

I A R S  
STATISTICAL NEWSLETTER

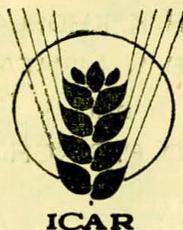
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INSTITUTE OF AGRICULTURAL RESEARCH STATISTICS  
(I.C.A.R.)  
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## PREFACE

This is the seventh issue of the *IARS Statistical Newsletter* and covers the activities and allied information in respect of this Institute during the quarter July to September, 1976.

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

I am thankful to all the officers and other members of the staff of the Institute who supplied the requisite material for this issue of the *IARS Statistical Newsletter*. I am also thankful to my colleague, Dr. Prem Narain, Senior Professor for his going through the material.

D. SINGH  
DIRECTOR,  
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NEW DELHI-110012.

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## **1. IMPACT OF MILK SUPPLY SCHEMES ON THE RURAL ECONOMY IN THE MILK COLLECTION AREAS OF DELHI MILK SCHEME**

As a result of the assured market and guaranteed price of milk offered by the urban milk supply schemes, it is likely that the milk producers in the rural milk collection areas of these schemes will receive an incentive for higher production of quality milk and there is likely to be general improvement in their economic status. With the object of developing a suitable sampling technique for assessing the impact of urban milk supply schemes as measured in terms of various response indicators, the benchmark and repeat surveys in the rural milk collection areas of Delhi Milk Scheme (DMS) were carried out for the purpose during 1966-67 and 1972-73 respectively. The relevant response indicators studied for the purpose included the changes in the number and breed of milch animals, productivity of milch animals, milk production and its mode of utilization in the area, feeding status of milch animals in terms of both quantity and quality, cropping and employment patterns in the area, gross annual income of both milk producers and non-milk producers and receptivity of milk producers to improved animal husbandry practices. The salient results of the study are as follows :

### **(i) Structure of the population**

The original classification of the population into supplying and non-supplying villages existing at the time of benchmark survey underwent a substantial change at the time of repeat survey. The change was proportionately more from supplying to non-supplying compared with that from non-supplying to supplying. Despite this, however, on the whole there was an increase in the number of supplying villages by about 6 and 9 per cent in the respective two strata. At the time of benchmark survey, about two-thirds of the households in both supplying and non-supplying areas were engaged in milk production and the remaining one-third were non-milk producers. Of the milk producer households, about 33 per cent

in the supplying area and 17 per cent in the non-supplying area were commercial. Among commercial milk producers, in the supplying area, about three-fourths supplied milk to organised agencies and the remaining one-fourth to unorganised agencies. DMS alone lifted milk from as many as 86 per cent of the households supplying milk to organised agencies. Further, about 70 per cent of the milk producer households were cultivators in both the areas, the proportion of cultivators among non-commercial milk producer households being 20 per cent more than that among the commercial households. Among non-milk producers on the other hand, only 20 per cent of the households were cultivators in both the areas. The structure of population underwent a change at the time of repeat survey. The number of households engaged in milk production marginally decreased in both the areas though there was a marginal increase in the proportion of commercial households among milk producers and that in the proportion of milk producers who supplied milk to organised agencies. Thus, contrary to the expectation that the proportion of milk producing families particularly those of the commercial type would increase as a result of the operation of DMS in the area, the impact of DMS was seen to be negative though of negligible magnitude.

#### **(ii) Average milk yield**

The average daily milk yield per cow in milk maintained by the commercial households decreased on the second occasion from 2.7 Kg to 2.1 Kg in the supplying area and from 3.1 Kg to 1.9 Kg in the non-supplying area. In non-commercial households, the milk yield decreased between the two occasions from 2.7 Kg to 2.4 Kg in the supplying area but increased from 1.9 Kg to 2.8 Kg in the non-supplying area. The corresponding milk yield of a buffalo in milk in commercial households decreased on the second occasion from 4.2 Kg to 4.0 Kg in the supplying area but increased from 4.2 Kg to 4.6 Kg in the non-supplying area. Almost similar trend in the yield rates was observed for the non-commercial milk producer households. The estimates of impact in respect of the average milk yield of both cows and buffaloes showed that the DMS failed to make any contribution by way of increased milk yield in the milkshed area.

#### **(iii) Total daily milk production**

On an average, the total daily milk production in the supplying area on both the occasions was of the order of 260 tonnes to which cows contributed about 25 tonnes and buffaloes 235 tonnes on each occasion. In non-supplying area, however, the total daily milk production increased on the second occasion from 600 tonnes to 1,000 tonnes, the increase being of the order of 66 per cent for both cow

and buffalo milk. The increase in the non-supplying area was due to an increase in the number of households, the number of milch animals and the average milk yield per milch animal.

Bulk of the milk production (90 per cent) was from buffaloes on both the occasions. Season-wise, the production was highest during winter but lowest during rainy in both the areas and on both the occasions. In supplying area, both commercial and non-commercial milk producer households contributed almost equally to the total milk production on both the occasions. In non-supplying area, however, the contribution from non-commercial households exceeded that from commercial households by two times on the first occasion and by two and a half times on the second occasion.

The DMS, despite its early commissioning, proved to be quite ineffective in being instrumental either in enhancing milk production or in inducing the farmers to take to dairying as a main vocation.

#### **(iv) Utilization of milk**

In supplying area, about 72 per cent of the milk produced in commercial households was sold on both the occasions as against non-supplying area where the proportion sold increased from 35 per cent on the first occasion to 62 per cent on the second occasion. This, however, should not be construed as showing a negative impact as there did not exist much scope for further increase in the sale of milk in supplying area.

The percentage consumption of fluid milk in the non-commercial households of supplying area was almost double of that in commercial households on both the occasions but no such marked trend was observed in the case of non-supplying area. Further, in supplying area, there was a marginal increase in the percentage consumption of fluid milk on the second occasion in both commercial and non-commercial households as against a sizeable drop in the non-supplying area.

