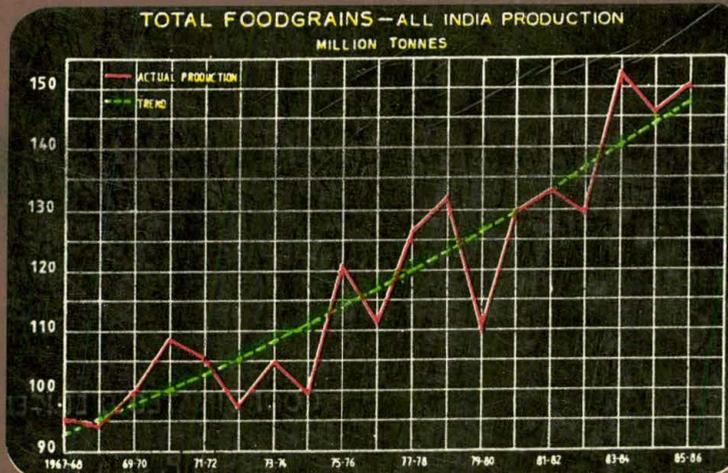


40th Anniversary of India's Independence

# ANNUAL REPORT

## 1986



भारतीय कृषि सांख्यिकी अनुसंधान संस्थान (भा० कृ० अ० प०)  
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INDIAN AGRICULTURAL STATISTICS RESEARCH INSTITUTE  
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# **ANNUAL REPORT**

**1986**

**INDIAN AGRICULTURAL STATISTICS RESEARCH INSTITUTE  
(I.C.A R.)**

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## PREFACE

It is, indeed, a great pleasure for me in presenting this compendium on the panorama of activities and achievements of the Institute during 1986 on the August occasion of the 40th Anniversary of our country's Independence. I hope this compendium will be well received by the scientific fraternity.

Head, Coordination Cell assisted by his technical personnel has done a fine job of editing the material and deserves commendation. Deep appreciation is also due to Shri Som Dutt and Shri R. C. Chauhan for assistance in the preparation of the report and to Shri Mahesh Chander, Mrs Rajni Gupta and Mrs Harsh Kapoor for efficiently and carefully typing various versions of the manuscript.

Prof. Prem Narain  
Director, IASRI

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## INTRODUCTION

### Aims and Functions

The Indian Agricultural Statistics Research Institute (IASRI) is a premier institute for promoting and conducting research and training in Agricultural Statistics in the country for improving planning and evaluation of agricultural research and development. To achieve these objectives, the IASRI has the following functions:

- To conduct research in experimental designs, sampling methods, statistical genetics, bio-statistics and statistical economics,
- To conduct post-graduate courses leading to M. Sc. and Ph.D. degrees in agricultural statistics and M.Sc. in computer application in agriculture,
- To provide advisory service to agricultural scientists/ workers from various agricultural organisations in India and abroad,
- To develop computer software for agricultural research,
- To conduct in-service training courses in agricultural statistics and computer applications and
- To provide consultancy service in data processing.

### Origin and Growth

The Institute on the recommendation of the Royal Commission on Agriculture made a modest beginning in 1930 as a STATISTICAL SECTION of the Indian Council of Agricultural Research (ICAR), the then Imperial Council of Agricultural Research. It was then manned by only one statistician with a limited staff. His main responsibility was to assist the agricultural officers in the various provinces of the country in planning of experiments, analysis of data and interpretation of results. In 1933, he was also made responsible for scrutiny of the technical programmes and progress reports of the research schemes of the Council.

The activities of the Statistical Section entered a new phase towards the end of 1943 when following the Bengal famine, the Government of India directed it to undertake research in the methods of collecting crop yield statistics by conducting objective surveys based on the methods of random sampling. This assignment resulted in the development of the use of random sampling method for estimating yield by crop cutting surveys whose efficiency and practicability was demonstrated in different states. The recognition which this method attained

was such that in the course of a few years the method was extended practically to the entire country to cover all principal food crops.

In 1944 the Statistical Section undertook statistical analysis of the 10 years data on goat breeding project at Etah in U.P. which led, for the first time, to the recognition of the need for application of statistical techniques to animal sciences. As a result several investigations both of methodological and basic nature followed and statistical techniques became integral part of research and development in animal sciences.

The Statistical Section was reorganised with a new name STATISTICAL BRANCH in 1945 into two separate units, each under the charge of a Statistician dealing with statistical application of research in agriculture and in animal husbandry and was headed by Statistical Adviser to the Council (ICAR). The Council also instituted regular post-graduate training courses for professional statisticians and for research workers in the field of agriculture and animal husbandry. Although research and teaching was integrated, a small training unit consisting of whole time professor, assistant professors and demonstrators, was eventually constituted for organising the various courses of study. The Statistical Branch soon acquired international recognition as a training and research institution in the field of agricultural statistics and was made responsible for training foreign students and organising

international seminars for the Food and Agriculture Organisation of the United Nations.

Valuable contributions were made by the Statistical Branch to the problem of improvement of crop acreage and production statistics. Sampling techniques were developed for securing objective and reliable estimates of marine fish catch and of livestock numbers. By the end of 1952, the crop cutting surveys for the estimation of production of the principal food crops were extended to almost whole of the country. In January, 1953 according to a decision of the Government of India, the work of large scale sample surveys on food crops and a few other surveys was transferred from the ICAR to National Sample Survey Organisation.

In September, 1952 the services of two F.A.O. experts, Dr. Frank Yates, Chief Statistician, Rothamsted Experimental Station, Harpenden (U.K.) and Prof. D.J. Finney of Oxford University (U.K.) were assigned to the Government of India to advise and assist the ICAR in reviewing its research and training activities. As a result of their recommendations the activities of the Statistical Branch expanded in many directions and in August, 1955, it moved to its present campus at Pusa as a STATISTICAL WING of the ICAR. The campus provided adequate space not only for office accommodation for the technical and the ministerial staff but also for facilities of a library, reading room, class room, for the training classes, an auditorium and a hostel with the usual amenities for

the students, admitted to the various courses of study.

In recognition of its significant role as a premier institution of training and research it was rechristened as the INSTITUTE OF AGRICULTURAL RESEARCH STATISTICS (IARS) in July, 1959. A mechanical data processing unit was also then added to the Institute.

On the completion of construction of a new four-storeyed building in the campus of the Institute in 1964, the mechanical data processing unit was shifted to its ground floor and was expanded with the installation of an I.B.M. 1620 Model-II Electronic Computer and other related equipments, while the first, second and the third floors of the new building provided additional office for expanding technical and ministerial staff of the institute and better accommodation for the Cooperative Canteen and Recreation and Welfare Club. All these facilities enabled the Institute to discharge its functions more efficiently. In October, 1964, new courses leading to M.Sc. and Ph.D. degrees in Agricultural Statistics were started in collaboration with the Indian Agricultural Research Institute (IARI), New Delhi which is a deemed university. In April, 1970 the Institute was accorded the status of a full-fledged institute under the ICAR set-up and is since then headed by a Director.

Since the activities of the Institute expanded manifold, a new three-storeyed Computer Centre building was constructed in the campus of the Institute in 1976. A

third generation computer B-4700 system was installed in March, 1977 which was inaugurated by Shri B.D. Jatti, the then acting President of India. A large number of general purpose application software have been developed and are available on library tape. In view of Institute's mandate for research in agricultural statistics rather than in agriculture its name was changed to INDIAN AGRICULTURAL STATISTICS RESEARCH INSTITUTE (IASRI) in January, 1978.

In order to cover the deficiencies in the existing documentation services dealing with agriculture, the Food and Agriculture Organisation of the United Nations initiated a series of studies, in 1971, to establish the Information System for Agricultural Sciences and Technology (AGRIS). After preliminary trials the system started functioning in 1975. As on 1st November, 1977 there were 82 input centres and 77 liaison offices all over the world, which contribute to the system. Our country is the third largest (next to USA and Japan) among the national input centres, from the point of number of inputs added to the system every month. The Institute provides selective information service to Scientists in the ICAR institutes and agricultural universities on references to documents relating to areas of their specific interest.

From October 1, 1983 the Institute is also functioning as a Centre of Advanced Studies in Agricultural Statistics and Computer Application under the aegis of the United Nations Development Programme (UNDP) for a period of 7 years.

This aims at developing a centre of excellence with adequate infrastructure and facilities to undertake advanced training programmes and to carry out research in various aspects of agricultural statistics and computer application. Under this project a new course leading to M.Sc. degree in computer application in agriculture has also been initiated.

The Institute has achieved international recognition for its high quality of research and teaching work in the field of agricultural statistics. A number of research workers from the Institute have served as consultants and advisors in Asian, African and Latin American countries. Also, a number of statisticians and students of the Institute are at present occupying high positions in universities and other academic and research institutions of USA, Canada and other countries.

#### Functional Set-up

The Institute has the following six Divisions and four Cells to undertake research, training, consultancy, documentation and dissemination of scientific output.

#### Divisions :

- Design of Experiments and Analysis of Experimental Data ;
- Sample Survey Methodology and Analysis of Survey Data ;
- Forecasting Techniques for Crops, Diseases and Pests ;

- Bio-statistics and Statistical Genetics ;
- Statistical Economics, and
- Computing Science.

#### Cells :

- Training Administration Cell ;
- UNDP Cell ;
- Coordination Cell ; and
- Monitoring Cell.

#### Management Committee

The Director of the Institute, who is incharge of the overall management of the Institute is assisted in the discharge of his functions by the Management Committee of the Institute (constituted by and under administrative control of the Council) by providing a broadbased platform for the decision making process, by examining the progress of the Institute periodically and by recommending suitable remedial measures for bottlenecks, if any. The Management Committee of this Institute was reconstituted for a period of 3 years with effect from Oct. 2, 1986:

1. The Director, *Chairman*  
Indian Agricultural Statistics  
Research Institute,  
Library Avenue,  
New Delhi-12
2. Shri D.C. Misra, *Member*  
Development Commissioner,  
Delhi Administration,  
Khyberpass, Delhi

**Management Committee in Session**



3. Director of Agriculture, Govt. of Haryana, Agriculture Department, Chandigarh *Member*
4. The Dean and Joint Director (Education), Indian Agricultural Research Institute, Pusa, New Delhi-12 *Member*
5. Major Jeevan Twari Former Director of Correspondence Courses, Punjab University, Chandigarh *Member*
6. Sardar Daljit Singh Panu, 1143, Sector-36-C, Chandigarh *Member*
7. Asstt Director General (ESM) Indian Council of Agriculture Research, Krishi Bhavan, New Delhi-1 *Member*
8. The Accounts Officer, National Bureau of Plant Genetic Resources, FCI Building, CTO Complex, New Delhi-12 *Member*

9. Dr S.S. Pillai, Jt. Director, IASRI, Library Avenue, New Delhi-12 *Member* *SKR*
10. Dr O.P. Kathuria, Senior Scientist, IASRI, Library Avenue, New Delhi-12 *Member* *MPS*
11. Shri P.N. Bhargava, Senior Scientist, IASRI, Library Avenue, New Delhi-12 *Member* *PNS*
12. Dr J.P. Jain, Senior Scientist, IASRI, Library Avenue, New Delhi-12 *Member* *OPT*
13. Senior Administrative Officer/Administrative Officer, IASRI, Library Avenue, New Delhi-12 *Member Secretary*

A meeting of the management committee was held on December 12, 1986 to consider the budget estimates of the Institute, acquisition of a new powerful Computer System with direct data entry facility, short-term training courses and new project proposals for approval.

### Research Collaboration

The collaborative projects which remained in operation during 1986 are as follows:

Sl. No.	Title	Collaborating Agency	Start	Completion
1	2	3	4	5
1.	Pilot studies on pre-harvest forecasting of groundnut yield	Directorate of Agriculture, Gujarat	Mar, 84	Dec, 88

1	2	3	4	5
2.	Pilot studies on pre-harvest forecasting of jowar yield	Department of Agriculture, Pune (Maharashtra)	Jul 84	Dec 86
3.	Pilot studies on pre-harvest forecasting of apple yield	Directorate of Horticulture, (HP)	Sep 83	Sep 86
4.	All-India coordinated research project (Kharif and Rabi)	(i) Agronomy, Soil Science and Agriculture Chemistry, Division of IARI, New Delhi (ii) Agricultural Universities (iii) State Departments of Agriculture	Mar 84	Sep 86
5.	Agricultural field experiments information system	(i) State Departments of Agriculture (ii) Agricultural Universities (iii) ICAR Institutes (iv) Agricultural Research Organisations	Oct 77	Mar 88
6.	Pilot sample survey for estimation of catch of inland fish in the region of Orissa	Directorate of Fisheries of Orissa (Cuttack)	May 85	Oct 89
7.	Sample survey for methodological investigation into HYVP	(i) Bureau of Economics and Statistics (ii) Statistical Departments of different states	Jan 84	Mar 87
8.	Pilot sample survey for estimation of production of hides and skins in Chingleput and North Arcot districts of Tamil Nadu and Surat district of Gujarat	Directorate of Animal Husbandry, Tamil Nadu and Gujarat	Feb 85	Dec 87

## Finance

### Budget statement for the financial year 1986-87

Head	Non-Plan		Plan	
	Funds (Rs.)	Expenditure (Rs.)	Funds (Rs.)	Expenditure (Rs.)
Pay & allowances	—	1,61,03,678.90	—	61,165.85
Travelling allowances	—	1,73,107.80	—	1,96,609.00
Recurring contingency	—	39,05,245.46	—	2,91,813.39
Non-recurring contingency				
(a) Works	—	1,22,837.50	—	1,08,063.75
(b) Equipments	—	1,298.00	—	1,02,570.00
(c) Library books and journals	—	3,377.20	—	5,37,113.16
(d) Vehicles	—	1,34,652.95	—	—
(e) Others	—	42,388.40	—	5,19,708.40
Grand total	2,06,74,000.00	2,04,92,981.21	19,00,000.00	18,17,043.55

#### Abstract (1986-87)

	Budget Grant (Rs.)	Expenditure (Rs.)
Non-Plan	2,06,74,000.00	2,04,92,981.21
Plan	19,00,000.00	18,17,043.55
Total	2,25,74,000.00	2,23,10,024.76

Leave salary and pension contribution: 1395.00

## PROGRESS OF PROJECTS

### DIVISION OF DESIGN OF EXPERIMENTS AND ANALYSIS OF EXPERIMENTAL DATA

#### Planning, designing and analysis of experiments on cultivators' fields

The objectives of the project are (i) to provide suitable sampling plan, appropriate statistical designs for experiments in accordance with their objectives and to critically analyse the data of experiments conducted on cultivators' fields under AICARP, (ii) to devise suitable proformae for recording of data and to prepare instructions manual for laying out the experiments and coding of data and (iii) to train the field staff in selection of random location and in laying out of the experiments and in collection, reporting and coding of data.

About 8,000 experiments spread over 48 districts in the country were planned during 1984-85. Based on the results of these experiments, the annual project report was prepared which was discussed in the annual workshop in Dec. 1986.

From the results, it was observed that in dryland areas, double cropping with cereal base crops is feasible. The double cropping system was also found to be

profitable. In the Eastern Region of the country, the short duration variety of rice gave as much yield as the traditional long duration variety and further, it was possible to raise another crop in the rabi season, either wheat, cowpea or legume.

Under irrigated conditions, cereal-pulse, pulse-cereal or oilseed-cereal crop sequences gave higher net returns compared to pure cereal sequences.

Studies on testing the efficacy of Mussorie rock phosphate revealed that in low pH soils, part replacement of superphosphate by one-third of Mussorie rock phosphate was found profitable for rice-rice in Qilon district and for rice-groundnut in North Kanara district. The yield increase was around 2-5 q/ha for rice and around 2-3 q/ha for groundnut.

#### Planning, designing and analysis of experiments planned under AICARP at cropping systems research centres

The objectives of the project are (i) to identify suitable statistical designs for the conduct of experiments according to the technical programme formulated each year in the annual workshop of the project, (ii) to develop suitable statistical method of analysis for the identified designs, (iii) to

statistically analyse the data of about 600 complex experiments at 40 CSR centres, and (iv) to develop the model proformae for the collection of data and the instructions manual for laying out the trials at cropping systems research centres.

The analysis of data relating to 500 complex experiments conducted at 40 cropping system research centres was undertaken for the year 1985-86. The statistical designs adopted in these experiments were RBD, split-plot, split-split-plot, confounded factorial and compact family block designs with main plots completely randomised, etc. The appropriate method of statistical analysis was applied for the analysis of experimental data. The results of the experiments conducted during 1984-85 were summarised and the annual project report was finalised.

Production potential experiments indicated higher gross monetary returns/ha in crop sequences involving rice-potato-maize and rice-potato-jute at Kalyani, maize-potato-wheat and fodder-cowpea at Purafarm, rice-maize, rice-groundnut-greengram at Rajender Nagar, rice-linseed-cowpea and rice-potato-groundnut at Raipur, cotton-wheat and groundnut-wheat at Hanumangarh, cotton-groundnut and cotton-safflower at Parbhani centres. The biological productivity was higher mostly in cereal based cropping sequence and other cropping sequences involving potato and/or fodder crops. Growing of a summer pulse crop like cowpea or greengram resulted in higher productivity and monetary returns in wheat growing regions

of north and north-western parts of the country where only two crop sequences involving rice and wheat are taken.

Experiments on intercropping systems indicated the possibility of obtaining the bonus yield for the intercropping without affecting the yield of main crop. It was possible to record an additional yield of 7.0 q/ha of greengram in pigeonpea and greengram intercropping at Hanumangarh when recommended dose of fertilizers for both the crops was applied. At Junagarh intercropping castor with greengram was beneficial since the yield of castor in intercropping treatments was not affected, besides yield of 4.1 q/ha of greengram was obtained. At Rahuri sowing of jowar in skip rows affected the grain yield while paired row sowing was proved to be advantageous over normal sowing. Results of jowar+pigeonpea intercropping system at Parbhani indicated that this system was viable only when fertilizer for intercrop was applied.

The experiments in progress on the same site for a number of years in rice-wheat sequence indicated the need for application of all the three nutrients N, P and K in balance dose for sustaining high productivity of yield. Application at  $N_{120} P_{80} K_{40}$  to both the crops resulted in high yields and more profit. In experiments planned and conducted to study the effect of Azolla on kharif and rabi rice at some centres indicated that the application of 10 tonnes of Azolla provided the yield equivalent to that obtained through 30kg N/ha. Treatment 10 tonnes of Azolla

alongwith 30kg N/ha gave the response very close to that obtained through 60kg N/ha. In rabi rice extent of Azolla substitution for nitrogen requirement was relatively less.

#### **Agricultural field experiments information system**

The object of the project is to maintain at a central place the results and other ancillary information in field experimentation in respect of all the agricultural experiments conducted at different research stations spread all over the country. This would avoid duplication of research and assist the scientists in developing efficient research programmes. The data under the project is collected by the personal visits of the regional staff posted at different regional centres under senior officers of Agriculture Departments/Universities. Till recently, the details of all the experiments collected under the project were brought out in the form of compendia volumes but now, this has been reorganised and made as computer based. Data Bank under which the entire data so collected is stored on magnetic tapes for future retrieval. From the data collected under this project, an Annual Index giving the brief details on the object, site and year of conduct of experiments is prepared for each experiment reported during a particular year. The summarisation of experiments for different crops is also being undertaken. During the year under report, an Annual Index Vol. No. XI was brought out giving the details of the experiments reported by the regional staff during 1982-83. The

summarisation of data of experiments on cotton conducted during 1966-67 was completed and the report is under print. The work on summarisation of experimental data for groundnut, sugarcane and oilseeds remained in progress. In addition, processing of the data of about 1,100 experiments reported by the staff working under the project at different regional centres remained in progress. Details of about 400 experiments conducted after 1978 were also received on coding schedules prescribed for Agricultural Field Experiments Information System. These were being edited and processed for storage on tapes.

#### **A study of factors in relation to homogeneity of error variances in groups of experiments on sugarcane crop**

The objective of the project is to find out the optimum conditions under which an experiment on sugarcane may be carried out for a set of years, so that the estimates of error variances may become homogeneous.

Secondary data relating to about 425 groups of experiments were extracted from the volumes and files of N.I.A.F.E. scheme. The analysis remained in progress.

#### **A statistical study for characterization of drought in relation to a crop**

The objectives of the project are to quantify drought threshold values in relation to a crop and to obtain the chances of occurrence of drought.

Analysis of data for Ahmednagar and Bijapur on cotton, bajra and groundnut

crops was carried out. Drought threshold values for groundnut crop were highest for both the districts. Cotton crop was least affected by deficiency in rainfall. Groundnut threshold values for Bijapur varied from 18mm to 242mm and for Ahmednagar from 3mm to 225mm whereas for bajra and cotton these values were much lower. For some periods cotton crop had negative correlation with rainfall indicating that rainfall deficiency may have varying influence on the crop during the same season. As such the intensity of drought in a season should be determined separately for different crops.

Probabilities of droughts were also obtained for droughts of different durations starting at different stages of crop growth.

#### **Yardsticks of additional production from the use of crop improvement measures**

The objectives of the project are (i) to prepare yardsticks of additional production and to work out benefit cost ratios using different response functions for crops from the use of fertilizers and irrigation, and (ii) to study the feasibility of developing composite yardsticks from experimental data.

The report "Yardsticks of additional production of rice from the use of fertilizers" was published. The yardsticks were prepared at district, state and agro climatic region levels and according to soil types. During the year the work relating to preparation of yardsticks using quadra-

tic and Mitcherlich's functions on different crops like wheat, maize, jowar and bajra were taken up. Single and composite yardsticks were worked out for these crops. Attempts to work out composite yardsticks to NPK at different levels of irrigation for cereals, pulses and oilseeds are also being made from experimental data.

#### **National index of animal experiments**

The objectives of the project are to record on uniform lines the research of all experiments on animals conducted at various research stations in the country during the past and to publish periodically the same in the form of compendia volumes for the benefit of research workers and planners.

