PREFACE

This is the Sixteenth issue of 'IASRI Statistical Newsletter' and covers the activities and allied information in respect of this Institute during the quarter Oct.-Dec., 78.

I hope this Newsletter has been proving useful to the Agricultural Research Statisticians and other users. I would welcome and appreciate any comments and suggestions for its improvement in the subsequent issues.

I am thankful to all officers and other members of the staff of the Institute who supplied the requisite material for this issue of the "IASRI Statistical Newsletter".

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CONTENTS

1. PRICE SPREAD OF VEGETABLES IN DELHI

Vegetables constitute an important source of minerals and vitamins in the human diet. However, their quality starts deteriorating in a relatively short period and accordingly they have to be consumed or otherwise disposed of within a day or so of their harvest. In the prevailing marketing structure, vegetables pass through a number of intermediaries within a few hours before finally reaching the consumer. It is generally felt that the producer's share in the consumer's rupee spent is very meagre mainly on account of the element of profit added to the original sale price at successive stages of marketing. It would, therefore, be of interest to study the relative price of vegetables at different stages of marketing, in other words, the share of different intermediaries in the price paid by the consumer (called the price spread). Such a study would also provide the basis for alternative channels or marketing structure so as to maximise the returns to the vegetable growers. A pilot survey covering this aspect was conducted by the Institute in Delhi during 1976-77. For the collection of data from growers and Mashakhors* in the Azadpur Mandi, 3 to 5 clusters of two wholesalers each and 3 to 5 clusters of two Mashakhors each were selected randomly. Five enumerators were posted in the wholesale Mandi for the collection of data on various aspects of marketing. Each enumerator was assigned one cluster of two wholesalers and one cluster of two Mashakhors. His duty was to collect the information on the arrival of the vegetables, transport used, transport charges paid, the quantity of different vegetables sold, the amount received by the grower, various charges paid by the seller and buyer etc. The time of enquiry was from 6 A.M. to 12 Noon on all working days in the following phasesd manner for each enumerator.

Wholesalers	Mashakhors
6.00 A.M.—7-00 A.M.	6.30 A.M.—7-30 A.M.
8.00 A.M.—9.00 A.M.	8.30 A.M.—9.30 A.M.
10.00 A.M.—11.00 A.M.	10.30 A.M.—11.30 A.M.

*Mashakhors=Semi-wholesalers

In Daryaganj Mandi one enumerator was posted who collected the prices of vegetables from wholesalers and Mashakhors.

For the collection of information from retailers regarding the price of different vegetables, their losses in transit and overnight storage, the entire Delhi region was divided into four zones namely East, West, South and North. From each zone one cluster of three localities/colonies was selected randomly. From each selected locality two/three retailers were further selected randomly for the collection of data. One enumerator was assigned the work of data collection from one cluster of three colonies aud thus 4 enumerators were posted for this work.

In this article some of the results obtained on the basis of data pertaining to period October to December, 1977 are presented. Vegetables marketing in Delhi is practised in two broad systems. In one system prevailing in Azadpur Mandi which is the largest Subzi Mandi in the capital, the produce is brought to the wholesaler who sells it in bulk charging 4 to 5 percent commission on the sale proceeds. The next stage is the Mashakhor, a sort of Semi wholesaler. who purchases in bulk and sells to the retailer in multiples of 5 Kg. or so. Sometimes for costly vegetables which are in short supply, the sale is done in multiples of 5Kg. by the wholesaler himself. The last intermediary in the chain is the retailer who purchases from the wholesaler or Mashakhor, as the case may be, carries the vegetables to his shop and sells to the consumers. In the second system prevalent at Daryaganj, Shahdara and other small mandies, the produce is auctioned by the wholesaler directly to the retailer in multiples of 5 Kg. or so, again on commission basis. The retailer either carries the vegetables to his shop for retail sale or sometime sells the same at the mandi itself. The small Mandies, therefore, serve as wholesale as well as retail markets.

The main vegetables during the last quarter of the year are tomato, brinjal, cabbage, cauliflower and peas. The prices and relative price spread of these vegetables at different stages of marketing for Azadpur and Deryaganj are given in Tables 1 & 2 respectively.

TABLE-1

Average prices of vegetables as observed during october, 1977 to December, 1977.

| Markets | Azadpur | | | Daryaganj | |
Vegetables	G	M	R	G	R
Tomato	.82	1.46	1.96	1.60	2.07
Brinjal	.60	.74	1.20	.69	1.13
Cabbage	.67	1.01	1.58	1.14	1.57
Cauliflower	1.05	1.31	1.65	1.25	1.67
Peas	2.49	2.92	3.91	2.97	3.81

G=Grower, M=Mashakhor, R=Retailer

The Price-spread i.e. the share of different intermediaries to the consumers' rupee spent for these Vegetables for both the Mandies are given in table 2.

TABLE-2

Price spread of vegetables as observed during October, 1977 to December, 1977.
(Figures in paise)

| Markets | Azadpur | | | | Daryaganj | | |
Vegetables	G^*	M	R	Total	G^*	R	Total
Tomato	42	33	25	100	77	23	100
Brinjal	50	12	38	100	61	39	100
Cabbage	42	22	36	100	73	27	100
Cauliflower	64	16	20	100	75	25	100
Peas	64	11	25	100	78	22	100

*The share of grower includes 4 to 5% commission charges paid to commission agent.

It may be seen from these tables that the share of grower increases with the elimination of one stage of marketing. However, the amount of increase in the grower's share varies from one vegetable to the other depending upon the perishable nature of the vegetables as well as the quantity received for sale. Almost the entire share of mashakhor goes to the grower when this agency gets eliminated. Another result emerging from the data of average sale price of vegetables in different months is that the share of retailer is relatively higher for cheaper vegetables and lower for vegetables which are costly. This is possibly on account of the fact that the consumer has the capacity to pay for vegetables upto a certain normal level which the retailer exploits in the peak season when the vegetables are available in abundance and the wholesale prices are fairly low.

It would thus appear that for the benefit of grower as well as the consumer, the marketing of vegetables should be simplified by keeping one or at the most two intermediaries before vegetables reach the consumer. This can be achieved either by setting up vegetable cooperative societies who can purchase directly from the growers or wholesalers or else by forming small consumer cooperative groups who can similarly buy vegetables at the wholesale level.

2. STUDY OF MARKETING SURPLUS OF WHEAT IN THE UNION TERRITORY OF DELHI

During the past two decades some studies have been undertaken by various researchers to investigate the relationship between total quantity of foodgrains produced, prices and the marketable surplus.—With the introductiono f new technological change in the agrarian system specily for the crop like wheat in north

India, there has been considerable increase in the average yield per acre. It is important to assess the impact of new technology on the marketed surplus of wheat. Very few studies have been taken up to investigate the disposal of wheat crop and its marketed surplus with reasonable accuracy.

The purpose of this article is to examine critically the relationship between the marketed surplus and the total production, area under crop, holding size, family size and the total income of the farmer. Study covered small, medium and large holding size groups of cultivators. The nature of relationship has been examined for the above mentioned groups as well as for the aggregate of holdings.

For the purpose of investigation the data collected during 1976 for studying the social cost benefit of tubewell irrigation of Nazafgarh Block in the Union Territory of Delhi have been utilised.

Sampling Plan : —

A multi-stage random sampling design has been used for estimation purpose. Out of 66 villages 12 villages have been selected by simple randam sampling. From each village twenty two cultivators have been selected, The data was collected from the selected cultivators through out the year regarding the holding size. area under crop, source of irrigation, total income from all sources, family size, expenditure incurred in applying inputs to the crop and other relevant information by trained enumerators.

Pattern of disposal :—

Wheat is the main rabi crop in northern India and also the main staple food. The cultivator, after making a provision for consumption and seed, releases his

produce for sale. Few of the farmers dispose off their entire produce in order to fulfil the social and personal obligation. The disposal under different holding size groups is presented in Table 1. It may be seen that on an average, the marketed surplus is 24.5 quintals per cultivator. The average quantity produced per cultivator is 21.9 quintals in small holding size while 48.9 quintals in large holding size. Similarly the amount kept for consumption is 11.3 quintals in small holding size and 21.1 in large holding size. It is observed that the proportion of contribution by various holding size groups to the total marketable surplus is almost in complete agreement with proportion of area occupied by the crop in different holding size group as shown in table below :—

TABLE—1

Pattern of Disposal of Wheat

Holding size	Area under crop (Acres)	Quantity produced in (Qtl.)	Consumption (Qtl.)	Marketed Surplus (Qtl.)
Small	2.6	21.9	11.3	7.4
Medium	5.6	48.9	16.4	22.7
Large	12.2	96.1	21.1	59.9
Pooled	6.1	50.4	21.5	24.5

Method of Analysis :—

Several researchers have examined the relationship between marketable surplus, total production and also the pattern of disposal of various crops. Mathur and Ezekiel examined the relationship between marketable surplus and prices of foodgrains in an investigation conducted in the districts of Akola and Amraoti of Maharashtra State during 1955-56 and 1956-57. Prof. Dandeker examined the

relationship between marketable surplus, prices and production of foodgrains. He gave different interpretations for viable sector of large holding and subsistence sector of small holding. Prof. Raj Krishna also studied the relationship between marketable surplus in relation to total production. He was of the opinion that non-linear model was relatively suitable for explaining the variation. It has also been suggested that the exponential functions provide better explanation. However, it is evident that there is a strong correlation between the marketable surplus and production of wheat.