The proportion of milk converted into milk products by commercial households was of the order of about 10 per cent in the supplying area and 25 per cent in the non-supplying area on both the occasions. In non-commercial households, however, the rate of conversion into milk products decreased from 67 to 58 per cent in the supplying area but increased from 56 to 70 per cent in the non-supplying area, the latter being at the cost of a drop in the consumption of fluid milk.

The per caput consumption of fluid milk in both commercial and non-commercial households increased by about 20 to 30 gm per head in the supplying area but decreased to the tune of 70 to 100 gm per head in the non-supplying area implying thereby a net positive impact of 100 to 125 gm in the per caput consumption of milk. Despite this, however, the per caput milk consumption was still much below the recommended nutritional requirement level of 200 gm.

#### **(v) Feeding of milch animals**

The level of feeding was found to be higher on the second occasion compared with that on the first both in respect of the quantity of greens and the total quantum of feeds fed to cows and buffaloes in the commercial as well as non-commercial households of both the areas. The concentrate feeding also generally improved on the second occasion in both types of households in the supplying area but only in commercial households of non-supplying area. Further, the increase in the level of concentrate feeding of buffaloes in commercial milk producer households was more in supplying area compared with non-supplying. This is in agreement with the expectation and implies a positive impact of organised milk schemes in respect of concentrate feeding to buffaloes which constitute the mainstay of commercial milk producers. An important change observed in regard to feed composition of the milch animals in the milkshed area was in respect of the proportion of wheat bhusa which increased on the second occasion compared with that on the first.

#### **(vi) Nutritional status of animal feeds**

The feed of a cow in milk in the commercial households of supplying area was more or less adequate in terms of DCP requirements on both the occasions but fell short in the non-supplying area by about 45 per cent on the first occasion and by 20 per cent on the second occasion. The TDN available to cows in milk was, however, more than their requirements, the excess being quite marked on the second occasion. A dry cow in the commercial households was given an excess of both DCP and TDN requirements in the two areas on both the occasions. In non-commercial households, the cows in milk as well as dry cows were given an excess of DCP and TDN in the two areas on both the occasions.

The feed of a buffalo in milk in both commercial and non-commercial households fell short by 15 to 20 per cent in terms of DCP but exceeded by 20 to 50 per cent in terms of TDN requirements in both the areas and on both the occasions. The buffaloes as such which constitute the main source of milk in the area have

not been provided the proper balanced feed necessary to meet their DCP requirements in both the areas. Furthermore, the nutritive value of feed fed to buffaloes deteriorated from occasion to occasion.

#### **(vii) Employment pattern**

On the whole, the number of workers which was of the order of one in three per family on the first occasion improved on the second occasion by 6 to 7 per cent. The proportion of workers among non-milk producing families which was comparatively larger on the first occasion decreased on the second occasion by 3 per cent in the supplying area. Among milk producer families, however, the proportion of workers was slightly higher in non-supplying area compared with supplying area on both the occasions which thus brings out the ineffectiveness of DMS in generating additional employment in the milkshed area.

Of the total number of workers in commercial milk producer families on the first occasion about 30 to 60 per cent were engaged in crop-production, 20 to 30 per cent in agricultural work, 12 to 15 per cent in milk production and the rest in other vocations. On the second occasion, there was a shift in the working force from crop production to milk production and agricultural work in both the areas. The main occupation of the majority of workers in both the areas was cultivation in the case of non-commercial type of milk producers and agricultural work in that of non-milk producers.

In addition to main occupation, a fairly substantial number of workers also had a subsidiary occupation viz. milk production in milk producing units and agricultural work in non-milk producer units. Such persons constituted 60 per cent of the working force in milk producer families and 10 per cent in non-milk producer families.

Even among commercial milk producer families hardly 12 to 15 per cent of the working force followed milk production as a main occupation on the first occasion. In view of the proportionately larger increase on the second occasion in respect of the working force engaged in milk production in the non-supplying area compared with that in the supplying area it can be concluded that the DMS failed to induce the farmers to take to dairying as a main occupation.

#### **(viii) Annual income**

The total cash income on the second occasion of all types of families averaged about Rs. 2,680 in the supplying area and Rs. 3,790 in the non-supplying area.

Non-commercial milk-producing families averaged higher incomes than other types viz. Rs. 3,050 in the supplying area and Rs. 5,075 in the non-supplying area. Next in order were commercial milk producing families with incomes averaging Rs. 2,900 in the supplying area and Rs. 2,690 in the non-supplying area. The corresponding incomes of non-milk producer families averaged Rs. 2,100 and Rs. 2,600 respectively. Of the total cash income of commercial milk producing families, about 50 per cent on the first occasion and 33 per cent on the second occasion was through dairying. A comparison of the change in the incomes of different types of families between the two occasions showed that the increase in the income was more in the non-supplying area compared with that in supplying area in the case of both commercial milk producer and non-milk producer families but reverse was the trend in the case of non-commercial families implying thereby a negative impact in the case of both commercial and non-milk producer families but positive one in that of non-commercial families. Such a comparison based on all types of families also showed a positive impact on the general economy of the area. All the same, however, the organised milk supply schemes operating in the area failed to make any dent on the economic status of the commercial milk producing families who constitute the main direct beneficiaries.

From the foregoing it is thus seen that the impact of DMS in respect of most of the response indicators was either negative or negligible.

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## 2. TRAINING ACTIVITIES

(a) The final examinations of the Professional Statisticians' Certificate and the Senior Certificate Courses were held during the period under report. The details of regular students who appeared in and passed the examinations are given below :

<i>Course</i>	<i>No. of regular students</i>	
	<i>Appeared</i>	<i>Passed</i>
P.S.C.C.	12	8
S.C.C.	16	16

The final examinations of the various courses for the M.Sc. and the Ph.D. students were held during the quarter. The new academic session for the M.Sc. and the Ph. D. Courses started on 13th September, 1976. 4 regular students were admitted to the Ph.D. Course and 6 regular and 10 departmental students were admitted to the M.Sc. Course.