During the year under report data on a large number of experiments conducted at various southern research stations were collected and scrutinised. Two compendia volumes, namely Vol. 3, No. 9 Animal and Poultry Nutrition Experiments pertaining to Ranchi Veterinary College, B.A.U., Kanke, Ranchi (Bihar) and Vol. 3, No 10 on Animal and Poultry Nutrition Experiments pertaining to OUAT, College of Veterinary Science and Animal Husbandry Bhubaneshwar (Orissa) were finalised for publication. Most of these experiments were laid as completely randomised design (CRD). This project has been renamed as 'Agricultural Experiments Information System for Animal Sciences' from Jan., 1987 for storage and quick retrieval of experimental data.

## **Change-over-designs, their construction and cataloguing useful in animal experimentation**

The objectives of the project are (i) to examine the feasibility of adopting the existing designs and improve them for future animal experiments, (ii) to study the optimal properties of change over designs for use in animal experimentation, and (iii) to prepare a catalogue of change-over designs useful in animal experiments.

Bibliography of the existing change-over designs was prepared. Indexing of change-over designs, their construction, efficiencies and analysis remained in progress.

## **Statistical analysis of intercropping data through bivariate technique**

The objective of the project is to analysis the data of intercropping experiments conducted under *AICARP* through bi-variate technique.

In order to increase the cropping intensity, intercropping has been an age old practice in India particularly in dry land areas. While agronomic aspect of the type of cultivation is well known, the difficulty arises in the statistical analysis and interpretation of the data of such experiments.

In the past a large number of experiments were planned and conducted under *AICARP* at its various research centres in India. In the present study, the data of intercropping experiments on pigeonpea-greengram system, conducted during the years 1979-80 to 1984-85 at Hanumangarh (Rajasthan) and for 1978-79 to 1984-85 at

Bichpuri (U.P.) were analysed through the bi-variate analysis of variance method and the use of graphical representation was also made. The different features of the results thus obtained are summarised below :

### *Hanumangarh*

It was observed that the main effects of the method of planting of pigeonpea gave significantly higher yield as compared to the other two methods viz. paired and skip row. the reduction in yield was in the range of 9 to 11% for these methods. For greengram with 100% of the recommended dose of fertilizer, the highest yield of the order of 6.03 q/ha was observed. If the greengram was planted in between the skipped rows of pigeonpea, there was an increase in yield (6.93 q/ha). The graphical representation also confirmed the above findings. The consistency over years of the different treatments could not be assessed because the error variances were heterogeneous.

### *Bichpuri*

At this centre the main effect of method of sowing was found to be significant while that of fertilizer varied from year to year. The normal method of planting of pigeonpea gave higher yield (11.98 q/ha) than that of the other two methods viz. paired row and skip row. For greengram, the highest yield was 3.86 q/ha when the 100% recommended dose was applied. It was observed that the cultivation of pigeonpea with normal method of planting and applying the ferti-

lizer at recommended level to the intercrop, consistently resulted in higher yield for both the crops in all the years. The residual variance and co-variance matrices for the years 1978-79, 1980-81, 1982-83, 1983-84 and 1984-85 were homogeneous and therefore, a combined analysis was carried out. The pooled analysis showed the main effect of method of planting were significant while that of fertilizer and interaction were non-significant. It was also observed from the pooled analysis that performance of the intercrop treatment namely the normal method of planting for pigeon-pea with 100% recommended dose to greengram was best and yield for main crops was 12.41 q/ha.

#### **Methodological studies and critical analysis of data relating to repeated experiments with some common treatments**

Any agro-technique, before it is communicated to a farming community for adoption, its performance is generally tested for its consistency over different places and under varying agro-climatic conditions. As such, the experiments are repeated over years or places. Under such a set of experimental programme, very often, the treatments which are not found promising, are dropped out from the experimental programme and are replaced by a new set of treatments. The combined analysis of the data generated under this type of programme poses several statistical problems which gets complicated with the type of designs adopted. In the present project, the method of statistical analysis of data collected over different places and

periods for different types of designs having common treatments with varying or constant statistical parameters is being developed. For this purpose the data on experiments repeated over years/places have been extracted from National Index of Agricultural Field Experiments Project of the Division and the method of analysis when the RBD is adopted with varying parameters and having some common treatments has been developed. For other designs, studies are in progress.

#### **Statistical assessment of cropping sequences in different agro-climatic regions of the country**

The objectives of the project are (i) to compare the performance of different cropping sequences in terms of economic values/energy equivalents/agronomic productivity, (ii) to set up confidence intervals for crop (s)/sequences for different agro-climatic regions, and (iii) to examine the consistency in performance of crop(s)/sequences over years.

The cropping sequence experiments under AICARP at 20 cropping systems research centres during 1978-85 for which replication-wise data were available, were compiled. The prices of various produce in different sequences at different agronomic research centres for various years were collected from different sources. Energy equivalents viz. proteins, carbohydrates and calorific values of various agronomic produce in different sequences were collected. The data in respect of 10 centres were converted into economic

values and analysis of variance carried out. Programmes for further conversion of the data into different energetics for bringing the same to univariate and carrying out analysis of variance for single year and for pooling over years were developed. Further, to test the stability of the performance of the sequences over years, various techniques are being investigated.

### **Statistical studies on nitrogen economy through organic sources**

The objectives of the project are (i) to study the direct and residual effects of nitrogenous fertilizers applied alone or in combination with organic sources like FYM, Azolla and Rhizobium culture in crop sequences and to determine the extent to which nitrogen could be substituted through these sources, and (ii) to study the comparative performance of slow release nitrogenous fertilizers and urea in rice based cropping systems.

Scrutiny and coding of the data collected for the experiments covering various aspects of nitrogen economy were completed and their analysis remained in progress.

### **Over-view of the designs adopted in animal nutrition experimentation in India with recommendations of new designs in appropriate situations**

The objectives of the project are to evolve the statistical methodology for evaluating the efficiency of the designs adopted for a given set of resources in animal nutrition experimentation and to

suggest the alternative efficient designs in situations when the designs adopted were found to be inefficient. For this purpose, experimental data on 1095 experiments collected under the project 'National Index of Animal Experiments' from 18 experimental stations of the country were utilized. It was observed that for most of cases, experiments were laid out in completely randomised block design. Only in very few cases, the RBD or change over design was adopted. For a large number of experiments, the number of degrees of freedom available for testing the treatment effect were inadequate. For evaluating the efficiency of the designs adopted, the method suggested by Bajpai and Nigam (1980) was adopted. Design weight  $w_1$  and Precision weight  $w_2$  were considered as the index of the success of an experiment. It was observed that for about 398 experiments, the index was of the order of 71% and for quite a large number of cases, either  $w_1$  was 0 or  $w_2$  was 0 i.e. for some cases, the design adopted was faulty or in some cases, the experimental material was not found suitable. In some cases it was observed that instead of CRD or RBD, if change over designs were adopted, there could be a good deal of improvement in the overall precision of the experimentation as well as saving in the experimental resources.

Mostly single factor experimentation approach has been adopted. For future experiments, specially for measuring strength of feed mixture experiments have been suggested. Fractional factorials and 2nd order rotatable designs have been

recommended to study interaction and response among various components of feed.

**Planning, designing and statistical analysis of the data relating to experiments conducted under the All India Coordinated Research Project on Long Term Fertilizer Experiments**

The objectives of the project are (i) to plan and design long term fertilizer experiments, (ii) to try alternative approaches for statistical analysis of data on long term fertilizer experiments, and (iii) to coordinate the work of the project on national level and also to provide necessary information to the Project Coordinator.

Data in respect of various characters for the year 1984-85 pertaining to 11 cooperating centres were statistically analysed and summary tables prepared for inclusion in the National Report which was under preparation. Past data from 3 centres were gathered for different years. Requisite computer programmes for the analysis of the data were prepared and necessary software for storage and retrieval of the data on magnetic tapes were developed. Alternative approaches for the statistical analysis of data were tried and the appropriate methodology for the analysis of the data covering various aspects was finalised. Based on the analysis of the data, the following salient results are obtained:—

- i) Farmyard manure applied in conjunction with 100% NPK gave highest yield rate at a number of centres

both for kharif and rabi crops. Response behaviour of the primary nutrients at different centres was by and large, influenced by the built up of soil nutrients due to continuous fertilizer application.

- ii) Response to nitrogen generally indicated an increasing trend for first 2-3 years and thereafter started declining. The response to phosphorus was generally evident from third year onwards and that to potassium, no consistent trend was obtained.
- iii) The linear component of year and treatment interaction was highly significant for all the crops in different centres. 100% NPK+FYM indicated highest rate of appreciation or minimum deterioration for different crops. The fertilizer dose maximising the yield was estimated to be 38-50% higher from recommended level for rice crop at Barrackpore and Pantnagar. The linear trend persisted for wheat crop in most of the centres which calls for a need to try high level of nutrients.

**Studies on designs for animal experiments**

The objectives of the project are (i) to review the existing literature and examine the feasibility of existing designs for animal nutrition and physiology experiments, (ii) to identify the situations where existing designs are inadequate and to construct new designs, (iii) to suggest optimal

designs for small number of experimental units, and (iv) to prepare a catalogue of designs suitable for animal experiments.

The situations in animal experiments, with special reference to animal nutrition and physiology, were reviewed. The study of optimal and highly efficient designs for these situations was initiated and the work in respect of varietal type of experiments were finalised. The preparation of catalogue remained in progress.

#### **DIVISION OF SAMPLE SURVEY METHODOLOGY AND ANALYSIS OF SURVEY DATA**

##### **Pilot sample survey for estimation of cost of cultivation of oilseeds and pulses**

The objectives of the project are (i) to evolve suitable sampling procedure for estimation of various components of cost of production of some important oilseeds and pulses, and (ii) to work out an index of cost of cultivation of these crops from year to year taking into account the fluctuations in the cost of various inputs.

The project is in operation at two centres: Bharatpur (Rajasthan) and Vidisha (Madhya Pradesh). Supervision of field work and training in respect of coding of data schedules were carried out at both the centres. Data collection for rabi 1985-86 and kharif 1986-87 was completed and data collection for rabi 1986-87 was in progress. Coding of kharif 1985-86 data completed and for rabi 1985-86 was in progress.

##### **Pilot sample survey on cost of production of banana/mango and its marketing practices in Surat and Bulsar districts of Gujarat state**

The objectives of the project are (i) to obtain suitable estimates of cost of production of banana/mango based on a suitable sampling design, and (ii) to study the prevailing marketing practices of the fruit in the region of study.

Data from the bearing set of orchards for estimating cost of maintenance per unit of area and per tree and cost of production per kilogram of fruit were collected by the method of cost accounting while data from non-bearing set of orchards were based on enquiry which was used for estimating cost of raising a young orchard to the bearing stage in case of mango. Estimates of cost of production were obtained according to different concepts of cost for 1979-80 and 1980-81 alongwith their standard errors. Some salient results are as follows:

*Mango* : Cost of raising an orchard upto the bearing stage which included value of land in the first year of planting was estimated to be Rs. 9969 per hectare of orchard area and Rs. 12024 per 100 trees in Bulsar district. Estimates of cost of maintenance per hectare were Rs. 2553 and Rs. 2095 during 1979-80 and 1980-81 with respective percent standard errors as 10 and 8. The corresponding estimates of cost per 100 trees were Rs. 2763 and Rs. 2452 with 10 and 8 as their percent standard errors in Bulsar district of Gujarat state.

Banana : Cost of maintenance per hectare of banana orchards in Surat district of Gujarat state during 1979-80 and 1980-81 was Rs. 9352 and Rs. 10632 with 2 and 3 their respective percent standard errors.

**A study of variability of various components of cost of cultivation of vegetables at different stages of sampling and determination of sampling sizes at given levels of precision**

The objective of the project was to study the variability of various components of cost of cultivation of vegetable crops at different stages of sampling like villages, cultivators field, etc. and determination of sampling sizes for given level of precision.

The study revealed that in survey on cost of cultivation of vegetable crops involving multiple pickings, large sample for second stage of sampling and stratification according to size of holding of the cultivators are more appropriate for getting a clear picture about cost components and their variability at each stage of sampling. Further, the cost of cultivation of vegetables was higher for cultivators having small holding sizes. Also the cost of cultivation, its components and their variability at each stage were higher for brinjal as compared to tomato.

**Pilot sample survey to study the impact of flood on agricultural production in a region of U.P.**

The objectives of the project are (i) to investigate a sampling procedure for assessing the losses caused by floods in

agriculture production including livestock, and (ii) to study the impact of floods in crops and livestock in the subsequent season.

Analysis of data regarding general information about selected villages and losses caused by flood to households, machinery, livestock, etc. was completed. Tabulation of data regarding labour inputs pertaining to kharif and rabi crops was completed. The tabulation of data pertaining to physical inputs for cultivation of crops in kharif and rabi seasons for 1981-82 was also completed and that for 1982-83 remained in progress.

Estimates of loss due to flood at the village level were worked out. The procedure for estimation of extent of loss due to flood at the cultivator level was being finalized.

**Pilot sample survey for developing a sampling methodology for estimation of livestock products on the basis of data collected as a part of the normal work of field agency of animal husbandry department**

The objectives of the project are (i) to evolve a suitable sampling technique for estimation of livestock products utilising the normal field agency of stockmen/stock assistants in the animal husbandry departments in the states, and (ii) to obtain estimates of annual production of major livestock products for the districts to be covered with a reasonable precision.

The data were scrutinised, coded and were being punched. The analysis work was in progress.

**A study of variability and trends of yield rates of high yielding varieties of rice during IV and V Five Year Plan periods**

The objectives of the project are (i) to study the variability and trends of yield rates and the associated practices for high yielding varieties of rice during IV and V Five Year Plans, and (ii) to study the distribution of yield rates over different holding size classes.

The average yield and average rates of consumption of chemical fertilizers generally did not differ significantly over the different holding size classes. However, the average yield as well as average rates of consumption of chemical fertilizers varied significantly over years in a majority of the districts studied. The varietal replacement was more frequent in the traditional rice growing districts compared to the non-traditional rice growing districts. The average yield was highly variable with irregular increases and falls over years, the successive falls generally being more steep and the successive increases being rather lower resulting in an overall falling trend in the yield rates. These falling trends were partly attributable to declining trend in levels of fertilizer application and unfavourable seasonal conditions, drought, etc. The linear and compound growth rates in average yield of HYV rice and fertilizer use in different holding size classes were negative in a majority of the cases although generally not statistically significant.

**Statistical summarization of results on yield rates, area and extent of adoption of improved practices for HYV of millets (maize, jowar, bajra) during IV and V Five Year Plan periods**

The objectives of the project are (i) to bring out comparative information on yield rates, area and adoption of improved practices for HYV of millets for different holding size classes during IV and V plan periods, (ii) to study the relative performance of important varieties and factors limiting their large scale cultivation, and (iii) to examine the trend of area, average yield and rates of application of fertilizer in and between two Plan periods and overall as well.

The average yields of high yielding/hybrid varieties of maize, jowar and bajra were found to be neutral to size of holding in a majority of the districts studied. Similar was the result in respect of consumption of chemical fertilizers. Varietal replacement was less frequent particularly for jowar crop on an average 5-6 different varieties were tried for maize and bajra while in case of jowar by and large the same variety continued during the entire period under study.

**Pilot sample survey for developing sampling methodology for assessment of impact of National Demonstration Trial on crop yield**

The objective of the project is to develop a sampling methodology to study the impact of N.D.T. on crop production in terms of labour employment, inputs potential and marginal productivity of various agricultural inputs.

The survey was conducted in Rohtak district of Haryana. The villages in the district were grouped into four categories on the basis of scores given to each village. The four categories were having different graded levels of influence of the National Demonstration Trials.

Category-wise yield/ha for wheat crop during 1981-84 was as follows:

Year	Cat I	Cat II	Cat III	Cat IV	CD of the two groups
1981-82	2405	2414	2588	2814	236
1982-83	2514	2756	2694	2998	310
1983-84	2261	2560	2608	2829	309
Overall	2393	2576	2630	2880	179

Significant differences in average yield were observed for all the three years. In the year 1981-82 the category IV having the highest intensity of demonstration gave significant higher yield as compared to categories I and II having the lowest intensity. In the second year also category IV gave significant higher yield as compared to category I. In the third year category III as well as category IV gave significantly higher yield as compared to category I. Overall pooled results indicate that higher the intensity of demonstration significantly higher was the yield except between categories III and IV.

Interaction between holding size and categories was not significant anywhere indicating the effect of intensity of demonstration was the same for small, medium and large cultivators.

### Sample survey for cost of cultivation, agronomic practices, area and yield rates of potatoes

The objectives of the project are (i) to estimate the cost of cultivation of important varieties of potatoes, (ii) to estimate the area and yield rates of different varieties, and (iii) to study the extent of adoption of improved agricultural practices under cultivators' conditions.

Overall cost of cultivation (Cost C) of potatoes was estimated as Rs.11, 400/ha. This varied marginally for different holding size groups, the highest was for small farmers (around Rs. 11, 820/ha). The cost of seed constituted the single largest component of cost accounting for about 40% of the total cost followed by human labour (23%) and fertilizers and manures (18%). The average yield was estimated as 238 q/ha. Thus the overall cost of production of potato was figured as Rs. 53/q. The net returns from potato cultivation was Rs. 4720/ha

The analysis of data on agronomic enquiry was in progress.

### A study of variability of yields and acreage under HYV cotton

The objectives of the project are (i) to study the variability in yield rates and area of HYV cotton from year to year for different holding size groups, and (ii) to determine the relationship between important inputs and the output.

The project is based on secondary data already collected under the Institute

project, 'Sample survey for methodological investigations into high yielding varieties programme from 1974-75 to 1979-80'. The present study is in respect of cotton crop covering 9 districts spread over 6 states.

Yield rates of hybrid cotton did not differ significantly over the different holding size classes in all the regions covered. Similar results were obtained in respect of use of fertilizers and adoption rates of HYV seeds. The results of input-output analysis revealed that the crop suffered losses of the order of 50 to 70 kg/ha on account of different causes of damage and delay in sowing resulted in a decline in the average yield. On the other hand the average yield (in terms of lint) increased by about 2 to 5 kg/ha for every additional kg of fertilizer and by around 30 to 60 kg/ha for every additional irrigation.

**✓ Pilot sample survey for studying the relative merits of the data obtained by actual weigh ment and those through enquiry for estimation of milk production**

The objectives of the project are (i) to study the relative merits of the data obtained by actual weighment and those through enquiry for estimation of milk production, and (ii) to obtain the estimates of annual milk production at district level with a reasonable precision.

Scrutiny, coding, punching and analysis of the data remained in progress.

**✓ A study of yield trends of wheat in India during last three decades**

The objectives of the project are (i) to study the variability and trends of yield rates of wheat during the pre-Plan period before the introduction of HYV of wheat and Plan period after the introduction of HYV of wheat and to build up forecasting models, (ii) to study the variability and trends of yield rates and associated practices of HYV of wheat in the IV and V Plan periods, and (iii) to study the distribution of yield rates over different holding size classes.

The application of Box-Jenkins forecasting methodology was made to study the trends in the production of wheat in the country as well as in certain selected districts. Out of the several models tried, the seasonal moving average model of order 2 turned out to be the best for forecasting the production as well as area and average yield separately. The forecast figures were obtained for the years 1986-87, 1987-88 and 1988-89 using the data for 40 years upto 1985-86. The forecast figures for the years 1978-85 were obtained using data upto 1976-77. The forecast figures were in close agreement with the actual figures for these years.

**✓ Pilot sample survey to evolve an appropriate methodology for estimation of lac production**

The objective of the project is to evolve a suitable sampling methodology for providing reliable estimates on (i) number of lac host trees, (ii) number of

cultivated lac host trees, (iii) average yield per cultivated host tree, and (iv) total production of stick lac with a reasonable degree of precision.

Consistency of the estimates of production of stick lac for Dudhi centre obtained using regression model was examined with market arrivals. It was found that these estimates were widely different from market arrival necessitating a change in the regression model.

The data collected during different seasons of Dudhi centre were used to study the relationship of yield of stick lac with its attributes viz. girth of tree, number of shoots with lac, total length of encrustation and weight of shoots encrusted with lac. Five regression models, viz. linear, square root, logarithmic, reciprocal and quadratic were tried. Positive and significant correlations were observed among all pairs of morphological characters and yield varying between 0.42 to 0.85, 0.76 to 0.97 and 0.15 to 0.77 during Baisakhi 1984, 1985 and katki 1984 respectively. Of the different models linear, quadratic and square root were seen equally efficient. Hence, linear model was chosen for its simplicity for estimation of lac production.

Field work at Bhandra district centre was in progress. The katki season data was received and scrutinized.

**Pilot sample survey for estimation of area of grazing land and its utilisation-Tamil Nadu**

The objective of the project is to evolve sampling technique for estimation

of area of grazing land, its utilisation and chemical composition.

The field work was in progress. Scrutiny of the data received was carried out. Model tables for the report, estimation procedure, etc. were finalized.

**Pilot sample survey for study of cost of production of chikoo and its marketing practices in Valsad district (Gujarat)**

The objectives of the project are (i) to obtain reliable estimates of cost of production of chikoo based on a suitable sampling design, and (ii) to study the prevailing marketing practices of the fruit in the region of study. The analysis of the data remained in progress.

**A study of employment and income of small farmers and landless labourers**

The objectives of the project are (i) to investigate sampling methodology for estimating employment and income, (ii) to study the extent of employment opportunities in the field of agriculture and (iii) to estimate the income of people belonging to this section.

The field work, tabulation and analysis of data remained in progress.

**Pilot sample survey for estimation of production of hides and skins in Chingleput and North Arcot districts of Tamil Nadu and Surat district of Gujarat state**

The objectives of the project are (i) to evolve a suitable sampling technique for estimation of production of hides and

skins, (ii) to study the practices like flaying on slaughtered and fallen animals, curing of hides and skins and their disposal, and (iii) to study the socioeconomic status of the householders handling hides and skins. Scrutiny of the data was completed and the analysis remained in progress.