An attempt have been made to describe the relationship between the total quantity produced, area under the crop, total holding size, family size and marketed surplus through a suitable empirical relationship.

The linear and Cobb Duglas type functions have been used to study the above relationship for small, medium and large holding separately as well as for all farms as a whole. The dependent variable in the analysis is marketed surplus of wheat while independent variables are, total output, area under crop, size of holding, income and family size.

Various combinations of variables explaining marketed surplus have been studied. It is evident from the results of regression analysis for small farms that when all independent variables are included in the multiple regression equation the value of R^2 is 0.799. The partial regression coefficients of marketed surplus on production and family size are significant at the 1% level. Variables e.g. total output, area under crop and family size are considered as independent variables and the multiple regression equation explained 79.85 per cent variation in marketed surplus. In this case also the regression coefficients of total production and family size are statistically significant. From the result it is evident that there is a significant and positive relatioeship between production and marketed surplus of wheat in all size groups while there is a negative relationship with family size. Results for medium, large and pooled group of holdings indicate similar pattern as exhibited in the case of small holdings.

Conclusion :

The main objective of this article is to study factors affecting marketed surplus of wheat on the holding of Najafgarh Block in rural Delhi. It has been observed that the surplus is mainly concentrated in the hands of big land owners. Variables affecting marketable surplus are total output, area under the crop, and family size. These variables explain about 80 per cent of the variation in the marketed surplus.

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3. TRAINING ACTIVITIES

During the quarter. the mid-term examinations of Junior, Senior and Professional Statisticians' certificate courses were held. The final examinations of the I trimester of 1978-79 session for M.Sc. anb Ph.D, students were also held.

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4. BASIC RESEARCH

A new class of designs called block designs with nested rows and columns were developed. Procedures of construction and analysis of these designs were developed.

New incomplete block designs for biological assays were olso developed.

Investigations had been made for a multistage design.

The review on supplemented block designs was being prepared.

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5. ADVISORY SERVICE

During the quarter under review, technical advice and guidance was rendered to research workers and students of the Research Institutes, Agricultural Universities and other research organisations in planning of their experimental investigations and statistical analysis/computerisation of their research data as also in regard to research projects referred to the institute by the I.C.A.R. and other organisations. Some details of the technical advice and guidance given by the Institute during the quarter under review, are given below in brief :

Crop Seiences

Shri B.N. Mittra Assistant Professor (Agronomy) of Indian Institute of Technology (I.I.T.) Kharagpur (W.B.) was given guidance in regard to the laying out of the Statistical design.

Crop Forecasting Methodology

Shri V.P. Malhotra, Scientist (S-2), Central Potato Research Institute (C.P.R.I.), Simla (H.P.) was given advice on planning and analysis of data on preharvest forecasting of potato yield.

Miss Vrinda Taiyal, a Ph. D, Student of Haryana Agricultural University was given advice in the analysis of the data for her Ph. D. thesis.

Animal Sciences

Shri Karan Singh, Deputy Director (Statistics), Directorate of Animal Husbandry, (H P.). was given advice on Mortality percentage at Poultry Farms, etc.

Shri Sushil Kamal Paul, Statistical Officer, Directorate of Veterinary Services, (W,B.), was given advice on the methodology of designing the survey in the projeet, "The studies for estimation of birth and death rates in bovines for preparation of life tables in W.B,"

Statistical Genetics

Dr. Narayanan of Poultry Breeding Farm Gurgaon (Haryana) was given advice on selection of birds on some phenotype index.

Sample Survey Methodology

Sarabhai group and Gandhi Peace fundation were given techuical guidance on planning of All India Seed Demand Survey.

Shri T.R. Ramakrishnan of Directorate of Economics and Statistics (Dte. of E & S) New Delhi was given technical advice regarding survey on cost of apple to be conducted by Dte, of E & S.

Shri V. Venkateswara Rao, a Ph. D. student of Banaras Hindu University was given advice on the analysis of his data.

Shri O.P. Gupta, Statistical Officer, Indian Grain Storage Institute, Hapur (U.P.) was given technical guidance regarding methodology for estimation of losses on storage in wheat of Bulandshahr (U.P.)

6. FIELD WORK

(a) Field Training

During the quarter under review, field training was imparted in connection with the projects mentioned below at the places shown against them.

(i) Pilot sample survey for estimation of number of Pigs slaughtered and study of attendant swine practices—Allahabad and Aligarh (U.P.)

(ii) Statistical investigations on economics of Pig-production-Aligarh (U.P.)

(iii) Pilot sample survey for estimating the yield of cotton on partial harvest data in Hissar (Haryana)-Chandigarh.

(iv) Sample survey for studying the impact of Madhavaram Milk Supply Scheme—Madras (T.N.)

(v) Pilot sample survey for estimating the incidence of pests and diseases and consequent loss in crop yield on High Yielding Varieties (H.Y.V.) of Wheat and Paddy-Gorakhpur (U.P.)

(vi) Sample Survey—Study to find out the causes of land lying idle in the operational holdings—Jhansi (U.P), Anantpur (A.P.), Jabalpur (M.P.).

(vii) Pilot sample survey to study the impact of New technology on Crop production, its disposal and employment in Agriculture-Delhi.

(viii) Pilot sample survey to estimate the Cost of Cultivation of Mango/Banana and its marketing practices-Surat (Gujarat).

(ix) Pre-harvest forecasting of yield of tobacco-Prakasam district (A.P.).

(b) Inspection/Supervision of Field Work.

During the quarter under review, inspection/supervision of the field work of the following projects was carried out in areas/places shown against them.

(i) Sample survey for methodological investigations into High Yielding Varieties practices (H.Y.V.P.)—Amritsar (Punjab).

(ii) Pre-harvest forecasting of yield of sugarcane—Old district Meerut (UP.), Kolhapur (Maharashtra).

(iii) Pre-harvest forecasting of yield of Jowar-Sangli (Maharashtra),

(iv) Pilot sample survey to evolve a sampling methodology for estimation of losses taking place in the transit and Price-Spread at various stages of of marketing—Delhi.

(v) Study of Economics of Marine Fisheries in coastal areas of Calicilt (Kerala).

(vi) Pilot sample survey for estimating the incidence of pests and diseases and consequent loss in crop yield on High Yielding Varieties (H Y.V.) of wheat and paddy—Gorakhpur (U.P.).

(vii) Pilot sample survey to evolve a sampling methodology for estimation of cost of cultivation of vegetable crops in Union Territory of Delhi-Delhi.

(viii) Integrated experimental-cum-survey approach for the study of constraints in transfer of modern technology to the farmers in Operational Research Project (O.R.P.) area of Cuttack and Puri (Orissa)-Cuttack, Puri (Orissa).

(ix) Sample survey—Study of yield constraints in Operational Research Project (O.R.P.) areas of Chittorgarh (Rajasthan)-Chittorgarh (Rajasthan).

(c) Other Field Work

The Field Officer-in-Charge of the scheme of "Pilot sample survey to evolve a sampling methodology for estimation of losses taking place in the transit and price-spread at various stages of marketing" in Ahmedabad district of Gujarat was given refresher training at Delhi in collection of data and filling in of different schedules.

7. ABSTRACTS OF PAPERS PUBLISHED

1. BATHLA, H.V.L. Study of correlations between cane yield and different characters attributing to yield. *Indian Sugar Crops Journal. July-Sept., 1978.*

Correlation studies between the yield and yield attributing characters in Sugarcane were made at the Sugarcane Research Station, Jullundur. Four approved varieties namely COL. 29 (Early matuing). COL. 9 (mid maturing), COJ. 46 and CO. 1148 (late maturing) were selected for these studies. It has been seen that cane thickness, cane length, number of internodes and leaf-width are very important and significant criteria in evaluating the yield potential of a variety and should, therefore, be incorporated in the various stages of selection trials in Sugarcane.

2. BHARGAVA, P. N.. ANEJA, K. G. and GHAI, R.K. Influence of moist days on crop production *Jour. Ind. Soc. Agri. Stat. Dec., 1978 Vol. 30. No. 2, pp 111 to 118*

The paper studies some aspects of moisture availability periods and their influence on crop production which perhaps has not been done earlier. The data utilised for these studies pertained to daily rainfall and U.S. Pan evaporimeter records for district Jalgaon (Maharashtra State) and the yield of Jowar, the principal crop of this tract. The Pan evaporimeter readings were converted to potential evapotranspiration (PET). Further, based on a comparison of rainfall with PET, the entire period of kharif season (viz. May to October) was classified into three categories of moisture availability periods depending on whether the moisture availability, is surplus or deficient. It was observed that both these periods (viz. moist and humid) have significant influence on crop production. The commencement and cessation of these periods were studied. It was found that the span of the humid period extended between the 3rd week of June to second week of September while that of the moist period extended between 2nd week of June to end of September. The mean cessation date of humid period was seen to be September 15 and it was found that the termination of humid period prior to september 15 appears quite likely to cause a depression in the crop yield. Through a graphical technique adopted to determine the

minimum number of moist/humid days needed for obtaining a normal crop yield, it was found that the requisite number of moist days was 30 while that of humid days was 25.