A programme of lectures for a period of 10 days was arranged for the benefit of students of the Professional Statisticians' Certificate and Senior Certificate Courses for acquainting them with broad research activities of the Institute. In order to acquaint the students of these courses with the research programmes of the various departments, they were taken to the Division of Agronomy, I.A.R.I., the Central Statistical Organisation and the Directorate of Economics and Statistics.

A survey on the "Level of Milk Production and Feeding Practices" was organised in which the students of the P.S.C. and the S.C. Courses carried out the field work under the technical guidance and supervision of the officers of the Training Unit of the Institute. The students visited the Directorate of Veterinary Services, M.P., Bhopal for this survey.

(b) Specialised training courses on Agricultural Statistics were arranged during the quarter under report for the benefit of the trainees deputed from other organisations. The details of such programmes are given below :

<i>Trainees</i>	<i>Sponsoring Organisation</i>	<i>Duration</i>
1. Post Graduate students of I.S.I., Calcutta	C.S.O., New Delhi	19.7.76
2. M.Sc. students of Deptt. of Statistics, Calcutta University	Calcutta University Calcutta.	24.9.76

(c) During the quarter under review, the following seminars were held by distinguished speakers.

<i>Name of Speaker</i>	<i>Title of Seminar</i>	<i>Date</i>
1. Dr. B.V. Sukhatme, Professor of Statistics, Iowa State University, U.S.A.	Some recent developments in designing surveys and analysis of survey data.	2.7.1976

- |   |  |            |
|---|--|------------|
| 2. Prof. V.P. Godambe,<br>University of Waterloo<br>Canada. | (a) Some basic ideas about<br>survey sampling. | 21.7.1976  |
|   | (b) Estimating Equations.                      | 27.7.1976. |
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### 3. BASIC RESEARCH

Some investigations were made regarding analysis of experiments involving ranking in paired and triad comparisons. A model has been developed for analysing the experiments involving ranking, conducted at different places or over time.

Some models were developed for forecasting the yield of crops at pre-harvesting stage based on meteorological factors.

The concept of balance in the sense of Jones (1959) has been considered in general for the intra-block models in connected designs. A general expression for the loss of information on any contrast is obtained. The concept of balance has been utilized to study the patterns of designs obtained by dualizing some partially balanced designs, augmented designs with one-way elimination of heterogeneity and to design and analyse some series of factorial experiments and bio-assays.

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#### 4. ADVISORY SERVICE

During the quarter under review, technical advice and guidance was rendered to research workers and students of Research Institutes, Agricultural Universities and other research organisations in planning of experimental investigations and statistical analysis/computerisation of research data.

Some details of the technical advice and guidance given by the Institute during the quarter under review are given below in brief.

##### **Crop Sciences**

- (a) Comments were given in respect of over 25 schemes on Agronomy and Soil Science referred to the Institute by the ICAR for critical examination from the statistical point of view.
- (b) Dr. S. Patnaik, Head, Crops and Soils Division, C.R.R.I., Cuttack was given technical advice regarding the analysis of data on uptake of nutrients.

##### **Animal Sciences**

- (a) Sh. B.S. Ranappa from the University of Agricultural Sciences, Bangalore was given technical advice regarding "Analysis of Diallel Crosses for Poultry".
- (b) Sh. Sudarshan Kumar, Deputy Director (Statistics), Directorate of Animal Husbandry, Punjab was given technical advice on the method of analysis of breeding data for assessing the influence of environment on production.
- (c) Sh. Lok Nath, Ph.D. student and Sh. P. Kumar, M.V.Sc. student of Genetics Division of I.V.R.I., Izatnagar were given technical advice in regard to the statistical analysis of their theses data.
- (d) Dr. C.S. Mathur, Professor of Nutrition, Agricultural University, Bikaner Campus was given technical advice regarding analysis of data collected under the I.C.A.R. Scheme.
- (e) Sh. Mani Mohan from the C.S.W.R.I., Avikanagar was advised in regard to the analysis of data on cross breeding of sheep.

### **Sample Survey Investigations**

- (a) The IARI, New Delhi was given technical advice in regard to planning of project/experiments on testing of seed treating equipment and relative efficiency of different chemicals at varying dosages.
- (b) The Directorate of Marketing and Inspection (Ministry of Agriculture and Irrigation) was given technical advice regarding presentation of results of their survey on marketable surplus of paddy.
- (c) Sh. J.S. Khanna, Deputy Director of Agriculture (Statistics), Haryana, Chandigarh was given technical guidance in regard to the planning of the benchmark sample survey in Drought Prone Area Programme (DPAP) of Haryana State.
- (d) Dr. S.K. Saha, Scientist, I.L.R.I., Ranchi was given technical advice in connection with a project on estimation of internal consumption of lac.

### **Data Processing**

Dr. A.C. Sharma, Asstt. Professor, J.N.U. Centre of P.G. Studies, Imphal (Manipur) was given technical advice in regard to the statistical analysis and computer programming of the data collected by his Ph.D. students.

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## **5. 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 studies on pre-harvest forecasting of yield of tobacco—Guntur (A.P.).
  - (ii) All India Co-ordinated Agronomic Research Project (E.C.F.)—Dhulia (Maharashtra).