#### **Sample survey for study of constraints in transfer of new agricultural technology under field conditions**

The objectives of the project are (i) to develop suitable sampling methodology for studying the effect of new agricultural technology including high yielding/improved varieties, fertilisers, plant protection chemicals and cultural and management practices for increasing productivity of land, (ii) to determine the extent to which the potential of high yielding/improved varieties has been achieved under field conditions, and (iii) to identify and investigate constraints and limiting factors in the transfer of new agricultural technology to cultivators fields.

The data collection work of the project was in operation in 16 selected districts spread over 9 States: Assam, Gujarat, Kerala, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu and Uttar Pradesh. Coded filled in data schedules for 1984-85 and 1985-86 were received from some of the centres and the same were under scrutiny. Field training was imparted to the supervisory and field staff in the collection of data and coding of filled in information in some of the States. Field data collection work for the year 1986-87 was in progress at all the centres.

#### **Pilot survey to develop statistical models for production and culling patterns in poultry**

The objectives of the project are (i) to estimate monthwise/seasonwise age-specific vital characteristics affecting the growth and structure of the poultry population, (ii) to estimate production of broilers in terms of number and weight and culling of layers by size of farm at regular intervals of time, and (iii) to develop appropriate models characterising the production and culling patterns in poultry farm utilizing the estimated vital characteristics.

Collection of field data was in progress. Scrutiny, coding and tabulation of part data were undertaken.

#### **Pilot studies for estimation of birth and death rates in ovines**

The objective of the project is to develop a suitable methodology for estimating specific fertility and mortality rates in stationary flocks of ovines according to breed, sex, and age. This involves (i) formulation of concepts, definitions and questionnaire, (ii) specification of sampling design, and (iii) development of estimation procedures.

Scrutiny and coding of schedules pertaining to detailed data canvassed from selected households (Tiruchirapalli district, Tamil Nadu) were completed. The entire data were transferred to punch cards and were being transcribed on magnetic tapes. Computer programs for group-specific mortality and exposures were prepared. The results obtained from analysis of complete

enumeration data were summarised and tabulated. Data relating to general information about the selected villages were compiled from schedules.

During the first quarter of 1987, programs for group specific births and exposures would be prepared. Data would be processed to achieve results on specific births, deaths and corresponding exposures. Suitable estimators would be developed.

#### **Statistical investigations on economics of pig production**

The objectives of the project are (i) to evolve a suitable methodology for evaluating the commercial aspects of rearing pigs to an assigned stage of growth under field conditions, and (ii) to estimate component-wise costs of rearing of pigs.

The estimated average daily cost of maintenance of a creeper was 11 paise for male and 12 paise for female and that of an adult pig was Rs. 1.21 for male and Rs. 1.22 for female. Feed accounted for about 60 per cent and unpaid labour about 30 per cent of the total cost in case of nearly all categories of pigs. The average cost per pig per day decreased as the number of pigs reared per household increased. Drafting of the project report remained in progress.

#### **Studies on comparative performance of mixed farming involving crops, livestock, poultry and fish**

The objectives of the project are (i) to determine design and response parameters

for studying the comparative performance in terms of production, investment, return, etc. of different systems of farming, singly or in combination, and (iii) to compare the different systems of farming in respect of labour intensification.

The statistical analysis of data remained in progress. The coding and punching of data pertaining to maintenance of bovines was completed. Suitable card designs were prepared for transferring coded data to punch cards and magnetic tapes. Tabulation of data connected with cultivation of crops, and keeping of poultry and fish was completed.

#### **A comparative study of some methods for estimating mortality rates in bovines**

The objective of the project is to compare estimates of mortality rates obtained by different methods with a view to judging their relative merits.

Age-specific mortality rates were estimated from the distribution of animal populations over single year age interval together with auxiliary data relating to breedable female bovines. The results were compiled and interpreted. Errors of approximation were investigated. Some of the final tables and draft write-up of report were prepared.

#### **Pilot study for developing a suitable methodology for estimation of cost of cultivation of fodder crops, Jalandhar (Punjab)**

The objective of the project is to evolve a suitable methodology of estima-

tion of cost of cultivation and yield rates of fodder crops.

Of the total households studied in kharif season 31 per cent were found growing fodder crops singly (bajra, jowar and maize), 18% in combination (bajra+maize, bajra+jowar and jowar+maize) and 51 percent were growing singly and in combinations. Bajra was the major fodder grown either as singly or in combinations with other fodders. Majority of the cultivators in rabi season (96%) were found growing berseem with other fodders like sarson, senji and javi. Further, sowing of kharif fodders was unevenly distributed over time. Of the total area sown 17 per cent was sown in April, 26 per cent in May, 17 per cent in June, 21 per cent in July and 19 per cent in August and September. On the other hand, rabi fodders were sown mainly during October and November.

Among kharif fodders highest yield was obtained for jowar being 112 q/acre followed by bajra+maize (107 q/acre), bajra (195 q/acre) and maize (97 q/acre). In rabi season berseem+sarson was the most favoured combination grown by the farmers, yielding 293 quintals per acre. The mixture of berseem, sarson and javi gave the highest yield 302 q/acre, Berseem-sarson-javi-senji crop mix yielded 286 q/acre.

The net costs per quintal including family labour for jowar, bajra and maize were Rs.  $6.67 \pm 0.79$ , Rs.  $7.36 \pm 0.51$  and Rs.  $8.09 \pm 0.59$  respectively. The corresponding costs excluding family labour were Rs.  $5.58 \pm 0.77$ , Rs.  $5.96 \pm 0.41$  and Rs.  $7.32 \pm$

0.44. A comparison of production costs and the market rates of kharif fodders revealed that the margin of profit per quintal was of the order of Rs. 2.78 for maize, Rs. 2.73 for jowar and Rs. 1.49 for bajra. The costs per quintal including family labour of fodder combinations: berseem+ sarson, berseem + sarson + javi and berseem + sarson + javi + senji during 1983-84 were estimated to be Rs.  $10.66 \pm 0.99$ , Rs.  $11.14 \pm 0.91$  and Rs.  $10.78 \pm 0.96$  respectively. The corresponding market rates per quintal were Rs. 14.07, Rs. 13.40 and 12.94 respectively.

Input of human labour per acre for jowar, maize and bajra+jowar cultivation was of the same order being 17 man-days. The labour input in bajra cultivation was 19 days per acre as compared to 21 days for bajra + maize. Human labour used per acre on the cultivation of rabi fodders was about 80 man-days of which 60 per cent was expended on harvesting the fodder.

Development of a suitable statistical methodology for estimating extent of labour utilization in livestock and poultry keeping in rural areas, Meerut (U.P.)

The objectives of the project are (i) to compare estimates of labour utilization for each species obtained by different procedures, (ii) to study the relative efficiency of three different types of primary stage units (i.e. size of cluster of villages), (iii) to study gain due to post-stratification, (iv) to study the efficacy of the 'nearest neighbour' imputation procedure for figuring out non-observations, and

(v) to determine norms for efficient utilization of labour for different species.

Data for 24 rounds were collected and scrutinized. In addition, different estimators of labour utilization were finalized.

#### **Study of distribution of age-specific mortality and fertility rates in bovines**

The objective of the project is to study the distributional aspects of age-specific mortality and fertility rates of bovines obtained for different sizes of samples.

Distributions for birth rates and death rates were formulated for individual and pooled age-groups of male and female cattle. Testing for equality and stability of distributions was completed. Possible Pearson-types were identified. Fitting of Pearson distributions was in progress.

#### **Pilot survey to evolve a sampling methodology for estimating the resources and total catch of inland fish in a region of Orissa**

The objectives of the project are (i) to evolve a suitable sampling methodology for estimation of inland fishery resources and total catch of inland fish, and (ii) to study the prevailing practices of pisciculture.

The analysis of the data pertaining to first phase of the survey i. e. estimation of inland fishery resources was continued. The field work pertaining to second phase i.e. estimation of fish catch from ponds and tanks and for estimation of prawn catch from brackishwater remained in progress.

#### **Pilot sample survey for estimation of losses, price spread at various stages and cost of cultivation of vegetable crops, Pune**

The objectives of the project are (i) to evolve a suitable sampling methodology for estimating the losses taking place in marketing of vegetables, (ii) to study the price spread of vegetables at various stages of marketing, (iii) to study the various marketing practices prevalent in the vegetable marketing trade, and (iv) to evolve a suitable sampling methodology for estimating the cost of cultivation per unit area and production of important vegetables.

The field work of this project was started in March, 1986 and was in progress in Khed, Haveli, Purander and Shirur taluks of Poona city under the administrative control of Director of Horticulture, Maharashtra State, Pune. The data pertaining to cost of cultivation of important vegetables were collected and scrutinised.

#### **Pilot studies for developing statistical methodology for assessing the losses due to diseases and pests in bovines**

The objective of the project is to evolve a suitable methodology for estimation of losses in the productivity of bovines due to diseases and pests. This would involve estimation of (i) incidence of diseases and occurrence of deaths due to them, (ii) losses in production due to disability and deaths, and (iii) extent of losses in production and reproduction which could be avoided through protection measures.

The data collected under preliminary enquiry of the project were coded and

punched and further analysis was in progress. In addition, data upto 27th round of detailed enquiry were also received and were being processed for analysis.

**Pilot sample survey for estimating the energy utilisation for different levels of adoption of modern technology in agriculture**

The objective of the project is to develop suitable sampling methodology for estimating the energy utilisation for different level of adoption of modern technology in terms of labour and inputs like irrigation, fertiliser, etc.

The analysis work was in progress.

**Pilot sample survey for determining the cost of production and to study the marketing practices of orange in Nagpur and Amravati districts of Maharashtra state**

The objectives of the project are (i) to obtain reliable estimates of cost of production of orange based on a suitable sampling design, and (ii) to study the prevailing marketing practices of the fruit in the region of study.

Analysis of data was in progress.

**Pilot sample survey for estimation of post-harvest foodgrain losses**

The objective of the project is to develop a statistical methodology for the estimation of foodgrain losses at different post-harvest stages.

Data of the first year (1985-86) were received and scrutinised. Coding, punching and processing of data was in progress.

## **DIVISION OF BIO-STATISTICS AND STATISTICAL GENETICS**

**Estimation of genetic variability in crop plants**

The objectives of the project are (i) to estimate the relative contribution of genetic and environmental variations, and (ii) to develop statistical technique for estimating these variations.

The data considered pertained to the Bersai variety of banana from village Nashirabad (Jalgaon) of uniformity trials experiment planned by the Institute. It consisted of 480 plants in 24 rows of 20 plants each. The spacing between rows and plants was 150 cm. The studied characteristics were number of fruits and weight of fruits per plant. Groups of different sizes were formed by combining the yield of adjacent plants. Genotypic and environmental components of variation and covariation between groups were estimated by fitting the regression model,  $W = G + En^{1-b}$  where W, G, E, n and b are the mean sum of squares or products between groups, genotypic and environmental components of variation or covariation, size of the group and a constant respectively. In this study it is shown how to estimate the relative contribution of genotypic and environmental covariations to the total covariation. Using these estimates the heritability of two

characters as well as genetic covariation between them, in the broad sense, were estimated as 0.61, 0.97 and 0.84 respectively.

#### **Direct and maternal additive and heterotic effects in crossbred dairy cattle**

The objectives of the project are (i) to evaluate the genetic components viz. the direct and maternal additive breed effects and heterotic effects in dairy cattle and to study the parameters that allow prediction of the performance of crosses that have not actually been tested by using multiple regression method of estimation, (ii) to estimate the heterotic effects based on fitting the biometrical genetic models to means of different grades on terms of additive, dominance and epistatic gene effects by an alternative approach to that of multiple regression technique when the performance of one or both the parents is not known, and (iii) to compare the estimates of heterosis obtained by the above two methods of estimation.

The data on crossbred dairy cattle from 14 military dairy farms for the period from 1955 to 1978 were utilised for the study after correcting for the non-genetic factors viz. farms, years and seasons by using least square technique.

Most of the production and reproduction traits exhibited significant heterosis.

Analysis of data for direct and maternal additive and heterotic effects as per the models of Robison et al (1981),

Jain (1982) and Sharma (1984) remained in progress.

#### **Statistical study of dynamical models for fishery growth and harvesting**

The objectives of the project are (i) to critically examine the existing models in fish population growth and fishery harvesting, (ii) to develop more realistic nonlinear dynamical stochastic growth models for single and multi-species fish populations, and (iii) to investigate various harvesting policies with a view to providing a firm theoretical basis for sustained yield.

More realistic stochastic fish population growth models incorporating the aspect of continuously distributed time delay was developed and their statistical study was carried out. As an illustration, the stationary solution of the well known Schaefer model with time delay in random environment was investigated.

#### **Statistical analysis of cross breeding data at military dairy farms**

The objectives of the project are (i) to study the problems associated with adjustment of data by least squares technique, (ii) to study the suitability of various grades of crossbred cattle for life time traits, (iii) to study the genetic divergence among the crossbred grades, and (iv) to study genotype-environment interaction.

Grade, farm, period and season-wise means, standard errors and coefficients of variation were obtained to study the general behaviour of the data. The least squares analysis of data with unequal

subclass numbers was performed for individual characters using linear model with grade, farm, period and season as fixed effects. The data were adjusted for non-genetic factors like farm, period and season and a new file of adjusted data was created. Using this file D<sup>2</sup>-analysis and clustering analysis were done. To study the problems associated with adjustment of data by least squares technique the data were adjusted for non-genetic factors in different ways and grade-wise mean, variance and coefficient of variation obtained for assessing the effectiveness of the various ways of adjustment.

#### **Investigations on appropriate statistical methods for comparing genetic groups based on multiple traits in dairy animal**

The objectives of the project are (i) to investigate into the statistical techniques for developing lactation performance indices applicable to cross-bred cattle and graded buffaloes based on multiple traits utilising repeated lactation records of animals, (ii) to estimate genetic parameters like heritability, genetic correlation, etc. of individual characters as well as of the lactation performance indices for purebred cattle and buffaloes, (iii) to develop statistical techniques for comparing genetic groups based on production and reproduction traits in dairy animals, (iv) to examine the feasibility of adopting lactation performance indices for determining optimum of exotic level inheritance in crossbred cattle, and (v) to develop methodology for estimating generalised heritability.

Breeding data for crossbred animals (Friesian × Sahiwal) from five military farms pertaining to the period 1955-79 were scrutinised and Sanders lactation correction factors for several production and reproduction traits were worked out. The data were adjusted to first lactation basis for three economic characters lactation yield, lactation length and dry period and these adjusted records were used to develop lactation performance indices ( $y$ ) for each genetic group. Analysis of variance for the compounded character ' $y$ ' was performed and the variance ratio of  $y$  were compared with those component traits to determine the extent by which the variation between animals relative to within animals is raised. Genetic parameters such as heritability, genetic correlation, etc. for each individual character as well as for the compounded character ' $y$ ' of Sindhi herd at Bangalore were worked out.

Breeding data of graded buffaloes maintained at 10 military farms will be scrutinised upto the end of March, 1987.

#### **Growth studies on crossbred cows available at various military farms in the country**

The objectives of the project are to study (i) influence of genetic groups, farms, periods of birth on body weights of crossbred females at different ages, (ii) body weight changes in crossbreds in relation to level of exotic inheritance, (iii) growth curves in respect of crossbred cows upto three years of age, (iv) growth rate and its relationship with weight and at first calving and first lactation milk yield, and (v)

genetic parameters of body weights at different stages of growth.

Heritability for birth weight was quite high (0.6) but for body weights at different stages of growth, it ranged from 0.21 to 0.53. This suggests good scope of improvement in growth rates through selection on the basis of body weights at earlier stages of growth. First lactation milk yield was moderately heritable while milk yield in first 300-day and first lactation period were lowly heritable. The heritability estimate for age at first calving was high suggesting great scope for lowering the age of freshening through selection.

The genetic correlations between birth weight and body weights at different stages of growth upto 36 months were quite awry to draw any firm conclusions. The genetic correlations among body weights at various ages were mostly positive suggesting that animals having higher body weight at early age tended to be heavier at later age.

The negative correlations between age at first calving and birth weight as well as body weights at different stages of growth suggest selection of early maturing animals on the basis of their body weights.

The genetic correlation between birth weight and first lactation milk yield was negative and moderate. This indicates that birth weight has very little role to play and should not be over-emphasized as a criterion for selecting dairy animals.

The study of genetic correlations showed that weight at 24 weeks of age is a good indicator of both weight at maturity

and first lactation milk yield. The weight at first calving was also found to be highly correlated with first lactation milk yield.

Age at first calving was found to have negative and low genetic correlation with first lactation milk yield suggesting that early calves though not lacking in the genetic potential for higher milk production cannot express fully because they have not yet attained the lactational maturity. Looking into these correlations, sequential selection programme on the basis of body weights at 24 weeks of age and after for better growth, early sexual maturity and more milk production is suggested.

#### Statistical studies in relation to crop insurance

The objectives of the project are (i) to critically examine and analyse premium and indemnity tables for different crops under crop insurance programme of the general insurance of India (GIC) as modified from time to time, (ii) to develop suitable statistical methodology for estimating premium and indemnity rates based on appropriate distribution of crop yield over time and space using data on crop cutting experiments, (iii) to investigate into the modification needed to take account of technological changes in yield overtime as noticed through linear or curvilinear trends, and (iv) to study the feasibility of adopting homogenous area approach for insuring individual crops as compared to groups of major crops grown in the given area.

Time series data of yield rates of crops covered under the comprehensive crop

insurance scheme implemented by the G.I.C. from kharif season of 1985 were received from the participating states. The crops covered were wheat, paddy, millets (jowar, bajra, maize), pulses (gram, urd, peas, masur, etc.) and oilseeds (groundnut, ragi, mustard, til, sesamum. etc.). The crop yield data were scrutinised, coded, tabulated and transferred to punched cards. Premium and indemnity tables were prepared by using normal curve technique.

Distribution of crop yields over time and space was studied for different crops alongwith its effect on estimating premium and indemnity rates.

#### **Selection indices for economic merit in poultry**

The objectives of the project are (i) to study in economic terms the profit accruing at the poultry farm due to adoption of selection index for rate of lay based on Osbornes procedure for six generations, (ii) to develop selection indices for economic merits involving production and adaptability traits in poultry for eggs, and (iii) to study the efficiencies of various selection indices developed in terms of expected genetic gains.

The statistical analysis was completed and the report finalised.

#### **Statistical studies in animal epidemiology**

The project has two components viz. (a) studies on culling process in dairy cattle, and (b) modelling the epidemiology of diseases in animals.

To study the culling process, various survival distributions such as smallest extreme value, Weibull, normal, log-normal, logistic, log-logistic, exponential and gamma were fitted. Weibull distribution was found to be the most appropriate among the distributions fitted. To find the relationship between survival and concomitant variables to survival under the exact parametric survival model, the computer programme was prepared and tested. Some salient results also discussed with Prof James H Matis, UNDP consultant and as per his suggestions further research work would be carried out.

#### **Use of discriminant function for comparing different grades in cross-breeding programme with sheep**

The objectives of the project are (i) to develop a sound technique for comparing the performance of different grades of sheep in terms of their economic characters when the variance covariance matrices of the populations to be compared are unequal, (ii) to obtain the discriminatory power and probabilities of Mis-classification of the functions developed, (iii) to compare the performance of the function developed with Fisher's linear discriminant function, and (iv) to cluster different grades of sheep into a fewer number of homogeneous groups.

The ratios of probabilities of misclassification (minimax procedure vs Fisher's linear function) were less than one in about 72% of the comparisons studied indicating the superior performance of the minimax

procedure over Fisher's linear discriminant function when the variance covariance matrices of the populations under comparison were unequal. These results were also found consistent with the results of the monte carle studies made by Marks and Dunn (1974). Further based on  $D^2$ -values of minimax linear functions, 14 different grades of sheep were seen to fall into 9 homogeneous clusters as follows : (I) Rambouillet, (II) Chokla, (III) Malpura, (IV) RC( $F_1$ ) (V) RC(5/8) and RC(3/4), (VI) RM( $F_1$ ) and RJ( $F_1$ ), (VII) RM(3/4), (VIII) RJ( $F_2$ ) and (IX) RC( $F_2$ ), RM( $F_2$ ), RM(5/8) and RJ(3/4), where 'J' stands for the Jaisalmeri breed.

#### Statistical investigations in sensory evaluation of agricultural products

The objectives of the project are (i) to develop methodologies for analysis of sensory data obtained in different situations, and (ii) to compare the efficiencies of the methodologies developed relative to the existing parametric and nonparametric procedures.

A statistical procedure was developed for selection of consistent sensory panels. A new statistical model was also evolved for paired and triad comparisons in sensory evaluation. In addition a model of multi-character sensory evaluation was developed.

Investigations on the slippage problems for K objects in sensory evaluation was made. Study on the efficiency of fractionation in sensory evaluation was com-

pleted and a model for fractional triad comparisons was developed.

#### DIVISION OF FORECASTING TECHNIQUES FOR CROPS, DISEASES AND PESTS

**Pilot studies on pre-harvest forecasting of yield of groundnut crop on the basis of data on biometrical characters, weather variables and agricultural inputs, Rajkot district (Gujarat)**

The objective of the project is to develop suitable statistical methodology for obtaining pre-harvest estimates of yield of groundnut on the basis of data on biometrical characters, weather variables agricultural inputs at various stages of crop growth.

Based on the data of the first round of the survey (1984-85) three linear multiple regression models were developed taking biometrical characters, agricultural inputs and weather variables alone, partial combination of these characters and all these characters together.

Forecast equations were fitted at three main stages of crop growth namely flowering, peg formation and pod development. It was observed that about 46% variation in yield could be possible in flowering stage, 42% at peg formation stage and 35% at pod development stage taking biometrical characters alone whereas taking the effect of crop inputs the variations in yield with the biometrical characters there was not much improvement in the value of  $R^2$ . Rainfall alongwith

biometrical characters and crop improved the value of  $R^2$  taking it to 54% at peg formation stage.