3. DHARMENDER KUMAR AND NARAIN, PREM. Lactation correction factors and repeatability of economic characters in Sahiwal COWS AND Murrah buffaloes. *Ind. Jour. of Dairy Sciences, Vol. 31, No. 3 Year, 1978 pp 220-225.*

The available records on lactation yield, lactation period, calving interval, yield per day of lactation and yield per day calving interval in respect of Sahiwal caws and Murrah buffaloes at Chak Ganjaria Farm at Lucknow for the period 1955 to 1975 were analysed to obtain Sander's correction factors and estimates of repeatability of the character For lactation yield, quadratic curves were found to fit well both in Shiwal as well as Murrah buffaloes. Sander's correction factors indicated the peak performanec forvarious characters in Sahiwal cows and Murrah buffaloes. In case of Sahiwal cows, estimates of repeatability for lactation yield, lactation length, calving interval, yield per day of lactation length and yield per day of calving interval were found to be 0.57, 0.34, 0.16, 0,78 and 0.02re spectively. In Murrah buffaloes, these estimates were respectively 0.26, 0.04, 0.16, 0.09 and 0.02. The implication of these estimates were discussed.

4. GURNANI, M, AMBLE, V.N., GOPALAN, R. Restricted selection Indices for Dairy Cattle. *Indian Journal of Heredity Vol. 9 No. 4 year 1977.*

A number of selection indices with and without restrictions have been given for selection of dairy cattle utilizing the information already availabie on the Tharparkar herd at NDRI, Karnal. Various combinations of the characters, first and second lactation yields in 305 days or less, age at first calving and first calving interval have been considered. It has been concluded that (i) selection effected at the beginning of second lactation is optimum when all the four charactersa re of economic value; (ii) selection effected at the end of first lactation is optimum when the mean genotypic value of calving interval is restricted; and (iii) restriction on age at first calving does not unduly reduce the gains.

5. JAIN, J. P. and RAJAGOPALAN, M. (1968) An approach for estimating changes in dynamic populations, *Jour. Ind. Soc. Agri. Stat. Vol. 30, No. 2 year 1978, pp 81-90.*

In repeated sampling enquiries, application of method of successive sampling with partial replacement of units is advantageous. Its use is however, restricted to situation where the size and structure of the population remain the same from occasion to occasion. Since those conditions are no longer tenable for dynamic populations, there is a need for developing new procedures of estimation. A rigorous methodology for dealing with such populations seems quite involved. In this paper a simple heuristic approach is indicated for estimating the totals of a character on the two occasions as well as the change that has taken place over time. The formulae developed have been illustrated with the data collected from the rural areas covered under the Delhi Milk Scheme during 1966-67 and 1972-73.

6. KATHURIA, O. P. Double sampling on Successive Occasions using a two-stage design. *Jour. Ind. Soc. Agri. Stats. Vol. 30, year 1978.*

Use of auxiliary information has been considered in sampling on successive occasions using a two-stage design when population value of the auxilary variate is not known, it is first estimated by drawing a larger sample of units from the population and the information so obtained is used to build estimators of the main character under study. Three different estimators called (i) a linear unbiased estimator, (ii) a double-sample estimator and (iii) a ratio-type composite estimator were built and their relative efficiencies were examined.

7. NARAIN, P. Statistical basis of designing expts. for residue analysis with special reference to sampling techniques. *Proceedtngs of Workshop ou Pesticide Residues with special reference to sampling techniques; March 20-21, year 1978 pp. 22-24.*

Some of the problems in estimating residues of plant protection chemicals applied to crops for controlling pests are discussed with particular reference to sampling procedures and statistical principles in designing field experiments. When plant and soil samples are to be taken periodically from an experimental

plot for pesticides residue analysis in the laboratory and several determinations are made on each sample, one has to distinguish between sampling and analytical errors and decide whether one analysis on each of the samples is better than running duplicates on a smaller number of samples. The total number of determinations for a specified precision and a given confidence coefficient can be obtained if some idea about the inherent coefficient of variation is available from past experience. Since the pesticide residues may differ considerably between individual parts of the plant like roots, stem, leaves, pods, etc. within a given plant and since a sampler has a natural tendency to select purposively, it is necessary to standardise the procedure of sampling for estimating the residues of a given plant as well as for a group of plants. Based on properly conducted experiments, one can decide whether regional sampling or composite sampling would be better and what would be the the sample sizes for number of plants and number of parts per plants. Further, when plant and soil samples are taken at periodic interval of times after treatment the residues diminish over time in a characteristic manner. Proper statisticla procedures are therefore necessary to fit suitable regression curves to the data to determine the rate of decrease of residues with time.

For a sound interpretation of experimental results on the differences between various treatments, it is necessary to replicate the experiment adequately as well as to allocate the treatments to the experimental plots randomly by the use of a ready-made table of random numbers. The number of replications required to obtain significant differences between treatment effects of specified magnitudes for a given confidence coefficient, can be derermined if some idea about the inherent variability in the material is, a priori, known. Apart from ensuring replication and randomisation, it is also necessary to group the experimental units such that comparisons among the plots comprising a replication are made under as indentical conditions as possible. A randomised black is commonly used to indicate a replication that has been assigned to a relativeiy homogeneous group of plots.

When plant protection measures are used to protect grains from loss due to storage, appropriate sampling techniques are necessary to determine whether there is any built up of residues from repeated application of the pesticide. For instance *malathion* is often used as a protective insecticide to control *Rhizopertha, Sitophilus*

Trogoderma and *Tribolium* in wheat and rice grains contained in gunny bags. Samples of grains are to be drawn from differeat gunny bags and analysed in the laboratory for *malathion* residues. Variance of residues between samples taken from the same bag is then compared with the variance of samples from different bags to decide whether one should take a large number of bags with one sample per bag or a smaller number of bags with two or more samples per bag.

For estimating residues of pesticide on perishable commodities marketed at different centres in a region with a given precision, it is necessary to adopt a stratified two-stage sampling design. The region is divided into homogeneous strata on the basis of plant protection measures adopted and in each stratum a suitable number of markets is randomly selected as first-stage units and a suitable number of samples of commodity for laboratory analysis-within each market is randomly selected as the second-stage units.

8. PURI, P. D. and NIGAM, A. K. Balanced Factorial Experiments II (1978). *Communications in Statistics A 7 (6) pp 591-605.*

In this paper it is established that a Balanced Factorial Experiment (BFE) with merged treatments is again a BFE. It is shown that BFE implies and is implied by a Partially Efficiency Balanced (PEB) design.

9. SHASTRI, S. S. Trends in marine fish landings in India *"Mahasagar"-Bulletin of the Natioual Institute of Oceanography Vol. II No 1 and 2 year 1978 pp 73-81.*

From the available species-wise data for the last twenty years, statistical models for the prediction of marine fish landings have been attempted. Only the species or groups of fishes having an average production of more than 20 thousand tonnes have been considered. The polynomial of fifth degree was taken into account for each of the 15 groups studied. On the basis of the results of the analysis of variance tables, fifth degree curves were fitted to 7 groups viz. mackerel, other sardines elosmobranches, *Leiognathus*, ribbon fish, other clupeids and Anchoviella. Fourth degree curves were fitted in the case of penaeid prawns, sciaenids and cat fishes, second degree curves for oilsardine and non penaeid

prawns and only linear curves for *Harpodon nehereus, Caranx* and pomfrets. Higher values of explained variations (Leiognathue max. 91%) indicate the closeness of fit. Majority of the species-groups studies generally show an increasing trend especially after 1966, with the exception of oil sardine and *Harpodon nehereus*, the former showing an increasing trend upto 1964-68 and then decreasing and latter constantly decreasing. The composition of average marine catches as per ISSCAAP species-groups is also given for world and India.

10. SINGH, D. and KHOSLA, R. K. Post harvest foodgrain losses in India. A review *Agri. Situ. Ind. 33 (8) Nov., 1978 pp. 499-500.*

A review of post-harvest foodgrain loss In India at different stages of harvesting, thereshing, cleaning, storage, transportation, processing, etc. has been made.

11. SINGH, K. B. and GOEL, B. B. P. S. Increase milk production by better management *Jour. Ind. Soc. Agri Stat. Vol. 30 No. 2 December, 1978.*

Milk production from animal depends upon its species, breed, stage, order, lactation and the management proctices viz. balanced feeding proper housing watering, grazing etc. Using the data collected in the integrated surveys conducted by IASRI in the Northern Region comprising Punjab, Haryana & Himachal Pradesh and in the southern region covering Andhra Pradesh, it was found that by better management the milk production can be increased by 51% in the northern region, 96% in the southern region.

12. SINGH, PADAM and SINGH, RANDHIR. A Sampling Scheme with varying probabilities without replacement *Jr. Ind. Soc. of Agri. Stats. Vol. 30 No. 2 pp 65-70.*

A new varying probability without replacement sampling scheme has been suggested. The new scheme is not only very convenient and simple to operate but fulfils many requirements of an ideal sampling scheme. Firstly, it is possible to compute a set of revised probabilities of selection such that the inclusion probabilities are proportional to size measures for all the units. Secondly, the inclusion probabbility for every pair of units is positive which provides unbaised estimate of

the sampling variance of the estimate of population mean. Further, the superiority of the suggested sampling scheme as compared to the usual pps systematic and pps with replacement sampling schemes has been examind empirically. Midzuno (1952) and usual pps systematic sampling scheme are particular cases of the new sampling scheme.