- (iii) Pilot sample survey to estimate the incidence of pests and diseases on high yielding varieties of paddy—Cuddalore (Tamil Nadu).
  - (iv) Pilot studies for estimation of birth and death rates in bovines for preparation of life tables—Anand (Gujarat).
  - (v) Survey on level of milk production and feeding practices—Bhopal (M.P).
  - (vi) Pre-harvest forecasting of yield of jowar—Poona (Maharashtra) and Sangli (Gujarat).
  - (vii) Sample survey for methodological investigations into HYVP—Chandigarh (Haryana), Hyderabad (A.P.), Madras (T.N.), Ahmedabad (Gujarat), Calcutta (W.B.), Chandigarh (Punjab), Lucknow (U.P.) and Chittorgarh (Rajasthan).
  - (viii) Pilot sample survey for developing a suitable sampling methodology for estimating the yield of cotton—Hissar (Haryana)
  - (ix) Sample survey to study the impact of new technology on crop production, its disposal and employment in agriculture—Delhi State.
  - (x) Economic and other factors influencing the fertilizers responses in cultivators' fields—Delhi.
- (b) *Field Work Inspection* : Field work inspection/supervision was carried out during the quarter under review in connection with the projects given below in the areas/places shown against them.
- (i) All India Co-ordinated Agronomic Research Project (M.A.E.)—Navsari (Gujarat), Karjat and Rahuri (Maharashtra), and Banswara (Rajasthan).
  - (ii) All India Co-ordinated Agronomic Research Project (E.C.F.)—Delhi.
  - (iii) Study of the impact of milk supply schemes on rural economy in the milk collection areas of Greater Calcutta Milk Supply Scheme—Calcutta (W.B.).
  - (iv) Sample survey for estimation of losses and price spread of vegetables—Delhi.

- (v) Survey on level of milk production and feeding practices in Madhya Pradesh—Bhopal (M.P.).
- (vi) Pilot sample survey for developing a suitable sampling technique for estimation of losses of vegetables in transit and their price spread at various stages of marketing—Delhi.
- (vii) Pre-harvest forecasting of yield of sugarcane—Meerut district (U.P.).
- (viii) Economic and other factors influencing the fertilizers responses in cultivators' fields—Gurgaon (Haryana) and Alwar (Rajasthan).
- (ix) Social benefits cost analysis of tube well irrigation in Najafgarh Block—Delhi.
- (x) Pilot study for estimation of birth and death rates in bovines for preparation of life tables—Kaira and Panch Mahal districts (Gujarat).

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## 6. ABSTRACTS OF PAPERS PUBLISHED

1. JAIN, J. P. and SINGH, D. Feed nutrients—A cost study. *Indian Farming*, May, 1976.

This paper summarises results on costs and returns of two important cultivated fodder crops, namely, jowar and lucerne, of Mehsana district and the economics of producing feed nutrients from them based on the data collected by the Institute during 1967-68.

2. RAMACHANDRAN, V. and PILLAI, S. S. Multivariate unbiased ratio-type estimation in finite population. *Jour. Ind. Soc. Agri. Stat.*, Vol. XXVIII, No. 1, 1976.

This paper gives an unbiased ratio estimator of population mean using data on two or more auxiliary variables along with its variance. It also indicates how to obtain the estimator of the variance. The utility of the results obtained is

illustrated with the help of the data collected from a sample survey on pepper crop.

3. RAUT, K. C. and NADKARNI, U. G. Cost of rearing sheep and goats under migratory and stationary conditions. *Indian J. Anim. Sci.*, 44(7), pp. 459-63, July, 1974.

Utilizing the data collected during a survey carried out by the Institute of Agricultural Research Statistics in Mandi and Mahasu districts of Himachal Pradesh for 2 years, the cost of rearing sheep and goats has been estimated under migratory and stationary types of management. About 70% of sheep and 70% of goats in Mandi district were stationary when compared with only 26% of sheep and 34% of goats of stationary type in Mahasu district. The average yearly cost of maintenance of a sheep in migratory flocks was about Rs. 6.60 in Mandi district and Rs. 19.50 in Mahasu district. In the case of stationary flocks the corresponding figures were about Rs. 26.50 and Rs. 16.50. The average cost of maintenance of a goat per year in a migratory flock was Rs. 3.85 in Mandi district and Rs. 15.70 in Mahasu district; the corresponding figures for a stationary flock were Rs. 11.75 and Rs. 9.70. Labour was the major component of cost accounting for 60 to 80% of the gross cost. The average annual greasy-fleece weight per sheep was about 970 g in Mandi district and 775 g in Mahasu district for migratory flock. The corresponding figures for stationary flocks were 600 g and 700 g.

4. SINGH, D. and JAIN, J. P. Annual milk production costs and returns per commercial producer family in the milkshed areas of Delhi Milk Scheme. *Indian J. Dairy Sci.*, 29(2), 1976.

Estimate of cost of production of one kilogram of milk as well as of yearly milk production per commercial producer family and net returns therefrom were obtained on the basis of the bench-mark survey carried out in 1966-67 by the Institute of Agricultural Research Statistics in the rural milk collection areas of Delhi Milk Scheme. Two different estimates of cost were computed—the one based on market rates of feeds and the other based on both market rates and cost of production rates for evaluating respectively the purchased and home-grown feeds. According to the first method of estimation, the cost/kg. of cow milk averaged Rs. 1.10 and that of buffalo milk Rs. 0.72. These figures were higher by about 25% than those obtained by the second method. The value of the yearly milk production per household which averaged 14 quintals was Rs. 950 as

against the production costs of Rs. 1,050 and Rs. 850 as per the two methods of estimation. When costs were analysed by the first method, the dairy units incurred some marginal losses which have to be viewed against the unaccounted for gains accruing to the general farm business.