#### **Studies to develop models for obtaining pre-harvest forecast of wheat yield on the basis of weather parameters**

The objectives of the project are (i) to study effects of weather variables on yield, and (ii) to develop models for obtaining pre-harvest forecast of wheat yield on the basis of weather parameters.

Work was carried out to study the effects of weather variables on wheat yield singly and jointly. Contribution of weather variables over trend was significant. Interactions of number of rainy days with sunshine hours and wind velocity as also between rainfall and wind velocity were significant. To obtain appropriate combination of weather variables for forecast model, various combinations using complete crop season data were tried. Study on forecast model using partial crop season data would now be tried.

#### **Use of growth indices and principal component technique in yield forecast of sugarcane**

The objective of the project is to develop forecast model on the basis of growth indices of biometrical characters and by using principal components of biometrical characters.

The model developed using growth indices of biometrical characters based on

2 or more periods data simultaneously was at par with the model using variables as such at a point of time. This is expected in sugarcane crop as the characters are components of yield. Similarly using principal components of biometrical characters did not improve the model. Model based on principal components of 2 or more periods was also at par with the model using variables as such at a point of time. It was, therefore, recommended model using variables as such at a point of time should be used.

#### **Yield forecast model based on biometrical characters and agricultural inputs for jowar crop**

The objective of the project are (i) to study influence of agricultural inputs and biometrical characters on yield singly and jointly and (ii) to develop suitable yield forecast model based on biometrical characters inputs.

Date of sowing and fertilizer application were seen to contribute significantly towards hybrid jowar yield. Inclusion of agricultural inputs alongwith biometrical characters in case of hybrid jowar increased the coefficient of determination by about 10%. In local jowar the contribution of agriculture inputs was negligible.

The model utilising indices of plant height, length of top most fully opened leaf and earhead based on observations of 8-10 and 10-12 weeks after sowing alongwith fertilizer and date of sowing explained 78% variation in yield.

### **Pilot studies on pre-harvest forecasting of apple yield in Shimla district (H.P.)**

The objective of the project is to develop technique for obtaining per-harvest estimate of apple yield on the basis of data on biometrical characters, weather variables and crop inputs.

Data collected during the first round of survey 1984 were analysed for estimation of mean values of various tree characters, their correlations with apple yield and regression of apple yield on various characters. Second round of data were scrutinised, coded and transferred on cards and magnetic tapes for analysis. Field work of the project was concluded and data schedules were received. Statistical analysis of data remained in progress.

### **Pilot sample survey for estimating the incidence of pests and diseases and their consequent loss in high yielding varieties of paddy crop in South Arcot district of Tamil Nadu**

The objective of the project is to develop methodology for estimating the level of incidence of pests and diseases, consequent crop loss and avoidable loss.

Estimates of crop loss due to pests and diseases were worked out for 3 seasons viz. Navarai (Jan. to June) 1978, Samba (July to Dec.) 1978 and Navarai (Jan. to June) 1979. The loss due to pests and diseases in high yielding varieties of paddy crop ranged between 3.4 to 9.6 percent during all the 6 seasons covered.

### **Models for forecasting aphid pests of mustard crop**

The objective of the project is to identify the meteorological variables influencing aphid-pest growth and to develop the methodology for forecasting the intensity of mustard aphid-pests at different stages of crop growth.

Using spectral analysis and certain meteorological variables the graphs of power density spectra of aphid-population were developed. The analysis indicated that variables like maximum temperature, minimum temperature and saturation density have a profound influence on aphid population growth and these variables could be used for forecasting aphid population.

### **Tobacco yield forecast model based on principal components of biometrical characters and crop inputs**

The objectives of the project are (i) to study the influence of crop inputs and biometrical characters on tobacco yield, and (ii) to develop a suitable yield forecast model based on principal components of inputs and biometrical characters as regressors.

Crop yield forecast regression models were developed using data for more the one stage simultaneously through their principal components as regressors. About 80% variation in crop yield could be accounted by the data on crop inputs and biometrical characters recorded during two consecutive periods.

## **DIVISION OF STATISTICAL ECONOMICS**

### **Study of cost functions for milk production in rural areas**

The objectives of the project are (i) to examine the suitability of different types of functions and various problems involved in their estimation with respect to milk production, (ii) to estimate the cost functions, and (iii) to derive supply functions for milk in rural areas.

Various production and cost functions were estimated and their suitability examined.

### **Economic analysis of acreage response for tur crop in India**

The objectives of the project are (i) to study the trend in acreage, production and productivity of tur crop in important pulse growing states, (ii) to examine the effect of price and non-price factors on acreage adjustment behaviour of farmers, and (iii) to investigate the overall causes hindering growth of tur production in the country.

The results pertaining to growth analysis, magnitude of variability, shifts in turn and competing crops acreage, acreage response functions and constraints analysis for tur production were properly tabulated. Also the project report was drafted and submitted for approval.

### **A study on institutional credit in agriculture**

The objectives of the project are (i) to examine the farm credit structure in India,

(ii) to study the causes of concentration of bank advances of farm sector in the selected states, and (iii) to investigate the impact of institutional credit on productivity of foodgrains.

The analysis regarding first and second objectives were completed while that for the third objective remained in progress.

### **Economic study of new farm technology with special reference to yield gap and associated factors in selected operational research project areas**

The objectives of the project are (i) to examine the new technology and its yield potential for different crops, (ii) to estimate the extent of gap in yields under farmers' environments, and (iii) to identify the socio-economic and other constraints responsible for gap between the potential yield and actual yield under the operational research projects on pulse production in Mohindergarh (Haryana), on dry land agriculture in Ranchi (Bihar) and on crop production in Bhilwara (Rajasthan) and Indore (Madhya Pradesh).

Field data collection was completed for ORP area in Ranchi while for others remained in progress.

### **Economic study of imbalances in rice and wheat production in India**

The objectives of the project are (i) to study the growth rates of area, production and productivity of rice and wheat alongwith the study of growth rates of selected inputs used in their production, (ii) to examine the variability in production

of rice and wheat and use of inputs in their production, and (iii) to study production functions of rice and wheat in different states.

Statewise data were being examined for obtaining the growth rates and variability in production of rice and wheat alongwith input use in their production such as use of chemical fertilisers, use of high yielding varieties seeds and irrigated area. Production functions for pre-green revolution period and post-green revolution period were estimated.

#### **Level of employment in modern farm technology**

The objectives of the project are (i) to examine employment generated in various enterprises including allied farm activities, (ii) to estimate overall employment generated on holdings of different sizes and various levels of technology, (iii) to examine employment pattern during lean periods, (iv) to estimate labour productivity in different crops, and (v) to examine the suitability of observation interview method of data collection to measure farm employment.

Details of sampling design for data collection were finalised. Data collection by field investigators remained in progress.

#### **DIVISION OF COMPUTING SCIENCE**

##### **Development of software for construction of selection index as applicable to animal breeding data**

The project envisages development of general purpose software for the construc-

tion of unrestricted as well as restricted selection indexes.

Program module for variance-covariance matrix based on half-and full-sib analyses for various traits was prepared and documented. In addition, programs for the methods of estimation as described by Cunningham were prepared, but are yet to be tested for proper functioning.

##### **A study of the use of split-plot designs in agricultural field experiments**

The program module envisages investigations into; (i) whether the split plot design adopted in the experiment is appropriate to the situation, (ii) whether the split plot design is effective in obtaining the significance of different effects, and (iii) how efficient is the split plot design as compared to randomised block design.

The project was completed.

##### **Development of computer software for cluster analysis**

Suitable computer programs for cluster analysis were developed and documented in the form of users manual.

##### **Computer software for quadratic programming techniques**

Computer programs for solving problems of quadratic programming were developed and documented in the form of users manual.

*[For list of on-going research projects along with their duration and project associates see Appendix-III]*

## UNDP CENTRE OF ADVANCED STUDIES IN AGRICULTURAL STATISTICS & COMPUTER APPLICATIONS

### UNDP Consultants

Consultant	Field of Consultancy	Period of visit
1. Dr James E Gentle (IMST, Houston, Texas, USA)	Computer Applications	Jan 27-Feb 19, 1986
2. Dr G K Kanji (Sheffield City Polytechnic, U.K.)	Applied Statistics and Operational Research	Aug 28-29, 1986
3. Dr James H Matis (Texas A and M University, Texas, USA)	Crop Forecasting Methodologies	Dec 4-22, 1986

They had extensive discussions in small groups with concerned scientists and made a number of recommendations. In addition, they delivered seminar talks :

Consultant	Seminar Topic
Dr James E Gentle	<ol style="list-style-type: none"> <li>1. Impact of Computers, Monte Carlo and simulation in statistics.</li> <li>2. Random number generations.</li> <li>3. Least squares computation and computation for robust procedures in linear models.</li> <li>4. Principles of algorithm design.</li> <li>5. Software for statistical application.</li> </ol>
Dr G K Kanji	<ol style="list-style-type: none"> <li>1. Robustness in analysis of variance.</li> <li>2. Analysis of variance for circular data.</li> </ol>
Dr James H Matis	<ol style="list-style-type: none"> <li>1. On the modelling and analysis of digestic flow data.</li> </ol>

## Deputation for Training Abroad

Scientist	Field of training	Training Centre	Period
1. Sh S N Mathur	Computer Applications	(i) Regional Computer Centre Edinburgh, UK (ii) Agricultural and Food Research Council Herpondam Computing Centre, UK	6 Months
2. Dr Randhir Singh	Sample Survey (Remote Sensing)	(i) University of Quebec, Canada (ii) OSU Columbus, USA (iii) Pennsylvania State University, USA (iv) University of Houston Texas, USA	7 Months

### Teaching and Equipments

Micro Computers IBM Pcs. (5 number) with necessary accessories and software were proposed to be procured with UNDP/FAO assistance.

### Meeting

A meeting of the Task Force in Computer Applications was held on 17th February, 1986 under the Chairmanship of Prof Prem Narain.

## POST-GRADUATE TRAINING AND EXTENSION

### Regular Courses

The four regular post-graduate training courses: Professional Statisticians, Certificate Course, Diploma in Agricultural and Animal Husbandry Statistics Course, Senior Certificate Course and Course in Advanced Computer Programming which were being conducted at the Institute (the first two courses since 1945) were discontinued in 1985 and a new set of short term refresher courses namely Refresher Course in Agricultural Statistics, Senior Level Refresher Course for Statisticians and Agricultural Scientists and also a short term course on the Use of Computer in Agricultural Research have been started from 1986. Apart from this, the Institute continued to conduct, in collaboration with IARI, two degree courses leading to MSc and PhD degrees in Agricultural Statistics and an MSc degree course in Computer Application in Agriculture. During 1986, 16 students were admitted to various courses: 8 PhD, 4 MSc in (Ag Stat) and 4 MSc (Computer Application in Agriculture). 16 students: 6 PhD and 10 MSc of Agricultural Statistics successfully completed their degree courses.

### Ad-hoc Training Course

The first short-term course on Use of Computer in Agricultural Research was

organised by this Institute from Sep, 1-27, 1986. The course was attended by 19 scientists from ICAR Institutes and Agricultural Universities. A function to distribute the certificates to the participants was held on Sep.-27, 1986. Dr RM Acharya, DDG (AS) was the Chief Guest.

### Ad-hoc Training Programme

A training programme on "Estimation procedure and tabulation programme relating to production surveys on milk, eggs, wool and meat and cost of production studies on milk and egg" was organised in collaboration with the Animal Husbandry Division of Department of Agricultural and Cooperation, Ministry of Agriculture from Sep. 22-26, 1986 at IASRI, New Delhi. The following scientists participated in the programme:

- i) Dr JP Jain—Studies on cost of production of milk and eggs-a resume
- ii) Dr Shivtar Singh—Cost of production of milk methodology
- iii) Shri KB Singh—Estimation of procedure for the estimation of production of milk and eggs
- iv) Shri TB Jain—Estimation of cost of production of poultry and eggs

- v) Shri LBS Somayazulu—Estimation of cost of relevance to the sampling design adopted by the Ministry
- vi) Shri RS Khatri—Tabulation programme for estimation of number of layers and egg production

### Research Fellowships

During 1986, 27 MSc and 27 PhD students received research fellowships. MSc students received fellowship at the rate of Rs. 800/- per month each besides Rs.2,000/- per annum as contingent grant. Of the 27 PhD students 20 received fellowship at the rate of Rs. 1,000/- per month each in the I and II year and 7 students received fellowship at the rate of Rs. 1,200/-per month in the III year in addition to Rs. 5,000/- per annum as contingent grant.

### Hostel

The Institute maintains two well furnished hostels: Panse Hostel and Sukhatme Hostel within its premises to cater residential requirements of the students. Ample facilities also exist for cultural activities and sports. All the students are supposed compulsorily to stay in the hostel. The general management of hostels is vested in the Warden, who is assisted by Prefect and the students Executive Committee. During 1986 the main activities included:

- New Year's day and Holi festival were celebrated with great pump and show
- Sarasvati Pooja was celebrated on Feb 13, 1986
- Students participated in ICAR Inter-Institute Sports Meet held at IVRI, Izatnagar from Mar 3-5, 1986 and bagged a number of prizes
- A cricket match was played between the students and faculty members of the Institute on Oct 19, 1986.
- Students Annual Day function was celebrated on Oct 27, 1986. On this occasion a Souvenir was also brought out highlighting the hostel activities.

### Seminars/Workshops/Conferences

#### *Seminars*

The results of the research projects and field trials undertaken in different aspects of Agricultural Statistics and Computer Applications were presented in the seminars organised regularly in the Institute. During the period under report 70 talks were delivered by the scientists, research scholars and various experts; the ones delivered by the eminent scientists are:

Sl. No.	Speaker	Topic
1.	Prof David Seckler, Executive Director, International School for Agricultural and Resource Development, Colorado State University, USA	Production and Poverty in Indian Agriculture
2.	Dr Padam Singh, Jt Adviser (Prospective Planning), Planning Commission, New Delhi	Models in 7th Five Year Plan
3.	Dr VPS Chauhan, Instt of Animal Science, Federal Institute of Technology, Zurich, Switzerland	Estimating breeding value of dairy sires using a model with variance co-variance between seasons within herds
4.	Dr JS Samra, Sr Soil Scientist, CSSRI, Karnal	Special soil variability

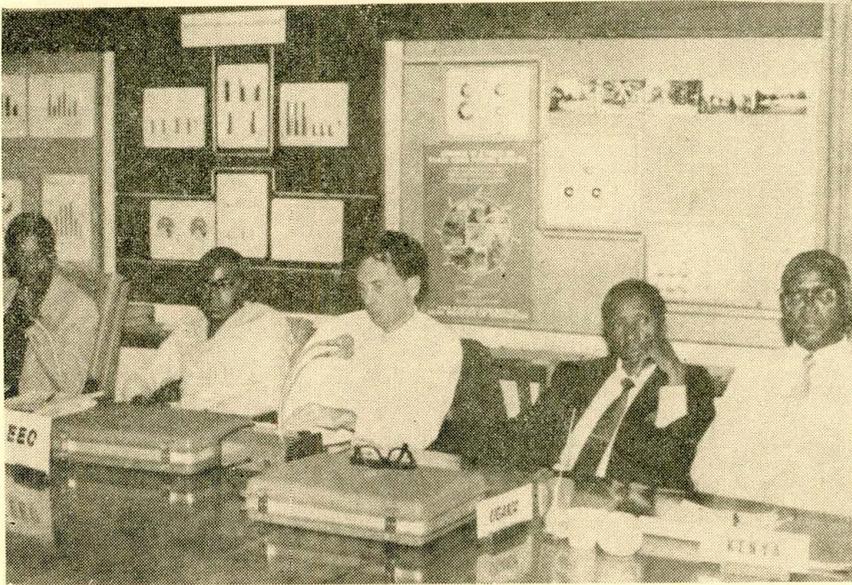
*Workshop on "Food Supply Information System"*

A workshop on food supply information system was organised by Afro-Asian Rural Reconstruction Organisation from Oct 13-25, 1986 in which this Institute participated as a collaborating agency. Heads/Sr Officers of the department of Statistics of 13 African countries and representatives of European Economic Community and Commission of Africa, UN participated at the workshop. The scientists from the Institute participated in various group discussions. A senior scientist of the Institute acted as a resource person for drafting the proceedings.

*8th National Conference of Agricultural Research Statisticians*

The 8th National Conference of Agricultural Research Statisticians of ICAR Research Institutes, Agricultural Universities and other Central and State Departments of Agriculture and Animal Husbandry engaged in Agricultural Research was organised by IASRI at Central Arid Zone Research Institute, Jodhpur from Jul 29-31, 1986. The main theme of the Conference was 'Priorities in Research and Education in Agricultural Statistics and Computer Applications'. Dr NS Randhawa, Director General, ICAR inaugurated the Conference. He stressed

**Delegates for the Workshop on "Food Supply Information System"  
Organised by the Afro-Asian Rural Reconstruction Organisation  
in group discussion on their visit to the Institute**



VIII National Conference of Agricultural Research Statisticians  
held at CAZRI, Jodhpur from Jul 29-31, 1986



Dr NS Randhawa, DG, ICAR delivering the inaugural address at the Conference



Dr C Prasad, DDG (Agri. Ext.), ICAR addressing the delegates in Technical Session-IV



Dr RM Acharya, DDG (A&S), ICAR giving his Presidential remarks in Plenary Session



A view of the participants at the Conference

the need to strengthen the statistical data base in the acreage and production of oilseeds and pulses in the country. He also drew the attention of statisticians to develop sophisticated models to have quick and reliable estimates of losses from floods, draught, pests and diseases. Key note address was delivered by Dr RM Acharya, Dy DG (AS), ICAR. Apart from inaugural and plenary sessions there were following four technical sessions:

- I Coordination and linkages between different ICAR Institutes for Research in Agricultural Statistics.
- II Gaps and priorities of Research in Agricultural Statistics pertaining to Crop Sciences and Forestry.
- III Gaps and priorities of Research in Agricultural Statistics pertaining to Animal Sciences.
- IV Gaps and priorities of Research in Agricultural Statistics pertaining to Social Sciences/Agricultural Economics.

About 96 scientists/research workers from different research Institutes/universities participated in the Conference.

The recommendations that emerged are as follows:

1. Development of survey sampling methodology for estimation of area and production in field crops in hilly areas.
2. Development of survey sampling methodology for estimation of

area and production of several crops grown in the same field.

3. Development of sampling methodology with imperfect and overlapping frames.
4. Development of survey sampling methodology for evaluation of comparative efficiency of different irrigation systems in canal command area.
5. Development of exact best based on LER distribution.
6. Development of statistical methodology for determining the optimal plot size for inter-cropping and agro-forestry experiments.
7. Development of survey sampling methodology for estimating stock rate of animals at a given time through time-series data in grazing land and utilisation of remote sensing data for adjustment of stocking rate.
8. Development of survey sampling methodology for animal disease surveillance.
9. Development of survey sampling methodology for effectiveness of AI under field conditions.
10. Development of comprehensive data base at IASRI with the help of the computer.
11. Development of statistical methodology for measurement and quantification of qualitative characters in social sciences.

## Lab-to-Land Programme

Lab-to-Land Programme was launched by the ICAR in 1979 for transferring relevant low-cost technology to small and marginal farmers and landless agricultural labourers, who had not benefited much from the modern technologies. The first two phases of the programme have since been completed and the third phase is in operation since Jun, 1984.

In the current phase this Institute has adopted 250 families in Akbarpur, Majra village in Alipur block of Delhi. Of these, 133 families are of landless agricultural labourers, 57 of marginal farmers and 60 of small farmers. Over 60% of the families are either of scheduled castes or of backward classes. The main emphasis of the programme is on improving the productivity of crops as well as livestock. Cropping improvement programme envisages demonstration of the benefits of multiple cropping through introduction of pulses and vegetable crops in the cropping pattern of the farmers, use of fertilizers, pesticides and improved agronomic practices; while livestock improvement programme envisages demonstrating the use of more succulent greens, balanced feed and provision of better management and health cover on milk yield.

During 1986 the items of work included:

### *Demonstrations of improved packages of wheat cultivation*

The Institute supplied seeds of three high yielding varieties of wheat viz.

HD-2204, HD-2329 and HD-2285 to 90 farmers, in addition to 50 kg of DAP and an equal quantity of urea as basal and top dressing doses of fertilizers respectively to each of the farmers. This package boosted the average production of wheat from 28 q/ha to 45 q/ha.

### *Demonstrations of summer crops*

The Institute supplied seeds of short duration variety of mung and bacterial culture to 60 farmers and improved seeds of vegetables to 18 farmers—bottle gourd and bhindi each to two farmers and radish to 14 farmers. This resulted in an additional income ranging from Rs. 1000 to Rs. 2000 per hectare.

### *Demonstrations on the use of balanced animal feed*

Demonstrations on the use of balanced animal feed to milking buffaloes were conducted in 90 households belonging to landless agricultural labourers. This resulted in an appreciable increase in milk yield.

### Advisory Service

The Institute continued to play its important role of giving technical advice and guidance in regard to problems in agricultural statistics and sampling techniques particularly in the statistical aspects of the projects financed by the ICAR.

Technical advice and guidance were also rendered to research workers and students of the various research Institutes, universities and other research organisa-

tions in planning of their experimental investigations and in processing and analysis of data on the computer. Division-wise brief resume of such assistance rendered during the year is as follows:

*Design of Experiment and Analysis of Experimental Data*

- Dr VR Balasubramanyam of National Botanical Research Institute, Lucknow in respect of analysis of data obtained through rotatable designs
- Dr SM Vaidya, Scientist (S-2) of Genetics Division, IARI on test of non-additivity in analysis of experimental data.