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8. PAPERS ACCEPTED FOR PUBLICATION

1. AGGARWAL, S. K., SINGH, MURARI and GOEL, B. B. P. S. Use of P-auxiliary variate in p.p.s. Sampling-*Biometrical Journal.*

2. GOEL, B. B. P. S. and NIGAM, A. K. Sequential Exploration in Mixture Experiment-*Biometrical Journal*

3. NARAIN, P. A new Sire Index for milk production corrected for an auxiliary trait-*Ind. Jour. of Animal Genetics and Breeding.*

4. RAHEJA, S. K., MEHROTRA, P. C., BANERJEE, A. K., RUSTOGI, V. S. and GUPTA, S. S. Factors contributing to regional variations in productivity and adoption of High Yielding Varieties (H.Y.V.) of major cereals in India-*Jour. Ind. Soc. Agri. Statistics.*

5. RAHEJA, S. K., MEHROTRA, P. C. and RUSTOGI, V. S. Extent and intensity of adoption of High Yielding Varieties (H.Y.V.) of cereal crops and associated improved practices by farmers in different holding-size-groups-*Food Farming and Agriculture.*

6. SAKSENA, B. C. and VERMA, S. P. Rural employment pattern in Milk Shed areas of Dudhsagar Dairy Mehsana (Gujarat)-*Indian Journal of Extension Education IARI, New Delhi.*

7. SINGH, MURARI. Group divisible second order Rotatable design. *Biometrical Journal.*

8. SINGH, MURARI, and DEY, A. Block design with nested rows and columns-*Biometrika.*

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9. I. A. S. R. I. PUBLICATIONS

1. BHARGAVA, P. N., KRISHNAN, K. S., KHURANA, G. L. and CHOUDHARY, B. L. Thirty years of Agricultural Field Experimentation in India (1948-77), year 1978.

2. BHARGAVA, P. N., KUMAR, PRABHAT and BATHLA, H. V. L. Annual Index of Agricultural Field Experiments, Vol. IV, year 1974-75.

3. JHA, M. P., IYER, V. N., AGGARWAL, RANJANA and CHANDRAHAS. Annual Progress Report of Pilot studies on Pre-harvest forecasting of Yield of Sugarcane in Meerut district (U.P.) for the year 1975-76.

The design adopted was a stratified multistage random sampling with 4 strata as blocks (one from each of the four zone). From each stratum two villages and in each village a simple random sample of two sugarcane fields were selected. In each selected field two sample plots of size 3 rows × 4 m were located randomly for recording biometrical observations at monthly intervals beginning from the third month after planning. While number of clumps/ millable canes were recorded on

plot basis,height of main shoot and width of third leaf were recorded on the basis of a sub-sample of 5 clumps per plot. Cane yield per plot was recorded along with the past-observation.

The yield of cane showed significant and positive correlation with number of clumps/canes, height of canes and also width of the third leaf. Regression analysis was undertaken with four models in which the variables were in orignal, logarithmic square root and reciprocal scales respectively. The multiple correlation coefficients were highly significant for all periods and all blocks. The partial regression eoefficient of yield on number of canes and height of cane/shoots was generally found to be significant and these two variables accounted for about 60 per cent of the variation in cane yield, when the crop was seven months old. Inclusion of other two variables did not improve appreciably the value of R. The study revealed that transformation of data from original scale does not improve the precision of the estimates of prediction.

4. KHOSLA, R. K., SINGH, D. P., KHATRI, R. S., BAL, S. D. and ANEJA, D. S. Annual Report of I. A. S. R. I. for the year 1977.

5. KHOSLA, R. K., SINGH, D. P. and BAL, S. D. I. A. S. R. I. Statistical News letter, Vol. IV, No. 3, July-Sept., 1978.

6. RAHEJA, S. K., GOEL, B. B. P. S., MEHROTRA, P. C. and RUSTOGI, V. S. Pilot Sample Survey for estimating yield of cotton in Hissar (Haryana)-Annual Report, 1976-77.

A pilot investigation for developing a suitable sampling technique for estimating the yield of cotton based on partial harvest data was carried out in Hissar district of Haryana State during Kharif 1976-77 by the Indian Agricultural Statistics Research Institute with the objectives of (i) developing a suitable sampling methodology for ertimating the yield of cotton and (ii) suggesting a suitable procedure building up advance estimate of cotton yield on partial harvest data. The data were collected from 36 randomly located plots each on high

yielding and local varieties of cotton. Biometrical observations were collected from a sample of 6 plants in each of the selected plots. The sample of plots was selected using stratified multistage random sampling design.

The results indicated that as against the present system of recording yield of all pickings for a fixed sample of fields under cotton, the technique of double sampling wherein a large sample of fields is taken for recording yield of only one picking (having high correlation with the total yield) and a sub-sample of fields for recording yield of all the remaining pickings was found to be more efficient and operationally more convenient too. Another procedure investigated for estimating the yield of cotton was of component sampling which consisted in estimating the yield of different pickings from independent samples of fields and then obtaining the average yield of cotton as the sum of the pickingwise averages. This procedure was found to be even more efficient than that of double sampling.

In the context of building up advance estimate of cotton yield much before the harvest operations are over, different regression models were studied with the help of data of first few pickings as well as biometric data like plant height and number of unpicked bolls. It was observed that the linear and Cobb Douglas models were quite appropriate for this purpose using the data of first two pickings only. Inclusion of biometric characters did not improve the prediction value of these models to any significant extent.

The results of the survey also showed that, since farmers can generally provide a fairly good idea of the expected number of pickings at first harvest itself, a quick check estimate of the average yield can be obtained by multiplying the first picking yield with the average expected number of pickings.

7. RAUT, K. C., SINGH, SHIVTAR and RUSTOGI R. L. Estimation of availability and cost of Milk production in I. C. D. area, Bikaner (Rajasthan).

The average dairy production of milk in the rural area of Bikaner district was about 197 tonnes of which 80 per cent was accounted for by cow milk. The average daily milk yield of a cow in milk was about 3.32 Kg. as compared to 5.36 Kg. per buffalo in milk. The corresponding estimates for a milch cow and a

milch buffalo were 2.21 kg and 3.84 kg respectively. The overall net cost per kg of cow milk was estimated to be 98 ± 2.6 paise including family labour and 70 ± 1.9 paise excluding it. The prevailing market rate of cow milk was Rs. 1.12 per kg. The net cost per kg of buffalo milk was 133 ± 5.9 paise when family labour was included and 99 ± 5.0 paise excluding it. The prevailing market rate of buffalo milk was Rs. 1.50 per kg. Feed cost accounted for 50 to 60 per cent and labour cost 24 to 33 per cent of the gross cost. The mortality rate was 6 per cent among milch cows and 7 per cent among milch buffaloes. It was as high as 18 per cent among the young stock. Of the total cow milk produced in a commercial milk producer households about 30 to 35 per cent was sold in each and the remaining season quantity consumed in fluid form or converted to milk products. Only about 10 per cent of the buffalo milk produced was sold.

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10. ABSTRACTS OF DISSERTATIONS APPROVED

Ph. D. Degree

1. AGARWAL, S. K*., On the use of Multi-auxiliary information in probability sampling.

Several methods of construction of indices of sizes of untits of a population using multi-auxiliary infomation such that the correlation between indices and the character under study is maximum have been discussed. These indices can be used for selection of the sample in sampling with varying probability and thereby the efficiency of the estimates of population mean/total from such samples can be increased. The methods suggested and their use in pps sampling has been illustrated with the help of several natural and hypothetical populations. The gain in

*Ph. D. Degree of the University of Jodhpur (Rajasthan)

efficiency was found to be enormous in several cases. The empirical studies carried out revealed that asymptotic variance of the estimation is not much different from the exact variance even for moderate values of N (say 20 or so).

The use of these indices can also be made in ratio and regression methods of estimation like a single auxiliary variate and the efficiency of ratio and regression estimators using indices was found to be more than the efficiency of multivariate ratio and multivariate regression estimators in most cases.

The use of indices in conjunction with ratio/regression estimators in cluster sampling as in the case of a single auxiliary variate was found to be more efficient than the latter one.

The efficiency of a ratio cum pps estimator using one auxilary variable for ratio estimation and another for selection and vice versa was found to be more than the efficiency of ratio estimator under pps or that of pps estimator based on a single auxiliary charater. In the ratio cum pps estimator the use of indices in place of an individual auxiliary variate was also considered.

(Guide : Dr. B. B. P. S. Goel)

2. SINGH, SHIVTAR, Sample surveys relating to economics of keeping cattle and buffaloes.

The feasibility of adopting sample surveys for studying the economics of keeping cattle and buffaloes has been, dealt with in this dissertation. Sampling design, the duration of the survey and the estimation procedure have been examined in detail. A method of projecting gross cost and index numbers based on it has been evolved. Level of feeding of animals along with their nutritional status has been examined. Least cost feeds have also been formulated using linear programming techniques.

It has been found that for achieving the major objectives, the duration of the survey relating to economics of keeping cattle and buffaloes could be one year instead of 3 years and about 32 clusters would be sufficient for estimating the cost of rearing yonng stock and maintenance of adult animals with 5 to 6 per cent standard error.

The method evolved of projecting the cost avoids conducting a second survey. It is found that the projections of cost obtained through the evolved method are within 10 per cent of the estimated obtained through the large scale sample surveys.

The existing level of nutrient intake for calves is found to be much below the level recommended by Sen and Ray in respect of DCP. This gap is found to very fairly widely but can be assumed to be about 75 per cent.

The results obtained on least-cost feeding schedules satisfying the current level of nutrient intake indicates 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 stack at a higher plane of nutrition. The linear programming solutions based on levels of nutrient intake recommended by Sen and Ray, indicate, as expected, that there would be scope for saving over the cost involved in feeding at the recommended level. But the savings would be of smaller order than those obtained in the previous linear programming solutions involving the current levels of nutrients intake.

[Guide : Dr. PREM NARAIN]

3. WIN, KYI, Some Investigations on Designs for Bio-assays.

This thesis deals with a new method of obtaining incomplete block designs for different biological assays.