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## 7. PAPERS ACCEPTED FOR PUBLICATION

1. JAIN, J. P., ANEJA, K. G. and NIRMAN, K. P. S. Role of Delhi Milk Scheme in generating employment and income in its milkshed areas. *Ind. Jour. Dairy Sci.*
  2. JAIN, J. P. and SAXENA, B. C. Milk production and its utilization. *Ind. Jour. Anim. Production.*
  3. RAUT, K. C., SINGH, SHIVTAR and RUSTAGI, R. L. Study on the economics of milk production in different categories of rural households. *Ind. Jour. Anim. Sci., Vol. 46, No. 11, Nov., 1976.*
  4. SINGH, D. and GOEL, B. B. P. S. Impact of increase in the prices of fertilizers on the production and profitability of high yielding varieties of wheat and rice cultivation. *Ind. Jour. Agri. Economics, June-Sept., 1976.*
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## 8. I.A.R.S. PUBLICATIONS

1. JHA, M. P., SINGH, PADAM, IYER, V. N. and CHANDRAHAS. Pre-harvest forecasting of yield of wheat—A consolidated report of pilot studies on pre-harvest forecasting of yield of wheat in Ludhiana (Punjab) and Aligarh (U.P.) districts during 1970-71 to 1974-75.

A pilot study on pre-harvest forecasting of yield of wheat was conducted in Ludhiana district of Punjab during 1971-72 to 1974-75 and in Aligarh district of Uttar Pradesh during 1970-71 to 1973-74. The survey covered four Community Development Blocks in each district. The primary objective of the survey was to evolve a suitable methodology to forecast yield rate of wheat on the basis of observations on biometrical characters such as plant population, number of tillers per plot, height of main tiller, diameter of main tiller at the base, number of green leaves per tiller and length of ear-head recorded at monthly intervals from the first month of crop growth till harvest. At harvest, grain yield also was recorded.

A stratified multi-stage random sampling design was adopted for the survey. In each district a sample of four Community Development Blocks was chosen and the totality of these Blocks constituted the population. All Village Level Workers' Circles falling within each Block were taken for the survey which formed the strata. Within each circle villages, fields and plots within fields constituted the primary, secondary and tertiary stages of sampling units. Annually, data from 200-250 fields were planned to be collected in each district.

The studies made can be classified as (1) calculation of estimates of various biometrical characters and (2) establishing a relationship between yield and biometrical characters.

The yield of wheat showed significant correlation with plant population and number of tillers per plot in both the districts in all the years. Other biometrical characters did not show any significant correlation with yield. The regression analysis was carried out using four linear models on different scales viz. (1) original scale, (2) logarithmic scale, (3) square root scale and (4) reciprocal scale.

The multiple regression coefficients of yield on biometrical characters were found to be significant. The amount of variation explained by the six biometrical characters varied from 50 to 60 per cent in Ludhiana district. In Aligarh, this percentage was much smaller and varied widely. The regression analysis also showed that among the six biometrical characters studied plant population and the number of tillers per plot are the two characters which greatly account for the variation in the yield. The results indicate that a satisfactory prediction of yield of wheat is possible on the basis of biometrical observations, two to three months after sowing of crop. A study of the four regression models did not show superiority of any of the models. Hence it is preferable to adopt the linear model in the original scale due to its simplicity and easy computation.

2. KRISHNAN, K. S., SONI, P. N., SINGH, D. and RAO, P. P. Irrigation effects on wheat.

The study deals with the results of critical statistical examination of the data pertaining to about 400 irrigation experiments on wheat. The data examined, were spread over 13 states in the country and pertained to the years from 1960-61 to 1971-72. The study summarises variety group-wise and soil type-wise the results of various irrigation factors like frequency of irrigation, stages of irrigation, irrigation at varying levels of soil moisture availability, etc., influencing wheat yield. Results of about 70 experiments in which interactions either between various irrigation factors or between different levels of irrigation factors under any one of the other factors like fertilizers, varieties, cultural practices, etc., were observed, have been dealt separately.

3. RAHEJA, S. K., GOEL, B. B. P. S., BANERJEE, A. K., MEHROTRA, P. C., RUSTOGI, V. S. and GUPTA, S. S. Annual Report of Sample Surveys for Assessment of High Yielding Varieties Programme for 1973-74, Vol. 1—Results of yield estimation surveys.

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## 9. ABSTRACTS OF DISSERTATIONS APPROVED

### M.Sc. Degree

1. BHASIN, PUNAM. Some contributions to the combined analysis of repeated experiments.

In experimental programmes it is customary to try a number of treatments at various places in a number of seasons. In such programmes some treatments may be common to all experiments and some common to a fraction of the experiments only. Under such situation a combined analysis of experiments presents certain problems. In the present investigation the analysis has been considered under the following situations :

- (i) When randomised block design is adopted at all places with some number of replications and treatments.

- (ii) When a balanced incomplete block design is repeated over different places but having the same set of parameters.
- (iii) When at some places randomised block design is adopted and at some places balanced incomplete block design is adopted.
- (iv) When a randomised block design is adopted at different places with different number of replications and treatments.

In respect of each situation along with the method of analysis the standard errors for different types of comparisons are also given.

The method of computation for situations (i) and (iv) is also illustrated through an example.

(Guide : Sh. S. D. Bokil)

## 2. WIN, KYI. Analysis of experiments involving ranking in triad comparisons.

Analysis of experiments involving paired and triad comparisons is a more generalised method of ranking. In triad comparisons, for a given 'v' treatments, in a replication an observer is presented with v treatments  $T_1, T_2, \dots, T_v$ , to be compared and is asked to state his preference between every member of the triplot. There would be  $({}_3^v)$  number of treatment comparisons. In designing part, it resembles with usual BIBD with the following parameters :-

$$D : (v, b, r, k, \lambda ; k=3; \lambda=v-2) ;$$

where

$$b = \frac{v(v-1)(v-2)}{6} ;$$

$$r = \frac{(v-1)(v-2)}{2}$$

For n observers, the experiment would have n replications and the total number of sets of comparison will be  $nv(v-1)(v-2)/6$  giving rise to total number of judgements  $nv(v-1)(v-2)$

A comparison has been made between paired and triad designs. The amount of comparisons which can be saved by triad comparison over paired comparison is obtained, in general as

$$\frac{v(v-1)(5-v)}{6}$$

In this thesis, a model for triad comparison was postulated. It was supposed that the treatments  $T_1, \dots, T_v$  have true ratings (or preferences)  $\pi_1, \dots, \pi_v$  on a particular subjective continuum which satisfies the conditions :—