*Sample Survey Methodology and Analysis of Survey Data*

- Chief Engineer (CAD), Ministry of Water Resources on the choice of survey design for obtaining yield estimates of irrigated and un-irrigated crops in command areas
- Jt Director (Stat), Directorate of Animal Husbandry, Trivandrum in the conduct of livestock surveys under centrally sponsored scheme
- Dy Director (AHS), Deptt. of Agriculture and Co-operation, Ministry of Agriculture, New Delhi on the estimation of milk production for 1983-84 and 1984-85
- Animal Husbandry Commissioner, Ministry of Agriculture, New Delhi on the possibility of estimating egg

production from ducks on the basis of data collected in the surveys sponsored by the Ministry of Agriculture, New Delhi and on the paper Livestock Development-Challenges and Prospects

- Director, Bureau of Economics and Statistics, Orissa on planning of survey for estimation of area and production of fruits, vegetables and minor crops in the state
- Jt Director (Stat), Deptt. of Agriculture, Haryana on estimation of sampling error of yield of wheat crop
- Directorate of Marketing and Inspection in sampling procedure to be followed for estimating production of hair and bristles
- Officers of International School for Agricultural and Resource Development, Colorado State University, Colorado Fort Collins-7, U.S.A. in planning surveys for monitoring irrigation system
- Director, Bureau of Applied Economics and Statistics, West Bengal in planning of survey on fruits and vegetables and choice of appropriate design for crop estimation surveys in the state
- Economics and Statistics, Adviser, Ministry of Agriculture in the formulation of recommendations and preparation of report for the Working Group on Agricultural Statistics

- Jt Director (Stat), Department of Agriculture, Haryana and Jt Director of Agriculture, Department of Agriculture, Punjab in statistical analysis of data on crop cutting experiments at block/tehsil level and as also in determining sample size
- Central Silk Board, Bangalore in formulation of a project for evolving a suitable sampling methodology for estimation of area and production of mulberry leaves and production of reeling cocoons
- Shri Sudershan Kumar, Deputy Director (Stat), Directorate of Animal Husbandry, Punjab, on procedures for determining mortality rates in farm animals
- Shri N Natraja, Asstt Director, Central Silk Board, Bangalore on, (a) sample survey for estimation of various sericultural parameters in Karnataka, and on (b) sampling plan and schedules for the survey on sericultural products
- Dr (Mrs) Kalpana Raghuvanshi, Director (Women's Programme), Vikram Research and Development Centre, Jaipur on the questionnaire to be used in the survey on 'Role of Women in Dairying in Rajasthan'.

*Bio-Statistics and Statistical Genetics*

- Manager, General Insurance Corporation of India on statistical aspects of crop insurance

- Dy Director of Statistics, State Govt. Rajasthan on some aspects of crop insurance scheme and methodology for determining premium and indemnity rates.

*Computing Science*

- International Airport Authority of India for computerising the activities of the authority
- Delhi Transport Corporation for computerising inventory system and procurement of suitable machine for the Corporation
- Indian National Scientific Documentation Centre for procurement of suitable machine for the centre
- Central Institute of Cotton Research, Nagpur for purchasing a suitable machine to be installed in the Institute for scientific work of the Institute
- Selection of a computer system for the National Bureau of Plant Genetic Resources, New Delhi
- Selection of a computer for the Ministry of Surface Transport to be located in the office of the Hon'ble Minister for Shipping and Transport
- Goat Research Institute, Makhdoom for purchasing a suitable computer system.

## Computing Services

B-4700 computer system worked in two shifts from 8.00 AM to 8.00 PM on all working days. It was also run occasionally during night shifts for completing the accumulated backlog. About 16,000 production and testing jobs were processed on B-4700 system excluding those processed through inter-active terminals. The inter-active terminals and graphics terminal were used extensively by the staff and students for developing programs and drawing of charts and diagrams.

Programming and data processing assistance was provided to 123 Ph D and 72

M Sc students in addition to 61 other research workers. For meeting their requirements 10 new programs were developed and a number of existing programs were modified.

The Institute continued to provide selective information service based on International Information System for Agricultural Science & Technology (AGRIS).

Mechanical Tabulation Unit undertook jobs of punching data on cards. About 10 lakhs cards were punched during the year.

## LIBRARY AND DOCUMENTATION SERVICES

### Resource Building

As a part of its important activities, library continued its resource collection programme as under :

- i) Total number of publications as on 1.1.86 : 19, 728
  - a. Books : 18,871
  - b. Journals : 707
  - c. Reports, etc. : 150
- ii) Number of publications added during 1986 : 1,083
  - a. Books : 760
  - b. Journals : 173
  - c. Reports, etc. : 150
- iii) Journals subscribed : 170
  - a. Indian : 45
  - b. Foreign : 125
- iv) Bulletins/Newsletters received on exchange : 75
- v) Number of reprints procured during 1986 : 40
  - a. for exchange : 17
  - b. for users : 23

### Maintenance

- i) Publications bound : 600
- ii) Publications mended : 350  
(in house)

### Library usage

- i) Working hours : 09.30-20.00 hrs
- ii) Number of readers who consulted the library : 19,950
- iii) Number of publications issued from the Library : 22,500

### Library Services

- i) Number of documents borrowed or lent out on inter-library loan : 100
- ii) Number of pages of scientific and technical nature reprographed : 46,670
- iii) Number of issues of 'Current Content Mirror' brought out : 10
- iv) Number of electronic stencils and transparencies made : 340

### Advisory Services

Provided guidance to the ICAR Institute's Libraries with regard to technical and organisational aspects.

### Library Committee

The Library Committee consisting of following officials :

- |                   |                 |
|-------------------|-----------------|
| 1. Dr SS Pillai   | <i>Chairman</i> |
| 2. Dr OP Kathuria | <i>Member</i>   |

3. Dr JP Jain	Member	<b>Art and Photography Unit</b>
4. Dr VK Sharma	„	
5. Sh SR Bapat	„	
6. Sh PN Bhargava	„	
7. Dr AK Nigam	„	
8. Sh SS Srivastava	Convenor	

met four times during the year for finalizing proposals with regard to purchase of books, subscription of periodicals and other general items.

**Conference/Workshop attended by Senior Librarian**

- i) Attended, Workshop on Library Information Science at NAARM, Hyderabad during July 8-11, 1986 and delivered an invited lecture on "Information needs of Agricultural Scientists."
- ii) Attended and participated in the deliberations of IASLIC Information Study Circle at ICCSR, New Delhi on Dec 14, 1986.

*Art*: Art Unit assisted the scientists in preparing diagrams, charts, histograms and maps for research publications and as also visual display of research findings in the exhibition room. It also assisted in transcribing the lectures write-ups on transparencies.

*Photography*: Photographic jobs including exposing, processing and printing of about 250 photos taken on various important occasions and of important research and extension activities of the Institute were executed. In addition enlargement of good number of photographs were also done.

*Visual Display of Research Findings*: The charts and graphs were updated in the light of recent research findings for display in the exhibition room. A number of new charts were also added to the existing ones depicting current research findings.

## PUBLICATIONS

### Research Papers

The major publications of the Institute comprised over 35 papers and popular articles the details of which are given in Appendices V and VI.

### Research reports/Monographs/Compendia

Jha, MP; RC Jain; SR Bapat; Rakesh Chandra 1984. Pilot studies on pre-harvest forecasting of yield of sugarcane in Meerut Distt. (UP).

Agrawal, Ranjana; RC Jain and MP Jha 1984. Effects of weather on rice yield and its forecast in Puri district (Orissa).

Garg, LK; P Narain; JP Jain; Lal Chand; PS Rana and Indra Singh 1985. Measurement of genetic improvement due to scientific breeding in cattle and buffaloes.

Arya, SN and UG Nadkarni 1985. Estimation of withdrawal rates in cattle and buffaloes in Amritsar and Ferozepur district (Punjab).

Singh, HP; BC Saxena; SP Verma and Balbir Singh 1985. Impact of Greater Calcutta Milk Supply Scheme on rural economy in milk collection area, Calcutta (WB).

Singh, Shivtar; KC Raut and JP Jain 1985. Pilot survey to study the performance of cattle under village conditions, Palampur area (HP).

Narain, P; OP Kathuria, PC Mehrotra and AK Banerjee 1986. Evaluation of Lab-to-Land demonstration programme conducted in Rai Bareli and Sultanpur districts (U P).

Pandey, RK and Shanti Sarup 1986. Study on changes in distribution pattern of land holdings and tenancy structure in India.

Leelavathi, CR; SR Bapat and P Narain 1986. Revised yardsticks of additional production due to improvement measures.

## AWARDS/HONOURS/SPECIAL RECOGNITION

Prof Prem Narain

—was nominated

- On the Editorial Board for Indian Journal of Pure and Applied Mathematics by the Indian National Science Academy.
- As External Examiner by the Education Council of Vishwa Vannayan Sansad (World Development Parliament). Pitamber Bhawan (West Bengal) on its various Institutions for a period of 5-years.
- On the Inter-Ministerial Group constituted by the Ministry of Finance, Government of India in connection with the Review of Comprehensive Crop Insurance Scheme, 1985.
- On the Board of Faculty of Science, Agra University, Agra.
- As Member of the Editorial Board of International Journal of Genetics and Plant Breeding for a period of two years.
- As Chairman of the Technical Group for Reviewing from time to time the Sampling Design and Estimation Procedures followed by different States in respect of Crop Estimation Surveys on Breeds, Vegetables and minor Crops conducted under the Central Sector Scheme of the DARE, Ministry of Agriculture.
- As one of the Eminent Scientist to work on the Executive Committee and Executive Council of the Maharashtra Association for the Cultivation of Science, Pune for 1986-89.
- As a Member of the Committee set up by the Department of Ocean Development to prepare a complete plan for Computerisation of the major activities of that Department.
- As Member of the Programme Committee of the XXVI Convocation of IARI.
- As Chairman of the re-constituted Management Committee of the Institute.
- As Member of the Management Committee constituted by the Government of India, Ministry of Agriculture, Department of Agriculture and Cooperation,

New Delhi to decide detailed methodology for collection of Animal Husbandry and Dairying Statistics in the country after taking into account sound statistical principles as well as functional requirements.

- As Member of the re-constituted Regional Committee No. 4 of Sub-humid Sutlej Ganga Alluvial comprising states of Punjab, Delhi, UP and Bihar

—was appointed as Member of the Sectional Committee No. X of the Indian National Science Academy for a period of 3 years.

—was the Chief Guest of Honour at the Zonal Science Fair, 1986 to Zone XXVI, district West, Directorate of Education Delhi Administration, held at Government Girls Senior Secondary School, Punjabi

Bagh, New Delhi, from Oct 28-29, 1986.

—was the Chief Guest at the Felicitation function of Prof PK Bose at Calcutta on his 70th birthday. The function was organised by Indian Association for Productivity, Quality and Reliability on Dec 27, 1986.

—was Member of the National Organisation Committee of the National Seminar on "Integrated Management Approach for Maximising Crop Production in Rainfed and Problem Areas", organised by the Indian Society of Agricultural Science, at IARI, New Delhi from Feb 26-28, 1986.

Dr SS Pillai

—was elected as Fellow of the Institute of Electronics & Tele-Communication Engineers.

**SEMINARS/WORKSHOPS/SYMPOSIA/CONFERENCES  
ATTENDED BY THE SCIENTISTS**

Sl. No.	Scientist Name	Programme Title	Venue	Period
1	2	3	4	5
1.	Dr Randhir Singh	National Convention of Indian Society for Training and Development	Trivandrum	Jan 16-19
2.	Dr J.S. Maini	XIII workshop on All India Coordinated Research Project on the Utilization of Agricultural By-products and Industrial Waste Material for Evolving Economic Ration for Livestock	APAU, Hyderabad	Jan 21-25
3.	Prof Prem Narain	II Regional Seminar on Crop Production Techniques and Fertilizer Management in Rainfed Agriculture in Southern Asia	New Delhi	Jan 22
4.	Shri Lal Chand	XI Workshop of All India Coordinated Research Project on Poultry Breeding	Madras Veterinary College, Madras	Jan 24-26
5.	Dr P.C. Mehrotra	National Workshop for Training and Planning	Vigyan Bhavan, New Delhi	Jan 27-29
6.	Shri I.C. Sethi	Seminar on 'Live System Designs' conducted by Tata Consultancy Service	Hans Hotel, New Delhi	Feb 4-7
7.	Shri P.N. Bhargava	IV Ground Water Congress	New Delhi	Feb 6-8
8.	Shri Shanti Sarup	National Seminar on 'Maximization of Pulse Yield'	DPR, Kanpur	Feb 22-24

1	2	3	4	5
9.	Prof Prem Narain Dr S.K. Raheja Shri P.N. Bhargava Dr A.K. Banerjee Dr P.C. Mehrotra Shri K.B. Singh Shri Jagmohan Singh Mrs Rajinder Kaur Mrs Ajit Kaur Bhatia Shri Madan Mohan	National Seminar on 'Integrated Management Approach for Maximising Crop Production in Rainfed and Problem Areas' organised by Indian Society of Agriculture Science	IARI, New Delhi	Feb 26-28
10.	Shri K.B. Singh	National Seminar on 'Future Strategies for Animal Science Education'	HAU, Hissar	Mar 6-8
11.	Dr K.K. Tyagi Shri K.B. Singh	National Workshop on Decentralised Energy Planning	IIT, New Delhi	Mar 27-29
12.	Shri P.N. Bhargava	Annual Workshop of AICRP on Diara Land Improvement	Jorhat, Assam	Mar
13.	Shri S.R. Bapat Shri R.C. Jain Shri B.H. Singh	XII Meeting of Sugarcane Research and Development Workers of Tamil Nadu	Sugarcane Breeding Institute, Coimbatore	Jul 11-12
14.	Dr B.S. Sharma	National Symposium on Advances in Cytogenetics, Immunogenetics and Biochemical Genetics	NBAGR & NIAG, NDRI, Karnal	Jul 29-30
15.	Dr S.S. Pillai Dr S.K. Raheja Dr A. Dey Dr J.P. Jain Shri P.N. Bhargava Dr R.K. Pandey Dr A.K. Srivastava Shri S.C. Rai Dr J.S. Maini Dr V.K. Bhatia	VIII National Conference of Agricultural Research Statisticians organised by IASRI, New Delhi	CAZRI, Jodhpur	Jul 29-31

1	2	3	4	5
16.	Dr S.K. Raheja	National Workshop on Monitoring Agricultural Extension for Management, New Delhi	Dte of Extension, New Delhi	Jul
17.	Dr A.K. Nigam	Agro-forestry Training-cum-workshop	CRIDA, Hyderabad	Sept 29
18.	Prof Prem Narain Dr O.P. Kathuria Dr S.K. Raheja Dr K.G. Aneja Dr A.K. Srivastava	International Workshop on 'Food Supply Information System in Africa'	Vigyan Bhavan & IASRI, New Delhi	Oct 13-25
19.	Dr S.K. Raheja	National Seminar on 'Wasteland Development'	New Delhi	Oct 16
20.	Dr R.K. Pandey	XI Indian Social Science Congress	Bombay University, Bombay	Oct 19-22
21.	Prof Prem Narain	Directors' Conference of the ICAR Research Institutes	IARI, New Delhi	Oct 30-31
22.	Prof Prem Narain	National Workshop on Statistical Quality Control	ISI, New Delhi	Nov 17-19
23.	Shri Mahesh Kumar	Workshop on Personal Computer	Taj Palace Hotel, New Delhi	Nov 24-25
24.	Dr S.K. Raheja	Workshop on 'Field Survey Methodology for Farming System Research'	LNMIED & SC, Patna	Nov 24-26
25.	Prof Prem Narain Dr J.P. Jain Shri J.C. Malhotra Dr J.S. Maini	Conference of the State Ministers of Animal Husbandry and Dairying	Vigyan Bhavan, New Delhi	Nov 27-28

1	2	3	4	5
26.	Prof Prem Narain Dr R.K. Pandey Shri S.C. Rai Dr V.K. Bhatia Shri Jagmohan Singh Dr K.K. Tyagi Shri K.B. Singh Dr Shivtar Singh Shri R.S. Khatri Shri Tribuwan Rai	XL Annual Conference of Indian Society of Agricultural Statistics	BHU, Varanasi	Dec 4-7
27.	Prof Prem Narain	National Seminar on 'Role of Women in Agro Industrial Perspective for Environmental Reconstruction' (Plenary Session)	IARI, New Delhi	Dec 9
28.	Shri R. Gopalan Shri O.P. Dutta	Workshop on 'Computer Data Network'	CSI, New Delhi	Dec 13-14
29.	Prof Prem Narain Dr S.K. Raheja Shri P.N. Bhargava	Seminar on 'Growth and Modernization of Fertilizer Industry'	FAI, New Delhi	Dec 15-17
30.	Shri Ram Kumar Shri S.D. Wahi	IV National Conference on Medical Rescue and Resuscitation and LXVIII Course in Medical Rescue and Resuscitation organised by National Association of Critical Care Medicine	Vigyan Bhawan, New Delhi	Dec 21-23
31.	Dr H.V.L. Bathla	Symposium on Man, Develop- ment, Bio-resources and Environment	Dr HS Gaur Vishwavid- yalaya, Sagar (MP)	Dec 26-28
32.	Prof Prem Narain Shri P.N. Bhargava Shri S.C. Rai Shri H.C. Jain	National Conference on Agricultural Productivity, Indian Association for Productivity, Quality and Reliability	IAPQ & R, Calcutta	Dec 27-29

1	2	3	4	5
33.	Shri T.B. Jain	XLVI Annual Conference of the Indian Society of Agricultural Economics	Sukhadia University, Udaipur	Dec 27-29
34.	Shri P.N. Bhargava Shri P.N. Soni Shri H.C. Jain Mrs Rajinder Kaur	XVII Annual Workshop of AICARP	OAUT, Bhuba- neswar	Dec 29, 1986- Jan 2, 1987

## PAPERS PRESENTED AT WORKSHOPS/SYMPOSIA/CONFERENCES

Sl. No.	Author/s	Paper title	Programme title	Venue	Period
(1)	(2)	(3)	(4)	(5)	(6)
1.	Saksena Asha Bhargava PN	A study of trend in the area irrigated by ground water	IV Ground Water Congress	New Delhi	Feb 6-8
2.	Bhargava PN Saksena Asha	An approach for increasing crop production in rainfed area through rainfall statistics	National Seminar on Integrated Management Approach for Maximising Crop Production in Rainfed and Problem Areas	IARI, New Delhi	Feb 26-28
3.	Kathuria OP Mehrotra PC Srivastava AK	Role of evaluation surveys in monitoring the progress of crop improvement programmes	"	"	"
4.	Raheja SK Banerjee AK	Idle land causes, remedial measures for reclamation and alternative uses	"	"	
5.	Singh Jagmohan Mehrotra PC	A study on impact of improved practices in cultivation of cereal crops in India	"	"	"
6.	Narain P Singh KB Jain JP	Human resources development in animal husbandry	the National Seminar on 'Future Strategies for Animal Science Education'	College of Animal Sciences HAU, Hissar	Mar 6-8
7.	Narain P	Focus on some major imbalances in the Indian economy	Annual Day Function of the National Council of Applied Economic Research	New Delhi	Apr 5

(1)	(2)	(3)	(4)	(5)	(6)
8.	Narain P Raheja SK	Achievements and constraints in agricultural research, education and extension activities	ICAR Regional Committee No. VI meeting	IARI, New Delhi	Jun 12-13
9.	Bapat SR Singh BH	Use of biometrical characters in forecasting the yield of sugarcane	XII meeting of Sugarcane Research and Development Workers of Tamil Nadu	Sugarcane Breeding Institute, Coimbatore	Jul 12
10.	Jain RC Agrawal Ranjana	Markov chain regression approaches to crop yield forecasting	"	"	"
11.	Narain P Sharma BS	Heterozygosity and optimum level of exotic inheritance in crossbred cattle	National Symposium on "Advances in Cytogenetics Immunogenetics and Biochemical Genetics"	NBAGR & NIAG, NDRI Campus, Karnal	Jul 29-30
12.	Bhargava PN Batra PK	Gaps and priorities in design and analysis of experimental data in crop science	VIII National Conference of Agricultural Research Statisticians organised by IASRI, New Delhi	CAZRI, Jodhpur	Jul 29-31
13.	Dey A	Gaps and priorities of research in agricultural statistics pertaining to animal sciences (Design of animal experiments)	"	"	"
14.	Jain JP Nadkarni UG	Gaps and priorities of research in agricultural statistics pertaining to animal sciences	"	"	"
15.	Pandey RK	Gaps and priorities of research in agricultural statistics pertaining to social sciences/agricultural economics	"	"	"

(1)	(2)	(3)	(4)	(5)	(6)
16.	Pillai SS	Coordination of linkages between different ICAR Institutes for research in agricultural statistics	..	..	..
17.	Raheja SK	Gaps and priorities of research in agricultural statistics pertaining to crop sciences	..	..	..
18.	Narain P	Programme of research and experimentation on improvement of crop area and yield statistics in Africa	International Workshop on "Food Supply Information System in Africa"	New Delhi	Oct 13-25
19.	Narain P	Crop forecasts/early warning system	..	..	..
20.	Raheja SK Banerjee AK	Survey methodology for estimation of area under waste land and proportion reclaimable	National Seminar on "Waste Land Development"	New Delhi	Oct 16
21.	Pandey RK Sarup Shanti	Agrarian social structure and land holdings in rural areas	XI Indian Social Science Congress	University of Bombay, Bombay	Oct 19-23
22.	Raheja SK Rustogi VS	Field survey methodology for farming systems research-problems and prospects	Workshop on "Field Survey Methodology for Farming Systems Research"	LN Mishra IED & SC, Patna	Nov 24-26
23.	Narain P	Livestock products statistics	Conference of State Ministers of Animal Husbandry and Dairying	New Delhi	Nov 27-28
24.	Prakash Anand Tyagi KK	Comparative study on the cost of production of fodder crops in different regions	XL Annual Conference of ISAS	BHU, Varanasi	Dec 4-7
25.	Arya SN	Application of chi-square for analysis of classified data on death frequencies	..	..	..