The new technique consists in first deriving conditions under which important bio-assay contrasts are estimable free from block effects. Next these conditions

are explored to derive the designs. Through the present technique, a large number of designs have been obtained and the designs obtained by earlier workers come out as special cases of the designs reported herein.

Through the new technique, two series of incomplete block designs for Parallel Line (PL) assays have been obtained, one for symmetrical PL assays and the other for asymmetrical PL assays. These designs estimate all the three important contrasts, viz., preparation (LP). combind slope (L_1) and Parallelism (L_1), free from block effects. These designs are available in reasonably small number of replications. The plans for these designs are given. The procedure of analysis of these designs is also given and illustrated through numerical data.

For symmetrical slope ratio assays new incomplete block designs have been proposed. These designs estimate the Intersection (L_1) contrast free from block effects and provide better estimates for the slops than the existing designs.

In certain situations, the log-dose response relationship cannot be taken to be linear, and instead may be a parabola. For such situations also, new incomplete block designs have been suggested which estimate a number of important contrasts with full efficiency.

(Guide : Dr. ALOKE DEY)

M. Sc. Degree

1· JAT, P. R. Empirical studies on relative efficiencies of methods of stratification for multivariate survey.

For designing a multivariate survey one should know the relative efficiencies of the available methods i.e., Ghosh, Samantha and Rao's methods before hand. As these methods are based on different rules of stratification, theoretical comparisons among them is difficult. So in the dissertation an attempt was made to compare the relative efficiencies of these methods by empirical studies on two real populations. This had been achieved by comparing the generalised variance of sample means, worked out under the available methods. Secondly the individual

variances of sample means worked out under these methods are compared against the corresponding individual variance of sample means obtained by univariate method of stratification under proportional allocation.

This study reveals that when the correlation between the two characters under study (in the population) is not high, the methods may not vitiate the results but simplifies the computations involved. In that case the study may be carried out even without considering the existing correlation between the two characters under study. No general conclusion can be drawn between the Samantha and Rao's methods of stratification, while both turn out to be better than Ghosh's method.

(Guide : Dr. J. P. Jain)

2. SAKSENA, M. P. Some contributions on the use of statistical methodology for the investigation on rainfall pattern in relation to a crop.

The pattern and behaviour of rainfall at a place is beset with uncertainties and is subjected to large variations from year to year. Because of this, the fluctuations in crop production in different years are largely attributed to this variation alone. The contribution of rain to this variability becomes more pronounced where the crops are grown under rainfed conditions. Inspite of uncertainties and large variations in rainfall, there are always systematic patterns in its availability during some parts of the year. For the scientific crop production and efficient use of rainfall during different phases, it is essential to build up the suitable data which can help in proper planning and may give rise to stability in total crop production, with less hazards due to variations in rainfall.

Sowing period plays a very important part in crop production. The proper sowing period will not only ensure the availability of soil moisture in the subsequent crop phases but would also identify periods for the various other crop operations. Keeping this in view, in the present thesis, an attempt has been made to find out the suitable sowing date for a crop in Jalgaon district. This district

belongs to semi-arid region and have a comparatively hotter climate. In this district, Jowar is the main crop grown under rainfed conditions.

An advance knowledge of the probable dates of effective monsoon is of great importance to start agricultural operations such as land preparation and sowing. It is essential to identify the onsent of monsoon as distinct from the pre-mosoon showers. An analysis of daily rainfall data of Jalgaon district for the period 1946 to 1977 revealed that pre-monsoon showers of high intensitys are common. These rains cannot be considered as effective monsoon for agricultural operations, as they are followed by dry spells which adversely affect the germination of seeds resulting in crop failure. To avoid such contingencies and to identify the effective rains for agricultural operations, a rigourous analysis of the rainfall data was undertaken. In order to obtain the proper sowing date, four criteria were formulated, based on different amounts of rainfall in a spell of 5 to 10 days. The rainfall data for 32 years was studied for these four criteria. The results suggest that in the district the most suitable sowing date would be around 2nd July. After having fixed up the sowing date, the rainfall of different crop growth periods were obtained for different years and the mathematical distributions to this data were fitted. From the fitted distributions, the expected amount of rainfall to occur for different periods corresponding to 0.25 and 0.75 probabilities were worked out. The results however suggest that during each of these periods adequate amount of rainfall is available to the crop, if the sowing operations are done during the first week of July.

(Guide : Sh. P.N. Bhargava)

3. YERI, P.R. A statistical study of long term rotational experiment.

The evolution of suitable crop rotation forms an important aspect of agricultural research so as to increase the return per unit area without impairing the productivity of the land. The rotational experiments consist of growing a particular sequence of crops in a pre-determined order. Along with the rotation of crops very often some agronomic treatments are also included in order to see their long term effect on the soil fertility. The sequence of crops and agronomic treat-

ments are selected on the basis of their economic returns, as well as their long term effect on the fertility of the soil. Keeping in view their economic importance and long term planning of the country for increased production, a detailed investigation on this aspect was carried out by collecting the data on a long term experiment planned at Akola in Maharashtra State.

The experiement consists of seven crop rotation treatments. The crops included in rotation were cotton, jowar and groundnut. The data was available for 24 years.

The analysis of the experiment was carried out by the analysis of variance technique. The statistical problem involved in this type of experiment is mainly of estimating the component of variance due to year effect and plot effect. Testing the significance of different crop rotations and estimating S.E.s. for different rotational me ans were also worked out. It is observed that the continuous growing of cotton and "cotton preceeded by jowar", have given the lowest yield. The inclusion of groundnut in the rotation has substantially increased the yield.

For investigating the long term effect of each of the crop rotation and for each crop seperately, regression method of analysis was adopted. The deteriorating trend of productivity was observed. The fact has been amply shown by the negative regression coefficient for all crops in all rotations.

The economic analys is for different rotations suggest that minimum return was obtained by adopting cultivation of cotton every year. The maximum return per hectare was observed when cotton was grown in alternative years with groundnut grown in rotation (i. e, cotton-groundnut-cotton).

(Giude : Sh. P.N. Bhargava)

11. COMPUTER SCIENCE AND NUMERICAL ANALYSIS

During the quarter under report, the Division of Computer Science and Numerical Analysis continued to give facilities for data preparation and electronic data processing to various Institutes under I.C.A.R., Agricultural Universities, Agricultural Colleges and Faculties of other Universities and Directorate of Economics and Statistics.

(a) Computer Utilization :

About 2830 production jobs and 1500 testing jobs wers processed on the B-4700 system. The IBM 1620 computer system was utilized for processing about 250 production jobs and the work of Directorate of Marketing and Inspection, Faridabad, which had been taken up as a payment job.

(b) Programming Facilities :

During the quarter under report, about 50 Ph. D., 26 M. Sc. and 45 researeh workers were given help in analysing their research data on the computer. To meet their requirements, about 40 programmes were developed.

(c) Training Activities :

An advanced course in computer programming for the benfit of system programmers of the division had been organised by Dr. S.S. Pillai from 22nd Dec., 1978.

(d) Programme Library :

153 Programmes were added to the programme library by various scientists of the centre.

(e) Data Bank :

A selective dissemination serivce based on AGRIS data base being received from Vienna every month has started functioning in the computer centre. Scientists can obtain references on selected topics of their interest from this computerised information system.

(f) Machanical Tabalation Unit :

During the quarter under report, about 3 lakh cards were punched and verified for the various schemes of the Institute and research scientists from Institutes under ICAR, Agricultural Universities and other organisations utilising the data processing at IASRI. Listing and sorting work of research workers and projects were also taken up.

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12. LIBRARY

(a) During the quarter under report, 65 books on various subject field of the Institute were added to the Library.

(b) During the quarter under report, the following reprints were procured for distribution by the Library.

S. No.	Author	Title	Source
1.	A. CHACKO, & A. DEY,	On the estimation of total weight chemical balance weighing designs.	Australian Jr. Stat. 20 (1) 1978, 83-86.
2.	DHARMENDRA KUMAR & PREM NARAIN	Lactation correlation factors and repeatability of economic characters in Sahiwal cows & Murrah buffaloes.	Indian Jr. Dairy Sci., 31-3-1978.

3. K.C. Gautam, & Padam Singh — A note on prediction-the case of finite populations. — Jr. of Indian Socy. of Agri. Stat. XXX, No. 1 June, 1977.

4. J.P. Jain — Stochastic models of structure of dairy female population. — Jr. of Indian Socy. of Agri. Stat. Vol. XXX No. 1 June, 1977.

5. Randhir, Singh — A note on the use of incomplete multi-auxiliary information in Sample Surveys. — Australian Jr. Stat. 19 (2) 1977, 105-107.

6. R.P. Singh & A.K. Nigam, — A class of optimum designs for cultivators field trials. — Jr. of Indian Socy. of Agri. Stat. Vol. XXX No. 1 June, 1977.

7. A.H. Manwani & K.B. Singh — Studies in systematic sampling for two dimensional finite population with special reference to survey for crop estimation of guavas. — Jr. of Indian Socy. of Agri. Stat. Vol. XXX No. 1 June, 1977.

8. Padam Singh — The selection of samples of two units with inclusion probabilities proportional to size. — Biometrika (1978), 65(2) pp. 450.

9. Prem Narain — Optimum designs for progency testing with minimum costs. — Indian Jr. Anim. Sci. 48(10) 708-711, Oct. 1978.

