is studied with a number of field experiments on tobacco and observed much reduction in experimental errors and thus increasing the precision of the experiment. Further developments in this direction are worked out (i) by iterating the covariance adjustment with the re-entered adjusted treatment means; and (ii) by the use of multiple covariance technique treating the neighbours in the row and across its sides separately.

20. ON POWER FUNCTION OF A CONDITIONALLY SPECIFIED TEST PROCEDURE IN AN UNBALANCED RANDOM EFFECTS MODEL

J. RAVICHANDRAN and C. V. RAO
Nagarjuna University, Nagarjuna Nagar

This paper deals with a hypothesis testing problem in a two stage un-

balanced nested design with random effects. As an exact test of hypothesis of no treatment effect is impossible, Tan and Cheng (Sankhya B, 1984) proposed an approximate F-test using Satterthwaite procedure. A conditionally specified test (CST) procedure is developed here using a preliminary test and the Tan and Cheng approximate F-test. The power function of the CST procedure is derived. The power gain of the CST procedure over the Tan and Cheng test procedure is studied.

21. AN EMPERICAL TEST FOR THE COMPARISON OF TREATMENTS

M. SUBRAHMANYAM and D. V. SUBBA RAO
C. T. R. I., Rajahmundry

Several non-parametric tests developed in recent years for the comparison of a set of treatments. In the present paper, two non-parametric test criteria S and S' statistics are suggested where

$$S = \frac{x}{1-x} \quad \text{and} \quad S' = \sqrt{S}.$$

and X measures the proportion of variation explained by treatments in the total variation after adjusting for block effects, if any. The ranges of S and S' vary from 0 to infinity as x vary from 0 to unity. The area under S and S' curves have been demarcated into three regions viz., region of non-significance, region of significance and region of high significance based on their unweighted, weighted and squared weighted averages. Formulae for working out the critical difference are also presented. It is further shown that the statistic S' is β (3/2, 1/2)-variate.

22. A COMPARISON OF DIFFERENT METHODS OF STABILITY STATISTICS

G. S. V. SUBRAHMANYAM
C. T. R. I., Rajahmundry

The diversity of parametric methods of stability statistics and their interrelationship with the clustering of genotypes for similarity of response to environments are given. The stability statistics are grouped according to the following different concepts. A genotype is stable if (i) the environmental variance is small; (ii) the response to environments is parellel to the mean response of the genotypes; and (iii) the residual mean square from regression model on the environmental index is small. Different methods of unicriterion and multicriterion approaches of clustering of genotypes are given. An example on tobacco varieties for stability statistics and clustering of genotypes is calculated.

23. VARIABILITY AND INTERRELATIONSHIP IN RAJMASH

G. C. MISRA and J. K. SINGH

Institute of Agricultural Sciences, Banaras Hindu University, Varanasi

Statistical analysis in terms of correlation studies has become a necessity for compact plant breeding programme. Realising the stress on the yield, efforts have been made to improve the method of selection of suitable plants in almost all the pulse crops except Rajmash. In the present paper an attempt has been made to measure the phenotypic, genotypic and environmental correlations between yield and other yield attributing characters namely plant height, number of primary branches, number of secondary branches, pod length, pods per plant, seeds per pod and seed index in thirty eight varieties of Rajmash. Genetic coefficient of variation, heritability and genetic advance were also estimated.

24. INFLUENCE OF RAINFALL AND FLOODS ON RICE YIELD

B. K. BHATTACHARYYA

Assam Agril. University, Jorhat

Crop-weather analysis Models have been developed by various workers. Effect of one or more weather parameters on certain crops have also been studied by certain workers. Assam receives a large amount of rainfall every year. Occurrence of floods is a regular feature in the state. Rice is the main crop of the state and all the three rice crops grown in the state are susceptible to floods. The crop is grown mainly under rainfed conditions. Rice crop is expected to be influenced by both rainfall and floods. In the present paper influence of rainfall and floods on rice yield in Assam has been studied. Relevant published data of Govt. of Assam have been used for the analysis.

25. ESTIMATION OF STABILITY IN TURMERIC ARRIVALS AND PRICES IN THE KRISHNA RIVER BELT OF ANDHRA PRADESH

G. SATYANARAYANA,[1] C. SREERAMA MURTHY[2] and
Y. ESWARA PRASAD[3]

Turmeric is an important cash crop in Krishna river belt of Andhra Pradesh. An attempt has been made to study the seasonal stability in

[1,2]Agricultural College, Bapatla 522 101.
[3]R. A. R. S., Lam, Guntur.

arrivals and prices of turmeric both bulbs and fingers over a period of 15 years by adopting one of the decomposition by multiplicative hypotheses methods. Growth functions were also used to estimate the trend and the risk of the growers and marketing agencies was calculated by coefficient of variation technique. The analysis revealed the seasonal movements of arrivals and prices of both fingers and bulbs reached peak stage during March to June and attained the lowest from September to February, with prices registering an exactly reverse situation. The growth functions revealed that the arrivals of fingers were independent of time and the prices of bulbs were more affected by its arrivals when compared to fingers. Finally the results indicated that the retailers in the study area were less risk takers than village merchants and processors.