(1)	(2)	(3)	(4)	(5)	(6)
26.	Banerjee AK Das US	Construction of nested PBIB designs	..	..	..
27.	Bhatia DK	A study on role played by literacy in milk production	..	..	..
28.	Bhatia DK Jain TB Singh J Singh B	Employment generation through poultry keeping in urban versus rural area	..	..	..
29.	Bhatia VK Mahesh Kumar Malhotra PK Narain P	Bayes discriminatory analysis in culling dairy cows for breeding	..	..	..
30.	Gola RC Mehrotra PC Raheja SK	An approach for identifying causal factors for inter regional yield gap	..	..	..
31.	Gupta Manisha Kathuria OP Banerjee AK	Estimation of losses caused by floods in agricultural production	..	..	..
32.	Chaudhry HB	An analysis on the availability of fish in India	..	..	..
33.	Gupta SS Mehrotra PC	Use of ancillary information in improving estimates of average yield of crops	..	..	..
34.	Jain TB	Life expectancy of bovines in rural areas of Andhra Pradesh	..	..	..
35.	Jaiswal UC Jain JP	Robustness of $D^2$ -statistics in studying divergence between different genetic groups of cattle with unequal sizes and covariance matrices	..	..	..

(1)	(2)	(3)	(4)	(5)	(6)
36.	Mathur DC Singh BH Sethi SC	A study on the prediction of yield of stick lac	"	"	"
37.	Mehrotra PC	Unequal cluster sampling for fixed sample size	"	"	"
38.	Mehrotra PC Rustogi VS	Estimation of area and produc- tivity of several crops grown together in the same field	"		
39.	Mehrotra PC Singh Jagmohan	Investigations into contribu- tion of area, yield and their interaction to growth in pro- duction of groundnut	"		
40.	Rai SC	Fractionation in sensory evaluation			
41.	Rai SC Sarup Shanti	Trend studies in economic variables non-parametric tests			
42.	Rai T Singh VPN	Study on the growth rate of yield rate of wheat production in India and its major wheat producing states			
43.	Rao PP Bhargava PN	Inter cropping data analysis through the method of ranking			
44.	Rustogi VS Singh Chandra Narang MS	An empirical study on the use of auxiliary variable on sam- pling and estimation			"
45.	Sarup Shanti Pandey RK	A study of shift in produc- tivity of red gram			"

(1)	(2)	(3)	(4)	(5)	(6)
46.	Saran SMG Singh BH Mathur DC	A comparative study of nitrogen fertilizers, ammonium sulphate and urea at constant level on different levels on the yield of paddy	..	..	..
47.	Satya Pal	A study on economic aspects and factors effecting the cost of cultivation of vegetable crops	..	..	..
48.	Satya Pal	A study of locational differences of retail prices of important vegetable crops and identification of factors responsible for these differences	..	..	..
49.	Satya Pal Rai T Singh VPN	Factors discriminating the yield of wheat on the sowing of treated versus untreated seed	..	..	..
50.	Satya Pal Srivastava AK	Estimation of vegetable production from partial harvests	..	..	..
51.	Saxena BC Ashok Kumar	Income in rural areas and time spent	..	..	..
52.	Shastri SS	A study on successive sampling	..	..	..
53.	Singh Balbir Singh HP Singh BH	Prediction of milk yield in West Bengal	..	..	..
54.	Singh BH Bapat SR	Study of effect of rainfall distribution on groundnut yield and its forecast	..	..	..

(1)	(2)	(3)	(4)	(5)	(6)
55.	Singh BH Bhatnagar SK Chandrasah	Appropriate number of repli- cations in sugarcane experi- mentation	..	..	..
56.	Singh BH Saran SMG Walia SS Mathur DC	Growth rates, trends, fluctua- tions in acreage, production and productivity of groundnut in Gujarat state	..	..	..
57.	Singh Jagmohan Gupta AS	Role of area and yield of pro- duction of rice	..	..	..
58.	Singh Jagmohan Kathuria OP	Impact of occurrence of flood at various stages of crop growth	..	..	..
59.	Singh Jagmohan Kathuria OP Banerjee AK	A study on yield of paddy under flood affected and unaffected areas in U.P.	..	..	..
60.	Singh VPN	Test of significance of multi- ple correlation coefficient R and conelation ratio 'n' by observing the values of R <sup>2</sup> or n <sup>2</sup>	..	..	..
61.	Singh VPN Rai T	Evaluation of the amount of variation in the yield of rice due to random components	..	..	..
62.	Tyagi KK Mehrotra PC Raheja SK	Estimating the by-products of sugarcane	..	..	..
63.	Walia SS Singh BH Bathla HVL	Predictions of marine fish landings in India	..	..	..

(1)	(2)	(3)	(4)	(5)	(6)
64.	Jain JP Singh Shivtar	Yield gap analysis with special reference to animal husbandry	Symposium on Yield Gap Analysis, XL Annual Conference of ISAS	BHU, Varanasi	Dec 6
65.	Pandey RK Sarup Shanti	Study of production potential and yield gap	"	"	"
66.	Raheja SK Mehrotra PC	Some investigation into yield gaps for wheat crop under field conditions	"	"	"
67.	Bhardwaj SP Pandey RK	Study of growth and prospects of international trade in India	LXIX Annual Conference of IEA	New Delhi	Dec 6-7
68.	Bathla HVL Katharia OP	Agricultural statistics to study the impact of agricultural development on environment	Symposium on Man, Development, Bioresources and Environment	AEB, Dr HS Gaur Vishwa Vidyalaya, Sagar (MP)	Dec 26-28
69.	Narain P	Trends and projections for agricultural productivity	National Conference on Agricultural Productivity	Indian Association for Productivity, Quality and Reliability, Calcutta	Dec 27-29
70.	Pandey RK Sarup Shanti	The analysis of productivity and constraints of rice production in Orissa state	"	"	"
71.	Rai SC Sarup Shanti	Measures and trend in groundnut production	"	"	"
72.	Bhargava PN Jain HC	A study of fertilizer management in cropping sequence	"	"	"

(1)	(2)	(3)	(4)	(5)	(6)
73.	Jain TB	Impact of intensive cattle development programme on life expectancy of bovines in rural areas of Punjab	XLVI Annual Conference of ISAE	Sukhadia University, Udaipur	Dec 27-29
74.	Pandey RK Sarup Shanti	Study of structural changes in land holdings-emergent trend and its implications	"	"	"

## OTHER INFORMATION ABOUT SCIENTISTS

### Fellowship/Membership of Scientific Societies

Prof Prem Narain

- Royal Statistical Society of Britain
- Indian National Science Academy
- Indian Society of Genetics and Plant Breeding
- International Statistical Institute, Netherlands
- National Academy of Sciences, India
- Secretary General, Federation of Indian Society for Agricultural Sciences of Technology
- Vice President, Indian Society of Agricultural Science, New Delhi
- Secretary, Indian Society of Agricultural Statistic, New Delhi
- Chairman, Editorial Board, Journal of the Indian Society of Agricultural Statistics, New Delhi

Dr S.S. Pillai

- Institute of Electronics and Telecommunication Engineers
- Member, Advisory committee for the Council for Advancement of Rural Technology, New Delhi
- Member of the Group of Communication Net Work for AGROMET set up by the Space Application Centre

Dr S.K. Raheja

- Indian Society of Agricultural Statistics, New Delhi
- Indian Society of Agricultural Science, New Delhi

Dr Aloke Dey

- Indian Society of Agricultural Statistics, New Delhi
- International Statistical Institute, Netherlands
- Biometric Society, Washington, USA

Dr O.P. Kathuria

- Indian Society of Agricultural Statistics, New Delhi
- International Association of Survey Statisticians, Paris, France
- Indian Society of Agricultural Science, New Delhi

Dr K.G. Aneja

- Indian Society of Agricultural Statistics, New Delhi
- Indian Society of Agricultural Science, New Delhi

Shri P.N. Bhargava

- Indian Society of Agricultural Statistics, New Delhi
- Scientific Panel for Agronomy
- Indian Society of Agricultural Science, New Delhi

Dr R.K. Pandey

—Indian Society of Agricultural Economics, Bombay

—Indian Economics Association, Bombay

—Indian Academy of Social Science, Allahabad

Dr J.P. Jain

—Indian Society of Agricultural Statistics, New Delhi

—Indian Society of Agricultural Science New Delhi

Shri S N. Mathur

—Computer Society of India

—Society of Information Sciences

Dr A.K. Nigam

—Indian Society of Agricultural Statistics, New Delhi

Dr H.P. Singh

—Indian Society of Agricultural Statistics, New Delhi

Shri S.C. Rai

—Joint Secretary, Indian Society of Agricultural Statistics, New Delhi

Dr J.S. Maini

—Indian Society of Agricultural Statistics, New Delhi

—Indian Society of Agricultural Science, New Delhi

Dr A.K. Srivastava

—Indian Society of Agricultural Statistics, New Delhi

Shri R.K. Khosla

—Indian Society of Agricultural Statistics, New Delhi

—International Association of Survey Statisticians, Paris, France

Dr A.K. Banerjee

—Indian Society of Agricultural Statistics, New Delhi

Dr P.C. Mehrotra

—Indian Society of Agricultural Statistics, New Delhi

—Indian Society of Agricultural Science, New Delhi

Shri S.R. Bapat

—Indian Society of Agricultural Statistics, New Delhi

Shri P.N. Soni

—Indian Society of Agricultural Science, New Delhi

—Indian Society of Agronomy, New Delhi

Dr Randhir Singh

—Indian Society of Agricultural Statistics, New Delhi

Dr V.K. Sharma

—Indian Econometric Society, Ahmedabad

Mrs Ranjana Agrawal

—Indian Society of Agricultural Statistics, New Delhi

Shri R. Gopalan

—Indian Society of Agricultural Statistics, New Delhi

Shri V.S. Rustogi

- Indian Society of Agricultural Statistics, New Delhi
- Indian Society of Agricultural Science, New Delhi

Shri L.K. Garg

- Indian Society of Agricultural Statistics, New Delhi

Shri K.B. Singh

- Indian Society of Agricultural Statistics, New Delhi

Shri J.C. Malhotra

- Indian Society of Animal Genetics and Breeding, IVRI, Izatnagar
- Indian Society of Agricultural Statistics, New Delhi
- Biometric Society, Washington, USA

Dr V.K. Bhatia

- Indian Society of Agricultural Statistics, New Delhi
- Indian Society of Agricultural Science, New Delhi

Shri O.P. Dutta

- Computer Society of India

Dr R.C. Jain

- Indian Society of Agricultural Statistics, New Delhi

Shri Jagmohan Singh

- Indian Society of Agricultural Statistics, New Delhi
- Indian Society of Agricultural Science, New Delhi

Shri T.B. Jain

- Indian Society of Agricultural Statistics, New Delhi
- Indian Society of Agricultural Economics, Bombay

Shri S.N. Arya

- Indian Society of Agricultural Statistics, New Delhi
- Society for the Advancement of Research in Animal Sciences, Ludhiana

Shri S.P. Verma

- Indian Society of Agricultural Statistics, New Delhi

Dr P.S. Rana

- Indian Society of Agricultural Statistics, New Delhi
- Indian Academy of Arithmetic, Indore
- Indian Society of Probability and Statistics

Shri S.D. Wahi

- Indian Society of Agricultural Statistics, New Delhi

Shri Lal Chand

- Indian Society of Agricultural Statistics, New Delhi
- Biometric Society, Washington, USA

Shri P.K. Malhotra

- Indian Society of Animal Genetics and Breeding, New Delhi
- Indian Society of Agricultural Statistics, New Delhi
- Biometric Society, Washington, USA

Shri R.S. Khatri

—Indian Society of Agricultural  
Statistics, New Delhi

Dr G.C. Chawla

—Indian Society of Agricultural Statis-  
tics, New Delhi

Shri D.C. Mathur

—Indian Society of Agricultural  
Statistics, New Delhi

—Indian Society of Agricultural  
Science, New Delhi

Dr Shivtar Singh

—Indian Society of Agricultural  
Statistics, New Delhi

Shri P.P. Rao

—Indian Society of Agricultural  
Statistics, New Delhi

Dr D.L. Ahuja

—Indian Society of Agricultural Statis-  
tics, New Delhi

Shri H.B. Choudhry

—Indian Society of Agricultural Statis-  
tics, New Delhi

Shri S.N. Bajpai

—Indian Society of Agricultural  
Statistics, New Delhi

Shri Anand Prakash

—Indian Society of Agricultural  
Statistics, New Delhi

Dr L.B.S. Somayazulu

—Indian Society of Agricultural  
Statistics, New Delhi

Shri M.R. Vats

—Indian Society of Agricultural  
Statistics, New Delhi

Shri M.S. Batra

—Indian Society of Agricultural  
Statistics, New Delhi

### Membership of Committees/Panels/Work- ing Groups

Prof Prem Narain

—Indian Science Congress Associa-  
tion, Calcutta

—General Council of the University  
of Edinburgh (U.K.)

—Computer Society of India

—General Body of the Jan Tinbergen  
Institute of Development Planning,  
Rohtak

—Bernoulli Society for Mathematical,  
Statistics and Probability, Nether-  
lands

—New York Academy of Sciences,  
U.S.A.

—Indian Society of Human Genetics

—Editorial Board of the Journal of  
Energy from Biomass and Recycl-  
ing, India House Development

—Chairman, the first and second  
meetings of Sub-Working Group  
for the discipline of Animal  
Husbandry Statistics for undertak-  
ing in depth studies for formula-  
tion of suitable proposals for the  
VII Five Year plan of the Ministry  
of Agriculture, New Delhi

- Scientific Advisory Committee of the Institute for Research in Medical Statistics, New Delhi
- Technical Evaluation Committee for evaluation of the design and methodology on collection of catch statistics of fish from different inland water resources, monitoring of progress of work and suggestions on improvement of sampling system for central sector scheme on Development of Inland Fisheries Statistics for implementation
- ICAR Committee of direction to consider the methodology and detailed programme of work relating to the All India coordinated project on "Survey of animal draught power in various agroclimatic zones of the country—Socio-economic features and current husbandry practices"
- Committee of Direction for the National Bureau of Animal Genetic Resources and the National Institute of Animal Genetics for formulation of detailed programme
- Direction Committee of Computer Science and Numerical Analysis IASRI, New Delhi
- Chairman, Advisory Board on Training Courses, IASRI, New Delhi
- Academic Council, IARI, New Delhi
- Committee on Improvement of Agricultural Statistics, National Sample Survey Organisation, New Delhi
- Sampling Methods Sectional Committee, TDC-33 for preparation of Standard of Statistical Quality Control of the Bureau of Indian Standards, New Delhi
- Committee on Improvement of Agricultural Statistics, Directorate of Economics and Statistics, New Delhi
- Faculty of Mathematics, University of Delhi
- Central Technical Committee on Agricultural Census (1980-81) of the Ministry of Agriculture, Govt. of India, New Delhi
- National Advisory Board on Statistics, Govt. of India, CSO, New Delhi
- Committee of experts to evaluate the proposal submitted by Economics and Marketing Research Department of Projects and Development India Ltd.
- Chairman, AFDC-57 on behalf of the Sampling Methods for Food Production Agricultural Inputs, Sectional Committee of the Bureau of Indian Standards, New Delhi
- Chairman, Management Committee, IASRI, New Delhi.

Dr S.S. Pillai

- Chairman of the Selection Committee set up by the P.G. School of the IARI for admission to M.Sc. and Ph.D. students of the P.G. School of IARI for the academic year 1986-87

- Panelist for discussing “Computers in Quality and Productivity” which was held on 2nd January, 1986 at Hotel Ashok during the one day Regional Convention of the Computer Society of India
- Selection Committees set up by the Department of Electronics for selection of system analysis and computer programmers
- Selection Committee set up by the Indira Gandhi Open University for selection of computer professionals for the University.

Dr S.K. Raheja

- High Level Coordination Committee for Agricultural Statistics constituted by Governor of H.P. for the state.
- Expert Committee constituted by the Ministry of Water Resources to determine the yield rates of crops under irrigated and unirrigated conditions in the command area of Lower Bhavani Irrigation project in Tamil Nadu
- Expert Committee constituted by the Standing Technical Committee for Agricultural Surveys of West Bengal to advise on appropriate sampling design for estimating area and yield rates of vegetables in the state
- Evaluation Committee constituted by DG, ICAR to evaluate the progress of work under the ICAR Lab-to-Land programme

- Working Group on Economic Advice and Statistics constituted by Planning Commission to consider the plan proposals of state governments
- Expert Committee constituted by Ministry of Agriculture to examine indepth problems of ratios of seed, feed and wastage of foodgrains
- Expert Group for improvement of production estimates of cotton, Ministry of Agriculture, New Delhi
- Panel of Judges of All India Crop Competition Scheme, Directorate of Extension, Ministry of Agriculture and Rural Reconstruction, New Delhi
- Centre for Agricultural and Rural Development Studies, New Delhi.

Dr O.P. Kathuria

- Technical Working Group constituted by Central Statistical Organisation for Improvement of Data Base for State Income and Related Aggregates
- Technical Committee of Direction for Improvement of Animal Husbandry Statistics constituted by Ministry of Agriculture, Govt. of India, New Delhi
- Task Force on Land Use Statistics constituted by Ministry of Agriculture, Govt. of India, New Delhi
- Technical Group for reviewing the sampling design and estimation procedure for crop estimation

surveys on fruits, vegetables and minor crops constituted by the Ministry of Agriculture, Govt. of India, New Delhi.

Dr R.K. Pandey

- Board of studies, IARI, New Delhi
- Board of studies in Agricultural Economics, Meerut University, Meerut.

Shri U.G. Nadkarni

- P.G. Faculty of the P.G. School, IARI, New Delhi
- Agricultural Research Communication Centre, Karnal.
- Sampling Methods Sectional Committee T.D.N.-33.

Dr. J.P. Jain

- Research and Studies Coordination Group constituted by the Ministry of Agriculture for initiation, Coordination and assessment of studies and research projects of the National Federation
- P.G. Faculty of the P.G. School, IARI, New Delhi.
- Management Committee of the Institute.

Dr K.G. Aneja

- P.G. Faculty of the P.G. School, IARI, New Delhi
- Bureau of Indian Standards Sub-committee on Product/Process

Control and Industrial Statistics (alternate member).

Shri V.S. Rustogi

- P.G. Faculty of the P.G. School, IARI, New Delhi.

Shri P.N. Soni

- P.G. Faculty of the P.G. School, IARI, New Delhi
- Board of studies of P.G. School, IARI, New Delhi.

Dr Bhagat Singh

- Board of Studies, Division of Agricultural Economics, IARI, New Delhi.

Shri G.S. Bassi

- NAARM, Alumni, Hyderabad (A. P.)

Shri K. B. Singh

- NAARM, Alumni, Hyderabad (A.P.).

Shri Satya Pal

- NAARM, Alumni, Hyderabad (A.P.)

Shri S. C. Rai

- Secretary, Staff Research Council of IASRI, New Delhi
- Food Sampling Committee AFDC-57 Bureau of Indian Standards

Dr V.K. Bhatia

- EC 3:7 Statistical Quality Control and its other Sub-committees (Bureau of Indian Standards).

—Committee to watch and review the progress of M.Sc. I and II year (CAA) Courses.

Shri Mahesh Kumar

—P.G. Faculty of the P.G. School, IARI, New Delhi.

Shri B. C. Saxena

—P.G. Faculty of the P.G. School, IARI, New Delhi.

Dr. Randhir Singh

—Board of Studies, IASRI, New Delhi  
—P.G. Faculty of the P.G. School, IARI, New Delhi

Dr. V.K. Sharma

—Board of Studies, IARI, New Delhi.

Dr. R.C. Jain

—P. G. Faculty of the P.G. School, IARI, New Delhi.

Shri T.B. Jain

—NAARM, Alumni, Hyderabad (A.P).

—Agricultural Research Communication centre, Karnal.

Shri S.P. Verma

—NAARM, Alumni, Hyderabad (A.P).

Shri S.D. Wahi

—Agricultural Research Communication Centre, Karnal.

Shri R.S. Khatri

—NAARM, Alumni, Hyderabad (A.P).

Dr. G.C. Chawla

—NAARM, Alumni, Hyderabad (A.P).

—Agricultural Research Communication Centre, Karnal.