(i)  $\pi_1 \geq 0$

(ii)  $\sum_{i=1}^v \pi_i = 1$

when treatment  $i$  appears with treatments  $j$  and  $k$  in a triplot.  $P(T_i > T_j > T_k)$  is indicated as the probability that treatment  $i$  obtains top rating, treatment  $j$  the middle and treatment  $k$  the last. The model was taken as

$$P(T_i > T_j > T_k) = \pi_i^4 \pi_j^2 / \Delta_{ijk};$$

$$\text{where } \Delta_{ijk} = \pi_i^4 (\pi_j^2 + \pi_k^2) + \pi_j^4 (\pi_i^2 + \pi_k^2) + \pi_k^4 (\pi_i^2 + \pi_j^2)$$

The model has the property that  $\sum_{i \neq j \neq k} \pi_{ijk} = 1$ ;

where  $\pi_{ijk}$  stands for  $P(T_i > T_j > T_k)$

Estimates of the treatment parameters are obtained using maximum likelihood method of estimation. Procedures for estimation of parameters were given. For test of significance for large sample,  $Z$  statistic which is given by  $-2 \log_e \lambda$  is taken to have the  $X^2$  distribution with  $(v-1)$  degrees of freedom (Wilks) under null hypothesis. As example on small sample, table for the distribution of  $Z$  is given.

Formulae for the variances and covariances of estimates of treatments ratings  $T_1, \dots, T_v$  have been obtained.

Combinations of results when experiments are performed in groups (i.e. groups may be judged at different times or under different circumstances) are also discussed. The failure of the treatment parameter to be the same for each group, represents a group  $\times$  treatment interaction or lack of agreements.

A test for the appropriateness of the model is also given.

A taste testing experiment in triad comparison was conducted using four treatments in twenty eight replications. Estimates of true ratings of the treatments along with their estimated variances and covariances were computed and appropriateness of the model was also tested in illustration of the present work.

(Guide : Sh. S. C. Rai)

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## 10. PAPERS PRESENTED AT INTER ORGANISATIONAL SEMINARS, WORKSHOPS, ETC.

During the quarter under review, papers by the officers of the Institute were presented in an inter-organisational conference and a seminar. The particulars of the papers presented and the conference and the seminar in which these were presented are given below :

1. *National Seminar on "New Agricultural Technology and Extension Strategy for Small and Marginal Farmers" organised by the Indian Society of Extension Education at P.A.U., Ludhiana in July, 1976.*

SINGH, D. and PANDEY, R.K. Impact of New Agricultural Strategy on small farmers in Aligarh district.

The objectives of the paper were to study the application of modern technology by the farmers, to examine the changes of the new technology of employment in the case of small farmers and to study the impact of new technology of income generation in terms of net profit of all farms. A comparison of small farms with medium and large farms was done in the selected areas. The nature of new farm technology, design of study and methodology along with application of modern technology and its impact of aggregated employment and annual profits per holding have been discussed. It was concluded

that new technology is in vogue on all farms. The proportion of small farms adopting it is smaller as compared to medium and large farms. Employment in crop production increased on all types of farms but relative increase was the highest on small farms. Average profits per holding increased by the use of new technology. But the gain was maximum on large farms followed by small farms. These conclusions, however, are based on the data of one year and should be qualified accordingly.

2. *Group Meeting of the Agronomists on the occasion of the Wheat Research Workers' Conference held at Hissar in August, 1976.*

KRISHNAN, K.S., SONI, P.N., SINGH, D. and RAO, P.P. Irrigation effects on wheat.

For abstract, refer to section 8 (2).

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## 11. COMPUTER CENTRE

- (a) *Computer Utilisation* :—During the quarter under report, the Computer worked for 1509 hours. The percentage of time utilised by the major users, viz., I.A.R.S., I.A.R.I. and the Directorate of Economics & Statistics, was 31.6%, 23.6% and 15.3% respectively. Other I.C.A.R. Institutes utilised about 19.7% of the time and the Central Agricultural Universities utilised about 8.8% of the computer time. Only about 14 hours were utilised for jobs on payment basis.
- (b) *Programming Facilities* :—Programming facilities were extended to about 40 Ph.D., 4 M.Sc. and 5 other research workers from various I.C.A.R. Institutes and Agricultural Universities.
- (c) *Mechanical Tabulation* :— During the quarter, work of punching, sorting, and listing of the data pertaining to various research projects of I.A.R.S., I.A.R.I. and other Institutes under ICAR was undertaken.

About 4.45 lakh cards were punched, 523 sorting jobs were carried out and 378 listings and 13 tabulations were prepared.

(d) *Other Information:*—(i) Thirteen students from the Department of Statistics, University College of Sciences, Calcutta, who visited the Institute during the quarter were acquainted with computer science and the use of the I.A.R.S. computer system.

(ii) A talk on the use of computer in agricultural research was given to the students of the Professional Statistician's Certificate Course of the Institute.

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## 12. LIBRARY

(a) During the quarter under report, 300 new books on various disciplines of the Institute were added to the Library for selected reading by research clientele of the Library.

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

<i>S.No.</i>	<i>Author</i>	<i>Title</i>	<i>Source</i>
1.	S.N. Bajpai & T. Jacob.	Estimation of maintenance requirements of animals from balance data.	Indian Jr. of Anim. Sci., 44(7), July, 1974.
2.	D. Singh & J.P. Jain	Annual milk production costs and returns per commercial producer family in the milkshed areas of Delhi Milk Scheme.	Indian Jr. of Dairy Sci, 29(2), 1976.