26. TREND OF YIELD POTENTIAL IN RAJMASH

G. C. MISHRA, J. K. SINGH and S. SINGH

Institute of Agricultural Sciences, Banaras Hindu University, Varanasi

The static trend in yield of pulse crops is of great concern for the scientists of this country. Rajmash is an important pulse crop as far as its yield potentiality is concerned. In the present paper analysis of trend of yield in Rajmash is done. It was seen that the major responsible factors for this static trend were plant height and pods per plant. Suggestions have been made for improvement in the methods of selection and also in the crop management system.

27. IMPACT OF PURNA CANAL IRRIGATION FACILITIES ON CROPPING PATTERN

V. B TAK and K. D. RAJMANE

Marathwada Agril. University, Parbhani

The present study was undertaken in Purna Command Area of Marathwada division of Maharashtra State. The area irrigated by Purna command is 66 per cent of gross irrigated area. The study was designed to examine the impact of Purna canal irrigation on crop pattern, before and after Purna irrigation project. The trend in area of important crops was studied during the year 1962-63 to 1980-81. The exponential trend equation $Y = ab^x$ was used to obtain compound growth rates taking years as an independent variables and index numbers of area as dependent variables. The impact were studied before the project period 1962-63 to 1967-68 and after the project period 1967-68 to 1980-81. The study revealed that, there was a negative growth rate of rabi, jowar, wheat, sugarcane before the project, but growth rates were positive after the pro-

ject period. The study also pointed out that there was a significant positive impact in case of shift in area of crops like, cotton, wheat, sugarcane-rabi, jowar in both the Parbhani and Nanded districts. The rate of increase in area was faster in post project as compared to pre-project period. Similarly, the impact of project was positive and significant in all the crops except paddy in Nanded district.

28. A BRANCHING PROCESS WITH EMIGRATION

S. C. GUPTA and O. P. SRIVASTAVA
H. A. U., Hissar

Galton-Watson (1874) branching process has been modified by several authors such as Heathcote (1965, 1966) and Seneta (1968) to incorporate the effects of some additional factors on the development of the population. This paper proposes a branching process considering a time-dependent emigration component at each generation. The expressions for the expected population size and the expected number of removals have been derived. The model has been extended to account for situations where the migration in the population also takes place. The model has been applied to a problem of genetic improvement.

29 MODIFIED PRODUCT TYPE ESTIMATOR

M. N. PATEL
Sir P. P. Institute of Science, Bhavnagar

In recent years, many research papers have appeared on modified ratio and product type estimators. For improving the estimator $\bar{y}$ in the case of simple random sampling design Searls—(1964-67) has considered the estimator of the type $\lambda \bar{y}$, where λ is a scalar and is obtained by minimizing the mean square error of $\lambda \bar{y}$. He has obtained the optimum value of λ as equal to $(1 + C_y^2)^{-1}$ where C_y is the coefficient of variation of the estimator $\bar{y}$. Thus, utilizing prior information on coefficient of variation, it was possible to improve the estimator. In this paper following the technique of Searls, the following modified product type estimator is suggested which utilizes the prior information on

$$\rho_1 \ C_x \text{ and } C_y \qquad t = \frac{\lambda \ \bar{y} \ \bar{x}}{\bar{x}_1} \qquad \text{where } \lambda \text{ is scalar.}$$

Its properties regarding BIAS, MSE and efficiency are investigated.

30 ON A CLASS OF VARIANCE BALANCED DESIGNS

D. K. GHOSH
Saurashtra University, Rajkot, Gujarat

Two methods for constructing Variance Balanced Designs (i) from symmetrical factorial design and (ii) developing the initial blocks of unit matrix of order *n* along with one extra column are discussed. An easy method for analysing Variance Balanced designs is carried out.

31 STABILITY OF FCV TOBACCO GENOTYPES IN ANDHRA PRADESH

N. S. MURTHY and C. R. NAGESWARA RAO
CTRI, Rajahmundry

Genotype environment interaction and stability of genotypes over environments are of paramount importance to breeders. The Parametric method of estimating the genotype and environment interaction and Phenotypic stability are used mostly in plant breeding. Non Parametric methods of estimating the phenotypic stability based on the ranks of the genotypes in each environment are being studied.

In this study some of the popular parametric methods of stability and the non parametric methods of stability due to Nassar and Huhn (1987) are studied on 7 *cv* tobacco varieties in 5 environments in Andhra Pradesh.