### SPECIAL LECTURES, TRAINING, STUDY TOUR AND MEETINGS

Prof Prem Narain

—attended

- Anniversary General Meeting of the Indian National Science Academy on Jan 2, 1986 at INSA, New Delhi
- Inter-Ministerial Group Meeting in the chamber of Shri K.N. Ardhnareeswaran, Addl Secretary, Ministry of Agriculture, New Delhi on Jan 22, 1986 in connection with the review of Crop Insurance Scheme-1985
- As chairman, the 2nd meeting of the Task Force of the UNDP Sub-Project 'Centre of Advanced Studies in Agricultural Statistics and Computer Applications' at IASRI on Feb 17, 1986
- Meeting of the Inter-Ministerial Group of Comprehensive Crop Insurance Scheme-1985 on Feb 27, 1986 at Krishi Bhavan, New Delhi
- Meeting of the Expert Group on Science Indicators held on Mar 21, 1986 at NISTADS, New Delhi-12 to discuss the objectives of the

Group Coordinators Meeting convened by the Commonwealth Science Council

- Second Human Resources Programme on 'Energy Management in Agriculture' organised by India House Developments at New Delhi from Apr 3-8, 1986
- Valedictory Function of the Training Course on 'Techniques of Estimating output of Food Crops' at New Delhi on Apr 30, 1986 organised by the Department of Statistics, Ministry of Planning, Govt of India
- ICAR Scientific Panel meeting for Agricultural Economics, Statistics and Marketing held at Krishi Bhavan, New Delhi on May 2, 1986
- Meeting of the Editorial Board of the Indian Journal of Genetics and Plant Breeding as well as the Annual General Body Meeting of the Indian Society of Genetics and Plant Breeding on May 26, 1986
- Executive Committee meeting of the Maharashtra Association for the Cultivation of Science, Pune on May 15, 1986
- Meeting of the Programme Implementation Committee (PIC) in respect of IASRI under the chairmanship of DG, ICAR headquarters on June 5, 1986
- 8th meeting of the ICAR Regional Committee No IV on Jun 12-13, 1986 held at IARI, New Delhi
- Meetings of the Academic Council of IARI, New Delhi on Jun 17, 1986 and Nov 26, 1986
- Executive Council meeting of the Indian Society of Agricultural Statistics held at IASRI, New Delhi on Oct 12, 1986
- As expert the meeting of the Executive Council of the Maharashtra Association for the Cultivation of Science, Pune on Oct 15, 1986
- Meeting of the Technical Advisory Committee on training for Indian Statistical Officers held at CSO, New Delhi on Nov 4, 1986
- Meetings of Board of Studies at the Institute of Agricultural Science, Banaras Hindu University, Varnasi on Dec 1-2, 1986
- Meeting of the Committee of Direction of ICAR to consider and finalise the methodology and detailed programme of work relating to the All India Coordinated Project on 'Capital Requirements for Modernisation in Indian Agriculture' held at Krishi Bhavan, New Delhi on Dec 12, 1986
- Meeting of the Committee of Direction of ICAR to consider and finalise the methodology and the detailed programme of work

relating to All India Coordinated Project on 'Survey of animal drought power in various agro-climatic zones of the country-Socio-Economic features and current husbandry practices' held at Krishi Bhavan, New Delhi on Dec 12, 1986

—Chaired

- Meeting of the 'Technical Committee of Direction for Improvement of Animal Husbandry Statistics' in which subject-matter specialists, Directors of Animal Husbandry, Senior Statisticians of Animal Husbandry Departments of various States participated, held at IASRI on Mar 10, 1986
- Meeting of the Management Committee of IASRI held on Dec 12, 1986
- Meeting of Technical Committee of Direction for Improvement of Animal Husbandry and Dairying Statistics of the Ministry of Agriculture, Govt of India, held on Dec 29, 1986
- VIII Session on Farm Research in National Seminar on (Integrated Management Approach for Maximising Crop Production in Rainfed and Problem Areas' organised by ISAS at IARI, New Delhi

—Delivered

- A lecture entitled 'Diffusion Models in Genetics' in the Department of

Mathematical Statistics, University of Delhi, Delhi on Feb 24, 1986

- Introductory lecture covering various aspects of Agricultural Statistics to the participants of the Training Course on 'Techniques of Estimating Output of Food Crops' for the nominees of Afro-Asian countries in Mar 13, 1986 at IASRI, New Delhi
- A key-note address on 'Some Aspects of Applied Stochastic Processes' in the All India Seminar on Stochastic Modelling and Decision Making, sponsored by UGC, held at university of Delhi on Mar 27, 1986
- An invited talk entitled 'Moments for the stochastic integral of the function of a random variable with applications in Population Genetics' on Mar 29, 1986 at All India Seminar on Stochastic Modelling and Decision Making, at university of Delhi
- A seminar on the topic 'Diffusion Models in Genetics' at the Department of Mathematics and Statistics, University of Windsor, Ontario, Canada, on Jul 3, 1986
- A seminar on the topic 'Progeny Testing with Auxiliary Traits' in the Dairy Science, Department of the Ohio State University, Columbus, USA on Aug 7, 1986
- A lecture entitled 'Designs of Industrial Experimentation' at the

Workshop on Statistical Quality Control on Nov 19, 1986. The workshop was organised by the Bureau of Indian Standards at New Delhi.

Dr S.S. Pillai

—delivered lectures on

- Computer Based Data Documentation and Retrieval System on Sep 19, 1986. The participants were attending the Summer Institute on Plant Genetic Resources held during Sep, 1986 at NBPGR, New Delhi
- Establishing Effective Management Information System for the National Seeds Corporation on Sep 26, 1986. The participants were managers of different regions of the National Seeds Corporation
- Data Retrieval for the International Information System for Agricultural Services and Technology on Oct 30, 1986. Workshop-cum-training course conducted by Tata Energy Research Centre between Oct 27, 1986 to Nov 1, 1986
- Processing and Analysis of Data on Dec 21, 1986. Workshop on Food Supply Information Systems conducted by the Commonwealth fund for Technical Co-operation

Dr R.K. Pandey

—delivered

- A lecture to participants at FAI Training programme for Fertilizer production, to promotion executive on economics of Fertilizer use on Apr 10, 1986
- A talk on Concepts, measurement and issues relating to employment at Institute of applied manpower research on Jun 25, 1986 at New Delhi

Dr J.P. Jain

—attended a meeting of the Technical Committee of Direction for Improvement of Animal Husbandry Statistics on Mar 10, 1986 at IASRI, New Delhi

Dr A. K. Ngiam

—delivered a lecture on “Some selection and estimation problems in probability sampling” at Statistics Deptt., Indore University, Indore in Jul, 1986

Dr V. K. Sharma

—delivered a series of 20 lectures from Apr 3-16, 1986 on Econometric Theory to ISS Probationers at CSO, Sardar Patel Bhawan, New Delhi

Dr J. S. Maini

—attended the meeting of the Technical Committee of Direction for

the improvement of Animal Husbandry Statistics on Mar 10, 1986 at IASRI, New Delhi

Dr A. K. Banerjee

—delivered a lecture on Practicals on Sampling to participants to ESCAP region on household survey conducted by CSO on Feb 27-28, 1986 and Mar 3, 1986

Dr P. C. Mehrotra

—delivered a lecture on activities of the division of sample survey methodology and analysis of survey data to a batch of M. Stat. students of ISI on Jun 4, 1986 at IASRI, New Delhi

Shri S.C. Rai

—attended

- Meeting of 'Task Force for replacement of main frame computer of IASRI' held at IASRI, New Delhi on Feb 17, 1986
- Meeting of Raj Bhasha Karyanyawan Samiti (Hindi) of the Institute on Feb 25; May 30, Oct 6, 1986 and delivered a lecture in the 6th special Hindi workshop on Jun 10, 1986
- Executive Council meeting of the Indian Society of Agricultural Statistics held on Oct 12, 1986 at Delhi and Dec 4, 1986 at Varanasi

- the meeting of management committee of the Institute on Dec 12, 1986

Dr A. K. Srivastava

—delivered

- Lectures on various aspects of sampling theory in the training course on 'Sampling and household survey methodology' organised by CSO from Feb 24, 1986 to Mar 5, 1986 at Vishva Yuvak Kendra, New Delhi
- Lectures on Sample Surveys at Institute of Research in Medical Statistics on Apr 30, 1986

Dr Prajneshu

—delivered an invited talk on 'Some stochastic models in population ecology, at the 73rd session of the Indian Science Congress held from Jan 3-8, 1986 at the University of Delhi

Shri J. C. Malhotra

—attended

- Meeting of technical committee on progeny testing of cross-bred bulls in Maharashtra held in Pune on Jun 11, 1986 and gave technical guidance on problems relating to growth studies on cross-bred cows available at various military farms in the country
- Second meeting of the Steering Committee on Agriculture Census held on Aug 6, 1986

- the meeting of Central Technical Committee on Agriculture Census held on Aug 13-14, 1986

**Dr (Smt) Ranjana Agarwal**

—attended

- Meeting of Core Groups of Standing Committee on Agriculture held at SAC, Ahmedabad on Jan 15, 1986
- Meeting of Science methodology review of the IRS-UP projects related to crops held on Jan 16-17, 1986 at SAC, Ahmedabad

**Dr Shivtar Singh**

—delivered a lecture on “Statistical basis for Crop Insurance” on Jul 4, 1986 at Suraj Kund, New Delhi during the conference of the heads of Crop Insurance Cells of General Insurance of India, organised from Jul 2-4, 1986

**Dr R. C. Jain**

—delivered a lecture on statistical research in pre-harvest crop forecasting methodology for the trainees of ISEC, Calcutta, on Oct 22, 1986

**Shri O. P. Dutta**

—attended a senior level training programme at JNU city centre organised by India House Development on ‘Energy Management in Agriculture’ from Apr 3-8, 1986

**Dr N. K. Ohri**

—delivered the three lectures on statistical methods in the 28th short (Refresher) course training in soil testing Laboratories held at the Division of Soil Science and Agricultural Chemistry, IARI during Oct, 1986

**Dr K.K. Tyagi**

—attended human Resource Development Programme on, ‘Energy Management in Agriculture’ from Apr 3-8, 1986 at JNU City Centre, 35, Ferozeshah Road, New Delhi. It was a Sr. Level Training Course organised by India House Development, New Delhi

**Shri R.S. Khatri**

—attended the meeting of the technical committee of Direction for Improvement of AH and Dairying Statistics, organised by the Deptt. of Agriculture and Cooperation, held at IASRI on Dec 29, 1986

## DEGREES RECEIVED

**Shri J. N. Garg**

—Ph D degree in Mathematics from Rohailkhand University, Bareilly. Thesis title was ‘A study of balanced random sampling and its applications’.

**Shri P.S. Rana**

—Ph D degree in Mathematics from Kurukshetra University, Haryana.

Thesis title [was 'Multichannel queuing systems'].

**Shri Subodh Kumar Bhatnagar**

—Ph D degree in Economics from Agra University, Agra, UP. Thesis title was 'A critical study of sugar industry in western UP' (with special reference to cost and availability of sugarcane).

### MISCELLANEOUS INFORMATION

**Prof Prem Narain**

—attended Silver Jubilee Convocation of IARI on Feb 2, 1986

—had discussion with

- Dr Blue Richardson, Dy Director and Mr MC Gupta, USAID, New Delhi regarding the agricultural growth, etc. and about various activities of IASRI on Jan 8, 1986
- Dr David Seckler, Director International School for Agricultural and Resource Development (ISARD), Colorado State University, USA regarding collaborative studies of mutual interest between ISARD and IASRI (ICAR), who visited IASRI on Mar 3, 1986
- Dr Anatoly N Lukyanenko, Counsellor, Agricultural Attache, Embassy of USSR, New Delhi in connection with various activities of the Institute as well as the various items of work being undertaken by them in the field of agricultural

statistics and computer applications, at IASRI on Mar 8, 1986.

- Dr Rolf Mueller, ICRISAT, Hyderabad on May 17, 1986 in connection with the various activities of ICRISAT and IASRI
- 4-member high level Chinese delegation, headed by Dr Sun Xiang, Dy Director and Agronomist, Department of Education Ministry of Agriculture, Animal Husbandry and Fishery, People's Republic of China, who visited IASRI on Dec 11, 1986 regarding the activities of IASRI. They were taken round the Computer Centre of the Institute
- Dr Th Bredero of World Bank on farm trials who visited IASRI on Dec 11, 1986.
- Mr Byzov and Mr Alexander P Sevostianov, Diploma in Engineering and Economics, Incharge of Science and Technology Section, USSR Embassy, New Delhi on the topics of mutual interest, IASRI on Dec 12, 1986
- participated
- In the Group Discussion on Methodology for the development of stability indices for dryland technology, held at IASRI, New Delhi on Mar 7 1986. Various Senior Officers from ICAR, CRIDA and

**Chinese delegation from Department of Education, Ministry of  
Agriculture, Animal Husbandry and Fishery, People's  
Republic of China on a visit to the Institute**



IASRI participated in this Group Discussion

- In the Workshop/Training Course on Agro-Forestry Research held at CRIDA, Hyderabad, organised by ICRAF, Nairobi, Kenya. He chaired a Technical Session on 'Agroforestry experimental designs' held on Sep 25, 1986 in this Workshop/Training Course. I also presided over a meeting to consider the Working Committee No. III relating to information Services for Agroforestry Research.
- addressed participants of Training on 'Estimation Procedure and Tabulation Programme' relating to production surveys on milk, eggs, wool and meat and cost of production studies on milk and egg, on Sep 22, 1986. The training was organised by the Animal Husbandry Division, Department of Agriculture and Cooperation Ministry of Agriculture, Govt of India from Sep 22-26, 1986 at New Delhi
- visited NBPGR, New Delhi on Nov 7, 1986 and had discussion with Dr RS Paroda, Director, NBPGR, on the topics of mutual interest.
- was Visiting Professor in the Department of Statistics, Ohio State University, Columbus, USA during the Summer quarter Jun-Aug, 1986

Dr S.S. Pillai

- officiated as Director from Jan 6-25 1986 and Jun 21-Sep 14, 1986
- was Head of the Office for IASRI from Oct-Dec 9, 1986. During this period he discharged the duties of the CAO and Sr. Administrative Officer in addition to his normal duties
- chaired session on Local Area Network/Long Haul Network for Information Transfer at the Sixth Annual Convocation of the Society of Information Science held at CERI on Dec 5, 1986

Dr S. K. Raheja

- was nominated by the D G, ICAR for a teaching-cum-research assignment to the International School for Agricultural and Resource Development at Colorado State University, Fort Collins, Colorado, USA for about 4 months from Oct, 1985 to Feb, 1986. He delivered lectures on survey methodology for monitoring of large irrigation systems, monitoring and evaluation of agricultural projects and allied topics to three International Training Programmes organised by ISARD, during the period of visit. He also carried out research in developing appropriate indicators and indices for determining the extent to which the irrigation management achieved the goals and targets. Regression analysis

technique was utilised for analysis of data. An overall index of efficiency of irrigation management was also developed which could be decomposed to determine the contribution of different components to the overall error in the achievement of goals. The following two papers were prepared on the basis of his work at ISARD:

- i) 'Performance monitoring in large scale irrigation systems— A case study of Warabandi system of Northwest India' Part-B
- ii) 'Statistical measures of managerial performance—application to the management of irrigation systems'.

Another paper entitled 'Quantitative indicators of the performance of irrigation management systems, was also prepared on the basis of work at ISARD and presented by Dr David Seckler, Director, ISARD at a symposium on 'Irrigation Management', A seminar 'Survey methodology for monitoring the performance of irrigation system' was delivered at International Food Policy Research Institute, Washington D. C. on Jan 27, 1986

Dr O. P. Kathuria

- organised and supervised the crop cutting work of the Lab-to-Land demonstration programme jointly with Director of Agri.

Statistics, U P in Amethi parliamentary constituency of U. P.

Dr J. P. Jain

- had technical discussion with Dr Piet Terhal, member, East European commission on operation flood, regarding methodology followed in estimation of milk production trends in production, demand for milk, etc. on Aug 13-14, 1986

Mr Giorgio Jingolani, Agricultural Economist, Delegation of the Commission of the European communities for South Asia and apprised him about the number and production statistics of bovines, methodologies adopted for their estimation, extent of cross breeding work done in cattle in India and performance of crossbreds vis-a-vis non-descriptis.

- Liaison Officer of the Institute for looking after the interest of the SC/ST employees
- Member, official representative, Joint-staff council of Institute
- Member committee for out-of-turn allotment of IASRI quarters
- Member, Department Promotion Committee for Administrative/ Ministerial posts and supporting staff at the Insitute
- Member, Course-progress review committee of the Institute

- Member library Committee of IASRI

Dr A.K. Nigam

- presented an invited lecture 'Balanced repeated replication in variance estimation' in the 73rd Science Congress held at Delhi University from Jan 3-8, 1986

Dr A.K. Banerjee

- taught sampling to participants of Afro-Asian countries conducted by CSO on Mar 20-21, 1986

Shri S.C. Rai

- participated in the Inaugural function of the workshop of Statistical Quality Control organised by Bureau of Indian Standards at Taj Palace Hotel, New Delhi on Nov 17, 1986 and attended the meeting of EC-3 and its various sub-committees on Nov 20-21, 1986 at Manak Bhawan, New Delhi

Dr Randhir Singh

- visited Space Application Centre, Ahmedabad from May 25-28, 1986 for having collaboration in the area of use of remote sensing techniques for yield and acreage estimation
- visited IIRS, Dehradun from Jun 2-5, 1986 to explore collaboration in the use of remote sensing tech. for yield and acreage estimation

Dr (Smt) Ranjana Agrawal

- delivered lecture on forecasting technique for crops, diseases and pests to M. Stat. students of ISI, Calcutta/New Delhi on Jun 4, 1986

Dr R.C. Jain

- imparted training on crop forecasting methodology to two FAO trainees from Bhutan on Nov 12, 1986

Shri T.B. Jain

- wrote a chapter entitled "Allied Enterprises-Poultry" for the book **Indian Agricultural Development since Independence** Oxford and IBH Publishing Company, New Delhi, pp. 199-208, published on behalf of the Indian Society of Agricultural Economics, Bombay

Shri Ram Kumar

- organised one day training programme on 'Data Processing' for 12 trainees of Senior Certificate Course 'of CSO, New Delhi on Jun 19, 1986 at IASRI, New Delhi-12
- took classes in Fortran language and use of linear programming package for the course "Computer Application in Agriculture", conducted for the scientist and other research workers from various ICAR Institutes and Agricultural Universities from Aug 1-27, 1986

## COORDINATION AND MONITORING CELLS

### COORDINATION CELL

This cell is responsible for documentation and dissemination of scientific output of the Institute through IASRI Newsletters, Quarterly Progress Reports, Annual Report, etc. It also organises National Conferences of Agricultural Research Statisticians and meetings of Senior Statisticians of ICAR Institutes and also conducts meetings of Staff Research Council and senior scientists and Heads of Divisions of the Institute from time to time.

#### Reports/Newsletters/Proceedings

- Annual Report, 1985, 115 pp
- IASRI Newsletter, Oct-Dec, 1985, 14 pp.
- IASRI Newsletter, Jan-Mar, 1986, 14 pp.
- IASRI Newsletter, Apr-Jun, 1986, 14 pp.
- IASRI Newsletter, Jul-Sep, 1986, 14 pp.
- IASRI Newsletter, Oct-Dec, 1986, 14 pp.
- Quarterly Progress Report, Jan-Mar, 1986, 14 pp.
- Quarterly Progress Report, Apr-Jun, 1986, 15 pp.

Quarterly Progress Report, Jul-Sep, 1986, 14 pp.

Quarterly Progress Report, Oct-Dec, 1986, 18 pp.

Proceedings of the 8th National Conference of Agricultural Research Statisticians, 1986 (under preparation).

#### Research Material Supplied to

##### ICAR

- For the General Body Meeting of the ICAR Society;
- For DARE report;
- Schedule of Meetings/Conferences/Seminars, etc. during 1986;
- For 'Publication of Research Highlights and Annual Report of ICAR' for the year 1986.

##### CSO

- For publication of 'Statistical System in India 1985;
- For International Technical Cooperation in Statistics;
- For 37th Annual Report on Sample Survey of Current Interest in India and 23rd report of the ESCAP region 1985;
- For 'Statistical News letter.

*DEPARTMENT OF SCIENCE AND  
TECHNOLOGY*

- For National survey on collection of data on resources devoted to research and development activities in the country;
- Schedule of Meetings/Conferences/Seminars, etc. during 1986.

*INDIAN NATIONAL SCIENCE  
ACADEMY*

- For Lectures/Seminars organised by INSA.

**Conferences/Meetings organised**

- 8th National Conference of Agricultural Research Statisticians of ICAR Institutes, Agricultural Universities and other Central and State Departments of Agriculture and Animal Husbandry engaged in Agricultural Research at CAZRI, Jodhpur, Jul 29-31, 1986;
- 8 meetings of Heads of Divisions and Senior Scientists of the Institute;
- A meeting of Staff Research Council from Nov 11-22, 1986.

**MONITORING CELL**

The chief functions of this cell are to monitor the progress of on-going research projects as well as to process the Plan schemes of the Institute. The items of work undertaken by the Cell during 1986 include :

- Preparation of summary progress reports of on-going research projects for the operative periods ending Sep 30, 1985 Mar 31, 1986;
- Preparation of EFC Memo of the Institute of VII Plan period including processing of Coordinated Research Scheme on Primary Data Collection involving adhoc field staff and preparation of annual budget estimates;
- Consolidation of Annual Action Plan for on-going research projects for 1986-87;
- Consolidation of Activity Milestones for on-going research projects for 1986-87;
- Coordination of Research Project Files;
- Convening of four senior-level meetings to finalise the Annual Action Plan and Activity Milestones for the on-going projects as well as the EFC Memo of the Institute.

## STAFF WELFARE ACTIVITIES

The Institute has manifold activities for the amenities and welfare for the staff. The major items are detailed below :

### JOINT STAFF COUNCIL

The Institute has a Joint Staff Council (JSC) to promote harmonious relations and secure the best means of co-operation between the Council/IASRI as employer and the general body of its employees in matters of common concern for insuring a high degree of efficiency of the service.

The JSC was reconstituted for a period of three years with effect from Jan 13, 1986 :

- I Director—Chairman
- II Representatives of the official side :
  - i) Dr J. P. Jain, Sr Scientist
  - ii) Shri S. R. Bapat, Scientist S-3
  - iii) Dr K. K. Tyagi, Scientist S-2
  - iv) Shri K. C. Bhatnagar, Scientist S-1
  - v) Shri R. L. Jhangira, Accts Officer
  - vi) Dr O. P. Kathuria, Sr Scientist
- III Elected representatives of the staff side:
  - i) Shri Asha Ram Sharma,  
Tech Asstt (Stat)
  - ii) Shri Pramod Kumar, Tech Asstt (Stat)
  - iii) Shri Mangal Singh, Card Librarian
  - iv) Shri R. B. Kadam, Superintendent

- v) Shri Hira Lal, Sr Clerk
- vi) Shri Dilbag Rai, Field Investigator
- vii) Shri Purushotam Sharma,  
S S. Grade I
- viii) Shri Maqsood Khan, S. S. Grade II

Shri K. C. Bhatnagar, Scientist S-1, was nominated as Secretary (Official Side) on the Joint Staff Council. During the year three meetings were held on Aug 12, Sep 3 and Dec 20, 1986, the last meeting was also attended by the Secretary (Staff Side) Central Joint Council.