10. Puri P.D — Balanced factorial experiments II. — Commun. Stat. Theor. Math. A 7(6) 591-605, (1978).

(c) During the quarter under report, nearly 3000 persons visited the Library.

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13. SEMINAR ASSOCIATION

During the quarter under report, 16 seminar talks were given by the distin-
guished visitors, scientists and the students.

S. No.	*Speaker*	*Topic*

A — Distinguished Visitors

1. Dr. WOLFGANG BAIR
   Chief Agricultural Meteorology,
   Dept. of Agriculture, Canada
   and President, Commission on
   Agricultural Meteorology
   (W.M.O.).

   Crop Wheather Models and
   their use in yield Assessment.

2. Dr. R.D. NARAIN, Director,
   Statistics Division, FAO of the
   U.N , Rome, Italy.

   General talk

3. Dr. Douglas,   Impact of Agricultural Development
   F. Barnes Research Fellow,   on ratio of Landless Labourers to
   University of Illinois (USA)   Cultivators.

B—Scientists of the Instt.

4. S.D. Bokil,   Evaluatlon of Progress under Planning.
   Scientist (S-3)

5. Dr. A. Dey,   Fractional Factorials for Asymmetrical
   Scientist (S-3)   Experiments.

6. K.B. Singh,   Increase in Milk Production by better
   Scientist-S1   management of animals.

7. Dr. D. Singh,   Some problems of Agricultural Statis-
   Director.   tics in South-East Asian Countries.

8. Dr. A.K. Banerjee,   Some investigations on yield and area
   Scientist (S-2)   under high yielding varieties of rice in
                         dIfferent districts.

C—Students

9. S.K. Ghabru,   Utility of Computer Programming in
   Ph. D. Student.   Soil Classification ond Soil Surveys

10. H.B. Choudhary,   Genetic Linkage, its Detection and
    Ph. D. (Gen.) Student   Estimation.

11. O.P. Sharma,   Heterogeneity of Error varianees in
    M.Sc. (Agri.) Student   combined analysis of series of Experi-
                         ments.

12. M.A. REHMAN,   A general method of detecting Additive
    Ph. D. (Gen.) Student   Dominance and Epistatic variation in
                                    material traits.

13. S.T. BHAKTA,   Genotype-Environment interaction, its
    Ph. D. (Gen.) Student   measurement and significance in Plant
                                    Breeding.

14. P.R. YERI,   A study of Long term Rotational
    M. Sc. (Agri. Stat.) Student   Experiment.

15. ANEEL V. KHANDEKAR,   Analysis of Variance in analytical
    Ph. D. Student   Chemistry.

16. N.P. SINGH,   Two-way Elimination of Heterogeneity.
    Ph. D. Student

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14. PAPERS PRESENTED AT INTER-ORGANISATIONAL SEMINARS, WORKSHOPS, ETC.

The title and authorship of papers presented and the particulars of the work-shop, seminars, etc. at which these were presented, are given below :—

(i) Seminar on the Impact of Computers on the statistical system in India-organised by Central Statistical Organisation (C.S.O.), New Delhi during

3rd-4th November, 1978.

PILLAI, S.S. Present state of development of Computer Systems with Special reference to Statistical applications.

(ii) International Symposium on Pottassium, organised by the Potash Research Institute of India held at New Delhi on 16th and 17th November, 1978.

1. KRISHNAN K.S. Response of high yielding varieties of wheat to fertilizer application with special reference to potassium.

2. KRISHNAN, K.S. Response of hybrid coarse cereals to fertilizer application with special reference to Potassium.

(iii) Seminar on "Reproduction and Artificial insemination (A.I.) of Buffaloes" held at N.D.R.I., Karnal (Haryana) under the auspices of F.A.O., SIDA and Govt. of India during 4th to 15th Dec. 1978.

PILLAI, S.S. Processing of data of fast computers.

(iv) Symposium on "Mathematical Modelling and its applications" organised by the Department of Mathematics of I.I.T., Kanpur (U.P.) during December, 1978

NARAIN, P. A stochastic modelling in population genetics.

(v) 32nd Conference of the Indian Society of Agricultural Statistics held at Punjab Agricultural University, Ludhiana (Punjab) from 21st to 23rd December, 1978.

1. AGARWAL, RANJANA, JAIN, R.C. and JHA, M.P. Forecasting of rice yield using climatic variables.

2. BAJPAI, S.N. and NIGAM, A.K. On optimum amount of Experimentation in Animal Nutrition.

3. BOKIL, S.D. Trend of Wheat in Pre-H.Y.V. and Post H.Y.V. Periods.

4. GOEL, B.B.P.S. and GARG, SAVITA. Use of Auxiliary Information in cluster formation.

5. MAINI, I.S. and GOEL, B.B.P.S. Estimation of Production of Hides and Skins using random sampling techniques.

6 NADKARNI, U.G., SOMAYAZULU, L.B.S. and JAIN, T.B. Cost of maintainance of birds and cost per egg in commercial poultry farmers of different categories.

7. NARAIN, P. Strategy of Cross-breeding in livestock and poultry.

8. PANDEY, R.K. and CHOWDHARY, H.B. Study of labour utilisation in crop production-Rural area of Delhi.

9. RAHEJA, S.K. and MEHROTRA, P.C. A study of the storage facilities, practices and problems in cereals in Delhi State.

10. RAI, S.C. Estimation from a bivariate population in cluster and two-stage sampling.

11. RAI, S.C. and RAO, P.P. Use of ranks in groups of Experiments.

12. RAUT, K.C., SINGH, SHIVTAR and CHANDRA, VIMAL, The economic animal-Some production characteristics.

13. SETHI, A.S. and SRIVASTAVA, A.K. Application of ratio estimator with Post-Stratification.

14. SINGH, JAGMOHAN. A study on effect of spacing on yield of Apple-U.P.

(viii) Symposium on "Mathematical modeling and its application" organised by the Department of Mathematics of the Indian Institute of Technology (I I.T.) Kanpur (U.P.) during December, 1978.
Dr. Prem Narain.

(ix) Workshop on Social Benefit Cost Analysis held at Indian Institute of Public Administration (I.I.P.A.), New Delhi during 13th to 19th December, 1978.
Dr. R.K. Pandey.

(x) 32nd Conference of the Indian Society of Agricultural Statistics (I.S.A.S.) held at the Punjab Agricultural University, Ludhiana (Punjab) from 21st to 23rd December, 1978.
Dr. D. Singh, Dr. Prem Narain, Sh. S.K. Raheja, Sh. S.D. Bokil, Dr. K.C. Raut, Sh. R.K. Khosla, Sh. Jagmohan Singh, Sh. Randhir Singh, Sh. M.L. Sahani, Sh. Shivtar Singh, Sh. K.B. Singh, Sh. H.V.L. Bathla, Mrs. Ranjana Kant and Sh. S.N. Bajpai.

(xi) 8th National Seminar of Indian Association of Scientific Library and Information Centres held at Indian Institute of Technology I.I.T., Kanpur (U.P.) from 26th to 29th December, 1978.
Sh. S.S. Srivastva.

(xii) National Symposium on Plant and Animal Genetic Resources held at Indian Agricultural Research Institute (IARI), New Delhi from 28th to 30th December, 1978.
Dr. Prem Narain (Secretary of one of its sessions) and Sh. S.N. Mathur.

16. MISCELLANEOUS

(a) Appointments, Promotions, Assessments, Transfers, etc.

(i) Appointments/Assessments :

The following Scientists S-2 have been appointed to S-3 grade of A.R.S. w.e.f. 1-7-77.

1. Dr. B B.P.S. Goel
2. Dr. Aloke Dey
3. Sh. T. Jacob

The following Scientists S-1 have been appointed to S-2 grade of A.R.S. with effect from the date mentioned against them :

1.	Shri V.S. Rustogi	1-7-76
2.	Shri L.K. Garg	1-7-76
3.	Sh. P.N. Soni	1-7-76
4.	Sh. A.K. Srivastava	1-7-77
5.	Sh. S.C. Rai	1-7-77

The following Scientists 'S' have been appointed to S—1 grade of A.R.S. w.e.f. 1-7-76.

1.	Sh. U.N. Dixit	11.	Sh. Jagmohan Singh
2.	Sh. S.P. Verma	12.	Sh. D.S. Sehra
3.	Sh. Darshan Lal Ahuja	13.	Sh. P.K. Batra
4.	Sh. Lal Chand	14.	Sh. Parbhat Kumar
5.	K. C.Gupta	15.	Sh. R.P. Jain
6.	Sh. G.C. Chawla	16.	Sh. Bharat Singh
7.	Sh. H.C. Gupta	17.	Sh. R.C. Goyal
8.	Sh. Jose Abraham	18.	Sh. Chandrahas
9.	Sh. G.S. Bassi	19.	R.K. Mahajan
10.	Sh. Khubi Singh		

Sh. S.K. Suri has been appointed to T-6 grade of the Technical Service w.e.f. 1-10-75

(ii) Transfers :

1. Dr. G.V.S.R. Krishna, Scientist S-1 transferrrd to Indian Oilseed Committee, Hyderabad w.e.f. 1-7-78.

2. Sh. Y. N. Nigam, Senior Administrative Officer reverted back to ICAR w.e.f. 26-10 78.

3. Sh. T.C. Sachdeva joined as Senior Administrative Officer at the IASRI vice Sh. Y.N. Nigam w.e.f. 26-10-78.

4. Sh. J.C. Malhotra, Scientist S-2 who was on deputation with Department of Agriculture as Deputy Director (Agri. Census) came back to IASRI w.e.f. 26-12-78.