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|----|---|--|---|
| 3. | D. Singh, Shivtar Singh & A.K. Srivastava | On repeat survey in two-stage sampling design.   | Journal of the Indian Socy. of Agri. Stat., Vol. XXVIII, No. 1, 1976. |
| 4. | S.K. Mehta, S.K. Agarwal, and A.K. Nigam  | On partially balanced incomplete block designs through partially balanced ternary designs. | Sankhya, Sr. B, Vol. 37(2), 1975.                                     |
| 5. | S.C. Rai                                  | Model for rank analysis in triad comparisons.  | Journal of the Indian Socy. of Agri. Stat., Vol. XXVIII, No. 1, 1976. |
| 6. | V. Ramachandran, & S.S. Pillai            | Multivariate unbiased ratio type estimation in finite population.                          | Journal of the Indian Socy. of Agri. Stat., Vol. XXVIII, No. 1, 1976. |
| 7. | K.C. Raut & U.G. Nadkarni                 | Cost of rearing sheep and goats under migratory and stationary conditions.                 | Indian J. of Anim. Sci., 44(7), July, 1974.                           |

(c) Shri S.S. Srivastava, Librarian, visited Krishi Bhawan, Lucknow in the month of August, 1976 for completing transfer to IARS Library of a rich collection 177 books on Statistics and allied subjects purchased by Dr. K. Kishen, Emeritus Scientist (ICAR) out of ICAR funds.

### 13. PARTICIPATION IN INTER-ORGANISATIONAL SEMINARS, WORKSHOPS, ETC.

During the quarter under review, two officers of the Institute participated in an inter-organisational conference and an inter-organisational seminar. The

names of the officers who participated and the particulars of the conference and the seminar in which they participated, are given below :

1. *National Seminar on the "New Agricultural Technology and Extension Strategy for Small and Marginal Farmers" organised by the Indian Society of Extension Education at P.A.U., Ludhiana in July, 1976.*

DR. R.K. PANDEY.

2. *Group Meeting of Agronomists on the occasion of the Wheat Research Workers' Conference held at H.A.U., Hissar, in August, 1976.*

SH. K.S. KRISHNAN.

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#### 14. MISCELLANEOUS

(a) **Management Committee**

A meeting of the Management Committee of the Institute was held on 28th Sept., 1976 at I.A.R.S. under the Chairmanship of Dr. D. Singh, Director, I.A.R.S.

(b) **Advisory Board**

A meeting of the Advisory Board on Training Courses of the Institute was held on 27th Sept., 1976 at the I.A.R.S. under the Chairmanship of Dr. D. Singh, Director of the Institute.

(c) **Staff Research Council**

A meeting of the Staff Research Council of the Institute was held on 16th and 17th September, 1976 to review the progress of 51 research projects currently under operation. Of these, 6 projects in which work had been completed were closed after discussion.

Also, in pursuance of a recommendation of the SRC, Dr. Jain presented the methodology adopted for and the main results of the 'Survey for studying the impact of milk supply schemes on rural economy in milk collection areas of Delhi Milk Scheme' to the members of the SRC at a meeting specially convened for the purpose on 19th and 23rd August, 1976.

**(d) Joint Council**

A meeting of the Joint Council of IARS was held on 13th Sept., 1976 under the Chairmanship of Dr. D. Singh, Director, IARS.

**(e) Annual Day of IARS Hostels**

The 'Annual Day' of the IARS Hostels was celebrated on 3rd August 1976. Shri S. C. Chaudhri, Chief Executive Officer, National Sample Survey Organisation and Additional Secretary, Department of Statistics, Ministry of Planning, presided over the Function and gave away prizes.

**(f) Appointments, Promotions, Transfers, etc.**

- (i) Sh. M. R. Garg, Sr. Administrative Officer was appointed to the post of Chief Administrative Officer w.e.f. 11th Aug., 1976 vice Sh. S. C. Basu, who was transferred to ICAR Headquarter as Dy. Director (Personnel).
- (ii) S/Sh. N. K. Ohri, D. K. Agarwal, V. K. Mahajan, V. K. Gupta, S. C. Gupta, V. K. Bhatia, Pranesh Kumar, Murari Singh, and P. K. Malhotra and Km. Suman Gupta were appointed as Scientist (S-I).
- (iii) Km. Ranjana Aggarwal, Jr. Scientist, was transferred from I.I.S.R., Lucknow to IARS, New Delhi.

**(g) Fellowships, Honours awarded, etc.**

S/Sh. Vimal Kishor, Pramod Kumar Bajpai, Ram Kishan Ram and Satish Kumar Gupta were appointed as Research Scholars and they joined duty in the month of September, 1976.

**(h) Exhibition Room**

During the quarter under report, the following visitors were taken round the Exhibition Room of the Institute.

- (i) Dr. K. M. Pretty, President, Potash Institute of Canada, Ontario (Canada).
- (ii) Dr. G. Kammer (of Buntchhof Research Station, Hanovar, W.Germany) Technical Secretary, International Potash Institute, Burne, Switzerland.

(i) **Distinguished Visitor**

Dr. John C. Williams, Assoc. Economic Affairs Officer, Economic and Social Commission for Asia and the Pacific, Development Planning Division, ESCAP Secretariat, Bangkok-2 (Thailand) visited the Institute on 10th Sept., 1976 for consultations in regard to a study of organic manures.

(j) **Other Information**

- (i) On 10th August, 1976, Dr. D. Singh, Director attended at the ICAR, New Delhi a meeting relating to "Establishment of National Institute of Medical Statistics". On 23rd August, 1976, he delivered a lecture on "Research in Agricultural Statistics" at the C.S.O, New Delhi for the benefit of Senior Statistical Officers trainees in "Official Statistics and Related Methodology".

On 4th Sept., 1976, Dr. Singh attended the first meeting of the ICAR Regional Committee for the Sub-humid Sutlej-Ganges Alluvial Plains held at the Indian Institute of Sugarcane Research, Lucknow (U.P.). On 20th September, 1976, he attended a meeting convened by the Department of Statistics (Ministry of Planning) for discussion of the results of the Scheme of Improvement of Crop Statistics to be implemented by the N.S.S.O.