(b) Fellowship :

The following followships have been awarded from October to December, 1978.

Courses	No. of fellowships	Amount of fellowships
1. P.S.C.C.	10	@Rs. 300/- p.m.
2. Diploma	3	@Rs. 400/- p.m.
3. M. Sc. I year	4	@Rs. 300/- p.m.
4. M. Sc. II year	3	@Rs. 300/- p.m.
5. Ph. D. I year	4	@Rs. 400/- p.m.
6. Ph. D. II year	3	@Rs. 400/- p.m.
7. Ph. D. III year	2	@Rs. 500/- p.m.

(c) Management Committee.

No meeting of the Management Committee could be held in the quarter as the ICAR are considering reconstitution of the committee.

(d) **Joint Council**

The meetings of the Joint Council of IASRI were held on 2-11-78, and 26-12-78.

(e) **Grievance Cell**

The meeting of the Grievance Cell, IASRI was held on 27-11-78.

(f) **Exhibition Room**

During the quarter under report, 5 new charts were prepared by the Artist for for the Exhibition Room. The Exhibition Room was decorated with new panels etc.

(g) **Distinguished Visitors**

Dr. Wolfgang Bair Chief, Agricultural Meteorology Department of Agriculture, Canada and President, Commission on Agricultural Meteorology (W.M.O) visited the Institute and delivered a talk in the second week of October, 1978 on Crop Weather Model and their use in yield assessment.

Dr. R.D. Narain, Director, Statistics Division, Food and Agricultural Organisation (F.A.O.) of the United Nations (U.N.), Rome, Italy visited the Institute and delivered a general talk during the 4th week of November, 1978.

Dr. Douglas F. Bernes, Research Fellow, University of Illinois, U.S.A. visited the Institute and gave a talk on "Impact of Agricultural Development on ratio of Landless Labourer to Cultivators" in December, 1978.

(h) **Other Information**

(i) Dr. D. Singh, Director, attended the meeting of the Standing Committee for screening and selections in respect of the nomination for the scheme of Professors of Eminance/National Fellow on 12th Oct., 1978 in Krishi Bhavan, New Delhi.

He attended the meeting of the Sub-Committee of governing body on 17th October, 1978.

He delivered a talk on Monitoring and concurrent Evalution of Applied Nutrition Programme to the participants of the 3rd Training programme on 16 November, 1978 held by the Department of Rural Develoment, Govt. of India, New Delhi.

He delivered a lecture-discussion on the topic "Sample Survey Methods in Education in the UNESOO" sponsored "National Training Seminar on Methods for Projecting School enrolement" at the National Staff College for Educational planners and Administrators, Hyderabad (A.P.) on 25th November, 1978.

He addressed the participants of the workshop on "Social Cost Benefit Analysis" organised by tne Indian Institute of Public Administration (I.I.P.A.), New Delhi held during middle of December, 1978 (13th to 19th Dec., 1978).

He was nominated as ICAR representative to the Meteorological Programme Advisory Committee (MPAC) Government of India, New Delhi.

He was a member of the "Expert working Group on Statistical Design, Data Management and Data analysis" of the Central Road Research Institute, (C.R.R.I), New Delhi.

Dr. Singh was one of the signatories to Memorandum of Association of India Association of Social Science Institute (IASSI), New Delhi.

(ii) Dr. Prem Narain, Joint Director (Trg. & Res.) was the chairman of the meeting of the Selection Committee for appointment of research fellows in the Council of Scientific and Industrial Research (CSIR), New Delhi.

He was elected a member of the Industrial Statistical Institute, Hague, Netherlands.

He was nominated member for the Committee on Improvement of Agricultural Statistics (CIAS) set up by the Government of India, Ministry of Agriculture and Irrigation, New Delhi.

He was nominated a member of the Executive Committee of the Indian Society of Animal Genetics and Breeding.

He was elected a member of the Executive Council of the Indian Society of Agricultural Statistics (ISAS).

He acted as a secretary of one of the Sessions of the National Symposium on "Plant and animal genetic resources" held at IARI, New Delhi from 28th to 30th Decembe, 1978.

He attended meeting of the Achievement and Audit Committee of the Central Marine Fisheries Research Institute (CMFRI), Cochin (Kerala) during Dec., 1978.

He discussed with Shri S.C. Ray, President, Indian Dairy Science, regarding theme of the XV Dairy Industry Conference.

(iii) Dr. S.S. Pillai, Joint Director (C.C.) was nominated as a member of the Information Retrieval Advisory Committee of Indian National Scientific Decumentation Centre (INSDOC), New Delhi.

He was nominated a member of the Technical Evaluation Committee to evaluate computors tendered for National Council of Applied Economic Research (NCAER), New Delhi.

(iv) Shri K.S. Krishnan, Head (Crop Sciences) was deputed to participate as a trainee at the Central Staff College of Agriculture Hyderabad for the training arranged for Senior Research Managers of the ICAR Institutes held from 18th to 30th Dec., 1978.

(v) Shri M.P. Jha, Head (Crop Farecasting Mothodology), visited Simla in

November, 1978 and discussed the technical programme of Pre-Harvest fore-casting (PHF) project on apple to be initiated shortly in H.P. with the officials of the Directorate of Horticulture (H.P.).

(vi) Dr. Padam Singh, Scientist (S3) attended a meeting on "Identification of Specific priority topics for application of Satellite remote sensing techniques in collaboration with Indian Space Research Organisation (ISRO), New Delhi in Sept. 78.

(vii) Dr. R.K. Pandey, Scientist (S3), took over as Head of the Division of Econometric Analysis. The division was formed on 15th November, 1978.

He helped in organising a training course on the constraints analysis from 6th Nov., 78 to 11th Nov. 1978.

(viii) Shri S.D. Bokil, Scientist (S3), acted as convener of a symposium on "Inventory and Storage Problems in Foodgrains and other Agricultural Products" of the 32nd Annual Conference of Indian Society of Agricultural Statistics (I.S.A.S.) held at Ludhiana (Punjab) from 21st to 23rd Dec., 78.

(ix) Dr. A.K. Nigam, Scientist (S2), worked as Abstractor for (a) Mahematical Review (b) Zentral Blatt Fiir Mathematika (c) Executive Sciences Institute U.S,A.

(x) Sh. S.N. Mathur, Scientist (S2), was made a member of an expert working group on Statistical Design, Data Management and Data analysis for "Road usar cost study in India" to be implemented by the Central Road Research Institute (CRRI), New Delhi under an agreement of Ministry of Shipping and Transport (Road Wing) Govt. of India New Delhi with World Bank.

(xi) Dr. J.P. Jain, Scientist (S2), was taking regular lectures on Statistical Genetics for M.A./M. Sc. Students of University of Delhi, Delhi.

(xii) Sh. P.C. Mehrotra, Scientist (S2), delivered a lecture on "Sample surveys for methological investigations into High Yielding Varieties Programme" (HYVP) to a batch of trainees of the International Statistical Education Centre, (I.S.E.C.), Calcutta (W.B.).

(xiii) Sh. A.S. Gupta, Scientist (S1), worked as a Central (Govt. of India) representative for "All India Jowar Crop Competition" for the year 1978-79 in District Mandsore (M.P.).

(xiv) Sh. K.B. Singh, Scientist (S1), delivered a lecture to a batch of the trainees of the International Statistical Education Centre (ISEC), Calcutta (W.B.) on 21st Nov., 78 in IASRI New Delhi on the topic" Surveys conducted by IASRI on Livestock Products and Method of estimation adopted".

(xv) Mrs. Ranjana Kant, Seientist (S1), and Sh. R.C. Jain, Scientist (S1), visited Indian Meteorological Department (IMD), Pune (Maharshtra) for discussing Methodology for Crop-weather relationship.

दिल्ली में सब्जियों के मूल्य-विस्तार

सब्जियाँ मानव आहार में धातुओं और विटामिनों का एक आवश्यक साधन निर्मित करती हैं। तो भी उनकी कोटि (Qualities) एक आरक्षित छोटी अवधि में गिरने लगती है और इसी कारण से उनका या तो उपभोग करना पड़ता है या फिर उनकी कटाई के एक या दो दिन के भन्दर बेच देना पड़ता है। प्रचलित बाजार के ढाँचे में सब्जियाँ भरततः उपभोक्ता तक पहुँचने के पहले कुछ ही घंटों में बहुत से विचौलियों (Intermediaries) के हाथों से गुजर जाती हैं। यह प्रायः बहुसभ किया गया है कि विपणन (Marketing) की क्रमिक अवस्थाओं पर प्रारंभिक विक्रय मूल्य में लाभ के अनुपात जुड़े होने की वजह से उपभोक्ता द्वारा खर्च किये गये रुपये में उत्पादक का थोड़ा ही हिस्सा होता है। इसलिए विपणन की विभिन्न अवस्थाओं पर सब्जियों के आरोपित (Relative) मूल्य विस्तार दूसरे शब्दों में उपभोक्ता द्वारा दिये गये मूल्य में विभिन्न विचौलियों का हिस्सा, का अध्ययन करना लाभ प्रद होगा। इस प्रकार का अध्ययन सब्जी उत्पादकों के लाभ को बढ़ाने वाले परिवर्तित स्रोतों या विपणन के ढाँचे को भी उपलब्ध करेगा। इस विषय वस्तु को दृष्टि में रखते हुए एक प्रायोगिक सर्वेक्षण (Pilot Survey) संस्थान द्वारा १९७६-७७ में दिल्ली में किया गया। उत्पादकों एवं माखाखोरों से आंकड़े इकट्ठे करने के लिए आजाद पुर मंडी में दो थोक विक्रेताओं से युक्त ३ से ५ समुदाय और २ मंडाखोरों से युक्त ३ से ५ समुदाय यादृच्छ (Randomly) रीति से चुने गये। विपणन की बहुत सी विषय वस्तुओं पर आंकड़े एकत्रित करने के लिए थोक विक्री वाली मंडी में पांच गणक (Enumerators) नियुक्त किये गये। प्रत्येक गणक को दो थोक विक्रेताओं वाला एक समुदाय और दो माखाखोर वाला एक समुदाय निर्दिष्ट किया गया। सब्जियों की पहुँच, प्रयोग किये गए वाहन, वाहन के लिए दिये गये धन, विभिन्न प्रकार की बिकी हुई सब्जियों की मात्रा, उत्पादक द्वारा प्राप्त धनराशि विक्रेता और खरीददार द्वारा दिये गये मूल्यों (Charges) आदि पर आंकड़े एकत्रित करना उनका कर्तव्य था। प्रत्येक गणक के लिए निम्नलिखित योजना के अनुसार