The name of Dr. D. Singh was selected by M/S Famous India Publications, Daryaganj, Delhi for inclusion in their reference work "Famous India—Nation's Who's Who, 1976" being brought out for international circulation.

- (ii) Dr. P. Narain, Sr. Professor, gave a seminar entitled "Some impressions about the Department of Statistics of Iowa State University, U.S.A." at the IARS, New Delhi on 2nd July, 1976. He attended the first meeting of the Expert Group on Nutrition Schemes of the Department of Food, Ministry of Agriculture and Irrigation, on 7th Aug., 1976.

- (iii) Sh. S. K. Raheja, Sr. Scientist, delivered a lecture on "Sample Surveys conducted by IARS" to the State Statistical Officers trainees at C.S.O. New Delhi on 4th Sept., 1976.
- (iv) Dr. K. C. Raut, Assoc. Professor, attended the meeting convened by the Planning Commission on 16th Aug., 1976 at Yojna Bhavan, New Delhi to consider "Agricultural Statistics needed for planning rural development". Sh. Raut also attended on 13th Sept., 1976 at Krishi Bhavan, New Delhi a meeting of the Technical Committee for Direction set up in the Department of Agriculture, Govt. of India, to give necessary technical guidance in conduct of surveys and to suggest measures for improvement of Animal Husbandry Statistics.
- (v) Sh. J. N. Garg, Jr. Scientist, attended the meeting on Technical Direction on Improving of Agricultural Statistics convened at the Directorate of Economics & Statistics on the 13th Sept., 1976.
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# PERIODICAL PUBLICATIONS

## ANNUAL REPORT

The Annual Reports 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 form of compendia series. Two such series in respect of the various States pertaining to the periods 1948-53 and 1954-59 have already been completed and the third for the period 1960-65 is nearing completion. The experimental data for the period 1966-71 have been collected and are under process.

The prices of the different volumes are given below :-

<i>State/Region</i>	<i>Series I (1948-53)</i>	<i>Series II (1954-59)</i>	<i>Series III (1960-65)</i>
Andhra Pradesh	Rs. 12.00	Rs. 12.80	}
Assam	Rs. 4.00	Rs. 6.80	
Bihar	Rs. 9.75	Rs. 21.85	
Gujarat	Rs. 6.75	Rs. 9.25	
Kerala	Rs. 7.25	Rs. 8.05	
Madhya Pradesh	Rs. 11.25	Rs. 13.70	
Tamil Nadu	Rs. 13.25	Rs. 11.70	
Maharashtra	Rs. 25.00	Rs. 24.25	
Karnataka	Rs. 14.00	Rs. 20.45	
Orissa	Rs. 3.50	Rs. 6.30	
Punjab, Haryana, H.P and J. & K.	Rs. 19.50	Rs. 19.20	
Rajasthan	Rs. 4.00	Rs. 6.20	
Uttar Pradesh	Rs. 35.75	Rs. 42.10	
West Bengal	Rs. 7.75	Rs. 8.15	
Central Institutes.	Rs. 11.00	Rs. 16.50	
Total for the set	Rs. 184.75	Rs. 227.30	

\* Prices not yet fixed.

Swan Press of Lahore, Delhi-6.

## OTHER PUBLICATIONS

	<i>Price</i>
Sample Survey for Estimation of Milk Production in Punjab (1956-57)— <i>V. G. Panse, Daroga Singh and V. V. R. Murty.</i>	Rs. 5.50
Sample Survey for Estimation of Milk Production in Eastern Districts of U. P. (1957-58)— <i>V. G. Panse, Daroga Singh and V. V. R. Murty.</i>	Rs. 4.25
Cost of Milk Production in Madras (1963)— <i>V. G. Panse, V. N. Amble and K. C. Raut.</i>	Rs. 4.75
Green Manuring of Crops (1965)— <i>V. G. Panse, T. P. Abraham and C. R. Leelavathi.</i>	Rs. 2.50
Cost of Milk Production in West Bengal (1967)— <i>V. G. Panse, V. N. Amble and K. C. Raut.</i>	Rs. 5.50
Monograph on Estimation of Wool Production (1970)— <i>Daroga Singh, M. Rajagopalan and J. S. Maini.</i>	Rs. 2.60
Monograph on Estimation of Milk Production (1970)— <i>Daroga Singh, V. V. R. Murty and B. B. P. S. Goel.</i>	Rs. 4.10
Survey on Mango and Guava in U. P. (1971)— <i>G. R. Seth, B. V. Sukhatme and A. H. Manwani.</i>	Rs. 3.50
Incidence of Pests and Diseases on Paddy (1971)— <i>G. R. Seth, D. Singh, M. G. Sardana and R. K. Khosla.</i>	.....
Cost of Milk Production in Delhi (Revised in 1972)— <i>D. Singh and K. C. Raut.</i>	Rs. 9.00
Survey on Vegetable in Rural Areas of Delhi (1973)— <i>B. V. Sukhatme, A. H. Manwani and S. R. Bapat.</i>	Rs. 3.50
Economics of raising Cattle and Buffaloes (1973)— <i>K. C. Raut, V. N. Amble and Shivtar Singh.</i>	.....
Estimation of Availability and Cost of Production of Milk (1975)— <i>K. C. Raut, D. Singh and Shivtar Singh.</i>	.....
Monograph on Study of Size and Shape of Plots for Yield Experiments on Vegetable and Perennial Crops (1975)— <i>D. Singh, P. N. Bhargava, R. K. Khosla and Asha Saksena.</i>	.....
Monograph on Sample Survey Techniques for Estimation of Egg Production (1975)— <i>D. Singh, B. B. P. S. Goel, J. N. Garg and D. V. S. Rao.</i>	Rs. 5.00

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For copies, please write to the Chief Administrative Officer, Institute of Agricultural Research Statistics (I.C.A.R.) Library Avenue, New Delhi-110012