शाहदरा और दूसरी छोटी मंडियों में प्रचलित दूसरी पद्धति में ठप्पज थोक बिक्रेता द्वारा पुनः कमीशन के आधार पर सीधे फुटकर बिक्रेता को ५ कि० ग्रा० या इससे थोक बिक्री में नीलाम की जाती है। फुटकर बिक्रेता तो सब्जियों को या तो अपनी दुकान पर फुटकर बिक्री के लिए ले जाता है या कभी-कभी इसकी मंडी में ही बेच देता है। इस प्रकार छोटी मंडियां, थोक और फुटकर दोनों प्रकार के बाजार की तरह सेवा करती हैं।

वर्ष के अन्तिम चतुर्थ भाग की मुख्य सब्जियां टमाटर, बैंगन, बन्दगोभी, फूलगोभी और मटर हैं। आजादपुर और दरियागंज के लिए विपणन की भिन्न-भिन्न अवस्थाओं में इन सब्जियों के मूल्य तालिका ९ में दिये गये हैं।

तालिका—९

अक्टूबर-दिसम्बर, १९७७ की अवधि में अधोलिखित सब्जियों के औसत मूल्य

[रु० प्रति कि० ग्रा०]

सब्जियां	बाजार				
	आजादपुर			दरियागंज	
	उ	म	फ	उ	फ
टमाटर	.८२	१.४६	१.०६६	१.६०	२.०७
बैंगन	.६०	.७४	१.२०	.६६	१.१२
बन्दगोभी	.६७	१.०१	१.२५८	१.२४	१.२५
फूलगोभी	१.०५	१.३६	१.६५	२.२५	१.६७
मटर	२.४६	२.६६	२.६२	२.६७	३.८६

उ=उत्पादक, म=माशाखोर, फ=फुटकर विक्रेता

सब्जियों के लिए एक सामान्य स्तर तक खर्च करने की क्षमता रखता है जिसका फुटकर बिक्री तथा शिखर ऋतु (Peck Season) में लाभ उठाता है जबकि सब्जियाँ भारी मात्रा में उपलब्ध होती है और थोक मूल्य स्पष्ट रूप से नीचे होते हैं।

यह इस प्रकार से प्रतीत होगा कि उत्पादक और उपभोक्ता दोनों के हित के लिए सब्जियों का विपणन, उपभोक्ता तक सब्जियों के पहुँचने से पहले, एक या अधिक से अधिक दो बिचौलिये रखकर सरल बनाया जाना चाहिए। यह या तो सब्जी की सहकारी समितियों की स्थापना करके जो कि उगाने वालों या थोक विक्रेताओं से सीधे खरीद सकें अन्यथा छोटे उपभोक्ता सहकारी समूह बनाकर जो इसी प्रकार से थोक स्तर पर सब्जियाँ खरीद सकें, पूर्ण किया जा सकता है।

[अनुवादक-श्री शिवप्रसाद गुप्ता
निरीक्षक-श्री डी०पी० सिंह]

OTHER PUBLICATIONS

	Price
Sample Survey for Estimation of Milk Production in Punjab (1956-57) —*V.G. Panse, Daroga Singh, and V.V. R. Murty.*	Rs. 5.50
Sample Survey for Estimation of Milk Production in Eastern Districts of U.P. (1957-59) —*V.G. Panse , Daroga Singh and V.V.R. Murty.*	Rs. 4.25
Cost of Milk Production in Madras (1963)—*V.G. Panse, V.N. Amble and K.C. Raut.*	Rs. 4.75
Green Manuring of Crops (1965)—*V.G. Panse, T.P. Abraham and C.R. Leelavathi*	Rs. 2.50
Cost of Milk Production in West Bengal (1967)—*V.G. Panse, V.N. Amble and K.C. Raut.*	Rs. 5.50
Monograph on Estimation of Wool Production (1970)—*Daroga Singh, M. Rajagopalan and J.S. Maini.*	Rs. 2.ᴸ
Monograph on Estimation of Milk Production (1970)— *Daroga Singh, V.V.R. Murty and B.B.P.S. Goel.*	Rs. 4.10
Survey on Mango and Guava in U.P. (1971)—*G.R. Seth, B.V. Sukhatme and A.H. Manwani.*	Rs. 3.50
Incidence of Pests and Diseases on Paddy (1971)—*G.R. Seth, D. Singh, M.G. Sardana and R.K. Khosla.*	....
Cost of Milk Production in Delhi (Revised in 1972)— *D. Singh and K.C. Raut.*	Rs. 9.00
Survey on Vegetable in Rural Areas of Delhi (1973)—*B.V. Sukhatme, A.H. Manwani and S.R. Bapat.*	Rs. 3.50
Economics of raising Cattle and Buffaloes (1973)—*K.C. Raut, V.N. Amble and Shivtar Singh.*	....
Estimation of Availability and Cost of Production of Milk (1975)—*K.C. Raut, D. Singh and Shivtar Singh.*	....
Monograph on Study of Size and Shape of Plots for Field Experiments on Vegetable and Perennial Crops (1975)— *D. Singh, P. N. Bhargava, R.K. Khosla and Asha Saksena.*	....
Monograph on Sample Survey Techniques for estimation of Egg Production (1975)—*D. Singh, B.B.P.S. Goel, J.N. Garg and D. V.S. Rao.*	Rs. 5.00

PERIODICAL PUBLICATIONS

ANNUAL REPORT

The Annual Report issued by the Institute cover all the aspects of its functions and activities and provide useful information to research workers in the field of agricultural statistics.

NATIONAL INDEX OF AGRICULTURAL FIELD EXPERIMENTS

The results of statistical analysis of the data pertaining to agricultural field experiments (other than varietal trials) conducted at the various research stations all over the country, are published in the forms of compendia series. Three such series in respect of the various States pertaining to the periods 1948-53, 1954-59 and 1960-65 have already been completed and the data for the period 1966-71 have been collected and are under process.

The prices of the different volumes are given below :—

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Uttar Pradesh	Rs. 35.75	Rs. 42.10	*
West Bengal	Rs. 7.75	Rs. 8.15	Rs. 7.00
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Total for the set	Rs.184.75	Rs.227.30	*

*Price not yet fixed

OTHER PUBLICATIONS (Contd.)

Price

Functions and Activities of IARS (1976)—*P. Narain, 4. Dey and P.P. Rao.* ....

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Monograph on Statistical Studies on the Behaviour of Rainfall in a Region in Relation to a crop (1977)—*P.N. Bhargava, P. Narain, Daroga Singh and Asha Saksena.* ....

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Monograph on Sample Survey Techniques for Estimation of Meat Production (1977)—*D. Singh, M. Rajagopalan, J.S. Maini and K.B. Singh.* ....

Sampling methodolgy for estimation of egg production and study of poultry keeping practices (1977)—*D. Singh, B.B.P.S. Goel, J N. Garg, K. B. Singh and M. Rajagopalan.* ....

Handbook on Methods of collection of Agricultural Statistics in India. (1978)—*K.C. Raut and D. Singh.* Rs 4.00

Hand Book on Sampling methods (1978)—*D. Singh, Padam Singh and Pranesh Kumar.* Rs. 10.00

Impact of Milk Supply Schemes on the rural economy in milk collection areas (1978)—*J. P. Jain, K. P. S Nirman, K. G. Aneja, and Prem Narain.* ....

Estimation of area of grazing land and its utilisation, Jhansi District (U.P.) (1978)—*K. C. Raut, U. G. Nadkarni P. R. Srinath and B. C. Saxena.* ....

Estimation of Production of Lac (1978)—*D.V.S. Rao and S. D. Bokil.* ....

Sampling Methodology for estimation of Meat Production (1978)—*D. Singh, J. S. Maini, B. B. P. S. Goel and G. S. Bassi.* ....

Annual Index of Agricultural Field Experiments Vol. IV, for the Year 1974-75 (1978) - *P.N. Bhargava, Prabhat Kumar and H.V.L. Bathla.* ....

Report of Sample Survey for estimation of production of Hides and Skins in Punjab during 1974-76 (1978)—*J.S. Maini, B.B.P.S. Goel and D.C. Dahiya.* ....

Pilot Sample Survey for estimating yield of cotton in Hissar (Haryana) during 1976-77 (1978)—*S.K. Raheja, B.B P.S. Goel, P.C. Mehrotra and V .S. Rustogi.* ....