### GRIEVANCE CELL

The Grievance Cell of the Institute (constituted as per ICAR rules) which provides to the employees a forum to ventilate their grievances relating to official matters and their remedial measures held its meeting on May 20, 1986.

### BENEVOLENT FUND

The Employees of the Institute have constituted a Benevolent Fund from their own contributions to provide relief in time to the families of the employees who die in harness and are self indigent conditions. The collection of funds and the relief disbursement provided during the year are as follows :

An amount of Rs 430/- was collected on the occasion of Benevolent Fund Day, Jun 30, 1986

An amount of Rs 23/- was received from the Collection for celebration of Krishna Janamasthmi on Sep 20, 1986.

A sum of Rs 500/- was given to the family of late Shri R. L. Sood, Ex-Assistant who expired on Mar 14, 1986.

A financial assistance of Rs 100/- was given to Shri S. A. Saiyed, Field Supervisor to meet part of medical expenses.

### RECREATION AND WELFARE CLUB

The Institute has recreation and welfare club which provides facilities for indoor and outdoor games promotes social and friendly relations among the members and look after the general welfare of the member. The club received the annual grant amounting to Rs 1359/- from the Institute and members contribution of Rs 784/- during the year. The club subscribed six magazines/journals for the benefit of members and also organised games tournaments in chess, sweep, rummy and table tennis.

### CO-OPERATIVE THRIFT AND CREDIT SOCIETY

The Society registered with the Registrar Co-operative Societies, Delhi Administration, Delhi, Regd. Co- 495/ (u) helped its members by advancing loan as was being done during past years. The source of funds of the society are share money, compulsory deposits and fixed deposits from the members of the society.

During 1986, the main functions and activities of the society included :

- Convening of annual general meeting on Nov 10, which made amendments in the bye-laws for raising the regular loan amount from Rs 5,000/- to Rs 10,000/-, emergent loan amount from Rs 300/- to Rs 600/- and number of instalments for regular loan from 30 to 45;
- Advancing of Rs 9,53,295/- as loan to the members;
- Raising the amount for held to needy members from Rs 1000/- to Rs 1500/- from the contribution of the members (Rs 6/- per year) towards the member welfare fund introduced in the year 1979;
- Extension of help of Rs 1000/- to the grieved family of Shri R. L. Sood, an active member of the society, on his sad and sudden demise.
- Conducting of election for the new managing committee on Nov 17, 1986 where the following were elected :
  1. Shri M. L. Sahni            President
  2. Shri Dev Raj              Vice-President
  3. Shri V. K. Mishra        Hony Secretary
  4. Shri Naresh Chand      Hony Treasurer
  5. Shri M. L. Choudhary    Member
  6. Shri A. P. Verma         „
  7. Shri Panna Lal Gupta    „
  8. Shri Raj Kumar          „
  9. Shri D. K. Sharma        „
  10. Shri Vishnu Hari Gupta „
  11. Shri R. D. Sharma        „

## CO-OPERATIVE CANTEEN AND STORE

Under the ICAR (Statistical Wing) Co-operative Store Ltd., Co-operative Canteen and Store continued to be run for the benefit of the staff members of the Institute. Tea, coffee, cold drinks, snacks, lunch provisions and general merchandise were made available to the Institute staff members at reasonable rates.

## SPORTS

At the Institute, there is a Sports Committee which holds competition to select team/individuals for various games/events to represent the Institute in the ICAR zonal/Inter-zonal Sports Meets. During 1986, the ICAR Inter-Zonal Sports Meet was organised by CAZRI,

The Co-operative Canteen and Store are being managed by the Committee consisting of elected members from the staff of the Institute. The annual accounts for the year 1985-86 of the store were prepared and duly got audited by the Registrar of the Co-operative Societies, Delhi Administration, Delhi. On the occasion of Dewali, gifts were distributed to the members of society.

Jodhpur from February 13-16, IASRI being winners in various games at the Zone-III-Sports Meet participated in the Inter-Zonal Sports Meet fielding a contingent of 27 members (Shri K. V. Sathe, Sr Scientist being Chief-de-mission, 2 Managers and 24 Sportsmen) with the following results :

---

<i>Event</i>	<i>Position</i>	<i>Team captain</i>
Table Tennis (Team Events)	Winner	Shri O. P. Khanduri
Table Tennis (Open Singles)	Winner	Shri O. P. Khanduri
Kabaddi	Runner	Shri D. P. S. Mann

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Among the 6 zones, Zone-III was adjudged second and IASRI secured the Runners Trophy on behalf of Zone-III as it contributed the maximum points.

Captain R. K. Marwaha, Chief Administrative Officer and Shri K. L. Kaul, Scientist (S-2) of the Institute participated in the Delhi State Bridge Championship Tournament, 1986, and bagged the trophy as well as, the cash prize.



Our winners of Delhi State Bridge Championship

## HINDI USAGE

To promote the use of Hindi in documentation of scientific output of the Institute and in day-to-day official matters like correspondence and notings the important steps taken during the year include :

- Four quarterly meetings of Official Language Implementation Committee of the Institute were held on Feb 25, May 30, Oct 6 and Dec 30, 1986 wherein main items discussed included implementation of Annual Programme for 1985-86, provision of Dr Rajendra Prasad Award-1986 for the best original standard book in the field of agriculture in Hindi, purchase of Siddharth Computer and delegation of power to the Director for permitting the scientists for original writing/translating Hindi books on assignment.
- Inspection Sub-Committee of the Institute under the Chairmanship of Shri S. C. Rai, Sr. Scientist, inspected various sections and divisions of the Institute on Sep 4, 1986 to assess the actual position of Hindi usage and as also to evaluate various sections and individuals in order of their involvement for awards.
- Five meetings of the Executive Committee of Kendriya Sachivalya Hindi Parishad of the Institute were held on Mar 1, May 27, Sep 20, Oct 13 and Dec 23, 1986 in which proposals for encouragement of Hindi use, Shakha membership, organization of various Hindi competitions, Hindi Diwas, etc. were discussed.
- ‘Hindi Fortnight’ was celebrated from Aug 16-30, 1986 to encourage Hindi usage in the Institute.
- Competitions for writing articles noting and drafting and debating in Hindi were held on Sep 5, 6 and 10, 1986 respectively. Hindi Diwas/Annual Function at the Institute was held on Oct 18, 1986 in which a Hindi Quiz Competition was also organised in addition to reviewing the progress during the year and distribution of prizes to all the winners of different competitions by the Chief, Guest Smt Pratibha Singh, M. P.
- Annual election of the Institute-Shakha of the Kendriya Sachivalya Hindi Parishad was held on Dec 23, 1986 under the Chairmanship of Shakha Patron (Director of the Institute). Dr O. P. Kathuria was unanimously elected as President and Shri C. S. Verma as Shakha-Mantri.

## IASRI PERSONNEL

Prof Prem Narain, Director  
Dr S.S. Pillai, Jt. Director (CS)

**Division of Design of Experiments and  
Analysis of Experimental Data**

Shri P.N. Bhargava, Head and Sr Scientist  
Dr A.K. Nigam, Sr Scientist  
Dr Alope Dey, Sr Scientist  
Km C.R. Leelavathi, Scientist S-3  
Shri P.N. Soni, Scientist S-3  
Shri V.N. Iyer, Scientist S-2  
Shri P.P. Rao, Scientist S-2  
Dr V.K. Gupta, Scientist S-2  
Mrs Asha Saksena, Scientist S-2  
Shri R.K. Ghai, Scientist S-2  
Shri J.K. Kapoor, Scientist S-2  
Shri H.C. Jain, Scientist S-2  
Dr B.L. Choudhary, Scientist S-2  
Dr G.C. Chawla, Scientist S-2  
Shri P.K. Batra, Scientist S-2  
Mrs Rajinder Kaur, Scientist S-1  
Shri Onkar Sarup, Scientist S-1  
Shri G.L. Khurana, Scientist S-1  
Shri D.K. Mehta, Scientist S-1  
Shri M.R. Vats, Scientist S-1  
Shri D.K. Sehgal, Scientist S-1  
Shri S.C. Mehta, Scientist S-1  
Shri Ravinder Srivastava, Scientist S-1  
Shri K.C. Bhatnagar, Scientist S-1  
Shri Madan Mohan, Scientist S-1  
Mrs Ajit Kaur Bhatia, Scientist S-1

**Division of Sample Survey Methodology  
and Analysis of Survey Data**

Dr O.P. Kathuria, Head and Sr Scientist  
Dr S.K. Raheja, Sr Scientist  
Dr J.P. Jain, Sr Scientist  
Dr A.K. Banerjee, Scientist S-3  
Dr P.C. Mehrotra, Scientist S-3  
Dr J.S. Maini, Scientist S-3  
Dr. A.K. Srivastava, Scientist S-3  
Shri U.G. Nadkarni, Scientist S-3  
Shri V.S. Rustogi, Scientist S-3  
Dr Randhir Singh, Scientist S-3  
Shri R.K. Khosla, Scientist S-3  
Dr H.V.L. Bathla, Scientist S-2  
Dr M.G. Mittal, Scientist S-2  
Dr Shivtar Singh, Scientist S-2  
Shri T.B. Jain, Scientist S-2  
Shri R.L. Rustagi, Scientist S-2  
Dr Pranesh Kumar, Scientist S-2  
Shri S.S. Shastri, Scientist S-2  
Shri K.B. Singh, Scientist S-2  
Shri S.S. Gupta, Scientist S-2  
Dr N.K. Ohri, Scientist S-2  
Shri Anand Prakash, Scientist S-2  
Dr K.K. Tyagi, Scientist S-2  
Shri M.S. Batra, Scientist S-2  
Shri G.S. Bassi, Scientist S-2  
Shri Jagmohan Singh, Scientist S-2

Dr D.L. Ahuja, Scientist S-2  
Shri B.C. Saxena, Scientist S-2  
Dr L.B.S. Somayazulu, Scientist S-2  
Shri K.P.S. Nirman, Scientist S-2  
Shri S.N. Arya, Scientist S-2  
Shri S.P. Verma, Scientist S-2  
Shri K.R. Rajagopalachar, Scientist S-2  
Shri Satya Pal, Scientist S-1  
Shri R.S. Khatri, Scientist S-1  
Shri D.C. Mathur, Scientist S-1  
Shri R.C. Gola, Scientist S-1  
Shri Jagbir Singh, Scientist S-1  
Shri V.T. Prabhakaran, Scientist S-1  
Shri Balbir Singh, Scientist S-1  
Shri S.C. Agarwal, Scientist S-1  
Shri H.O. Aggrawal, Scientist S-1  
Shri V.K. Mahajan, Scientist S-1  
Shri Satya Pal, Scientist S-1  
Shri S.C. Sethi, Scientist S-1  
Shri D.K. Bhatia, Scientist S-1  
Shri Bhagwan Das, Scientist S-1  
Shri M.S. Narang, Scientist S-1  
Shri A.S. Gupta, Scientist S-1  
Shri J.P. Goyal, Scientist S-1

#### **Division of Statistical Economics**

Dr V.K. Sharma, Head and Scientist S-3  
Dr R.K. Pandey, Sr Scientist  
Shri Shanti Sarup, Scientist S-2  
Dr U.N. Dixit, Scientist S-2  
Shri H.B. Choudhary, Scientist S-2  
Dr Bhagat Singh, Scientist S-2  
Shri B.L. Kaul, Scientist S-2  
Shri Ashok Kumar, Scientist S-1  
Shri Ant Ram, Scientist S-1  
Shri S.P. Bhardwaj, Scientist S-1

#### **Division of Forecasting Techniques for Crops Diseases and Pests**

Shri S.R. Bapat, Head and Scientist S-3  
Dr K.G. Aneja, Scientist S-3  
Dr Ranjana Agrawal, Scientist S-3  
Dr R.C. Jain, Scientist S-3  
Shri G.N. Bahuguna, Scientist S-2  
Dr Chandrahas, Scientist S-1  
Shri B.H. Singh, Scientist S-1

#### **Division of Bio-Statistics and Statistical Genetics**

Prof Prem Narain, Director and Head  
Dr Prajneshu, Scientist S-3  
Dr J.C. Malhotra, Scientist S-3  
Dr B.S. Sharma, Scientist S-3  
Dr V.K. Bhatia, Scientist S-2  
Shri Lal Chand, Scientist S-2  
Shri L.K. Garg, Scientist S-2  
Shri P.K. Malhotra, Scientist S-2  
Shri S.D. Wahni, Scientist S-2  
Dr J.N. Garg, Scientist S-1  
Dr P.S. Rana, Scientist S-1  
Shri R.K. Jain, Scientist S-1

#### **Division of Computing Science**

Shri A.C. Kaistha, Head and Scientist S-3  
Shri R. Gopalan, Scientist S-3  
Shri I.C. Sethi, Scientist S-2  
Shri O.P. Dutta, Scientist S-2  
Shri M.L. Sahni, Scientist S-2  
Shri S.P. Doshi, Scientist S-2  
Shri Mahesh Kumar, Scientist S-2  
Shri Ram Kumar, Scientist S-2  
Shri M.L. Choudhary, Scientist S-2  
Shri K.C. Gupta, Scientist S-2  
Shri S.L. Garg, Scientist S-2  
Shri K.L. Kaul, Scientist S-2  
Shri R.C. Goyal, Scientist S-1

Dr D.L. Ahuja, Scientist S-2  
Shri B.C. Saxena, Scientist S-2  
Dr L.B.S. Somayazulu, Scientist S-2  
Shri K.P.S. Nirman, Scientist S-2  
Shri S.N. Arya, Scientist S-2  
Shri S.P. Verma, Scientist S-2  
Shri K.R. Rajagopalachar, Scientist S-2  
Shri Satya Pal, Scientist S-1  
Shri R.S. Khatri, Scientist S-1  
Shri D.C. Mathur, Scientist S-1  
Shri R.C. Gola, Scientist S-1  
Shri Jagbir Singh, Scientist S-1  
Shri V.T. Prabhakaran, Scientist S-1  
Shri Balbir Singh, Scientist S-1  
Shri S.C. Agarwal, Scientist S-1  
Shri H.O. Aggrawal, Scientist S-1  
Shri V.K. Mahajan, Scientist S-1  
Shri Satya Pal, Scientist S-1  
Shri S.C. Sethi, Scientist S-1  
Shri D.K. Bhatia, Scientist S-1  
Shri Bhagwan Das, Scientist S-1  
Shri M.S. Narang, Scientist S-1  
Shri A.S. Gupta, Scientist S-1  
Shri J.P. Goyal, Scientist S-1

#### **Division of Statistical Economics**

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Dr R.K. Pandey, Sr Scientist  
Shri Shanti Sarup, Scientist S-2  
Dr U.N. Dixit, Scientist S-2  
Shri H.B. Choudhary, Scientist S-2  
Dr Bhagat Singh, Scientist S-2  
Shri B.L. Kaul, Scientist S-2  
Shri Ashok Kumar, Scientist S-1  
Shri Ant Ram, Scientist S-1  
Shri S.P. Bhardwaj, Scientist S-1

#### **Division of Forecasting Techniques for Crops Diseases and Pests**

Shri S.R. Bapat, Head and Scientist S-3  
Dr K.G. Aneja, Scientist S-3  
Dr Ranjana Agrawal, Scientist S-3  
Dr R.C. Jain, Scientist S-3  
Shri G.N. Bahuguna, Scientist S-2  
Dr Chandradas, Scientist S-1  
Shri B.H. Singh, Scientist S-1

#### **Division of Bio-Statistics and Statistical Genetics**

Prof Prem Narain, Director and Head  
Dr Prajneshu, Scientist S-3  
Dr J.C. Malhotra, Scientist S-3  
Dr B.S. Sharma, Scientist S-3  
Dr V.K. Bhatia, Scientist S-2  
Shri Lal Chand, Scientist S-2  
Shri L.K. Garg, Scientist S-2  
Shri P.K. Malhotra, Scientist S-2  
Shri S.D. Wahi, Scientist S-2  
Dr J.N. Garg, Scientist S-1  
Dr P.S. Rana, Scientist S-1  
Shri R.K. Jain, Scientist S-1

#### **Division of Computing Science**

Shri A.C. Kaistha, Head and Scientist S-3  
Shri R. Gopalan, Scientist S-3  
Shri I.C. Sethi, Scientist S-2  
Shri O.P. Dutta, Scientist S-2  
Shri M.L. Sahni, Scientist S-2  
Shri S.P. Doshi, Scientist S-2  
Shri Mahesh Kumar, Scientist S-2  
Shri Ram Kumar, Scientist S-2  
Shri M.L. Choudhary, Scientist S-2  
Shri K.C. Gupta, Scientist S-2  
Shri S.L. Garg, Scientist S-2  
Shri K.L. Kaul, Scientist S-2  
Shri R.C. Goyal, Scientist S-1

**Director's Cell**

Shri S.C. Rai, Head and Scientist S-3

Shri D.S. Aneja, Scientist S-1

Shri H.C. Gupta, Scientist S-1

**Monitoring Cell**

Dr H.P. Singh, Head and Scientist S-3

**UNDP Cell**

Shri S.C. Rai, Head and Scientist S-3

**Training Administration Cell**

Shri S.N. Mathur, Head and Scientist S-3

Dr Randhir Singh Dahiya, Scientist S-3

**Technical Officers**

Shri Rajendra Singh, Field Officer

Shri S.K. Suri, Field Officer

Shri S.S. Srivastava, Librarian

Shri S.K. Sablania,

Mechanical Tabulation Officer

Shri S.D. Sharma, Field Officer

Shri S.K. Mahajan, Jr Technical Officer

Shri D.C. Pant, Jr Technical Officer,

Shri Amar Ranjan Pal, Sr Artist

**Administration**

Capt R.K. Marwaha,

Chief Administrative Officer

Shri Anthony Tete, Sr Administrative Officer

**SANCTIONED AND FILLED UP POSTS**  
(as on 31-12-1986)

S. No.	Designation of the Post	Scale of Pay (Rs.)	No. of Posts		No. of SC/ST employees	
			Sanctioned	Filled	SC	ST
1	2	3	4	5	6	7
1.	Director	2000-2500*	1	1	—	—
2.	Jt Director	1800-2250*	2	1	—	—
3.	Sr Scientist	1800-2250*	22	29	—	—
4.	Scientist S-3	1500-2000*				
5.	Scientist S-2	1100-1600*	29	54	—	—
6.	Scientist S-1	700-1300*	63	39	2	—
7.	Scientist S-0	1640-2900	35	14	1	—
8.	Chief Admn Officer	1300-1700*	1	1	—	—
9.	Sr Admn Officer	1100-1600*	1	1	—	—
10.	Accounts Officer	700-1300*	1	—	—	—
11.	Field Officer	700-1300*	3	3	—	—
12.	Mech Tabulation Officer	700-1300*	1	1	1	—
13.	Librarian	700-1300*	2	1	—	—
14.	Jr Tech Officer	700-1300*	3	2	—	—
15.	Sr Artist	700-1300*	1	1	—	—
16.	Asstt Field Officer	2000-3500	1	1	—	—
17.	Asstt Engineer	2000-3500	1	—	—	—
18.	Asstt Admn Officer	2000-3500	3	1	1	—
19.	Hindi Officer	2000-3500	1	1	—	—
20.	Security Officer	2000-3500	1	1	—	—
21.	Electronic Computer Operator	1640-2900	8	5***	—	—
22.	Artist	1640-2900	1	1	—	—
23.	Superintendent	1640-2900	8	7	—	1
24.	Sr Personal Asstt	1640-2900	1	1	—	—
25.	Photographer	1400-2300	1	1	—	—

1	2	3	4	5	6	7
26.	Tech Asstt (Stat)	1400-2300	156	118	16	—
27.	Tech Asstt (Eco)	1400-2300	8	8	1	—
28.	Tech Asstt (Lib)	1400-2300	2	2	—	—
29.	Asstt EC Operator	1400-2300	6	3	1	—
30.	Field Inspector	1400-2300	2	2	—	—
31.	Hindi Translator	{ 1640-2900	1	1	—	—
		{ 1400-2300	1	1+	—	—
32.	Assistant	1400-2300	25	19	5	1
33.	Stenographer	1400-2300	11	8	—	—
34.	Jr Stenographer	1200-2040	18	13	1	—
35.	Sr Clerk	1200-2040	20	22**	3	—
63.	Field Supervisor	1200-2040	6	6	—	—
37.	Punch Supervisor	1200-2040	3	3	1	—
38.	Card Librarian	1200-2040	1	1	—	—
39.	Receptionist	975-1540	1	—	—	—
40.	Electrician	975-1540	1	1	—	—
41.	Key Punch Operator	975-1540	45	44	4	1
42.	Field Investigator	975-1540	30	30	5	—
43.	Coders	975-1540	10	2	—	—
44.	Reference Assistant	975-1540	1	—	—	—
45.	Counter Assistant	975-1540	1	—	—	—
46.	Telephone Operator	975-1540	3	3	—	—
47.	Tubewell Operator	{ 975-1540	2	2	—	—
		{ 950-1400	1	1+	1	—
48.	Sr Gestetner Operator	950-1400	1	1+	—	—
49.	Carpenter	975-1540	1	1	—	—
50.	Driver	{ 975-1540	3	3	3	—
		{ 950-1400	2	1	—	—
51.	Zerox Operator	950-1500	1	—	—	—
52.	Jr Clerk	950-1500	38	34	4	—
53.	Supp Staff—Grade IV	825-1200	103	98	30	2
54.	Grade III	800-1150				
55.	— Grade II	775-1025				
56.	— Grade I	750-940				

Notes : \*Indicates old scale

\*\*Two posts excess filled against Jr Steno

\*\*\*Five Sr Tech Asstt are working against the vacant post of E.C.O.

+Auxiliary posts

## ON-GOING RESEARCH PROJECTS

S. No.	Title of Project	Project Leader & Associates	Duration
1	2	3	4
<b>Division of Design of Experiments and Analysis of Experimental Data</b>			
1.	Planning designing and analysis of experiments on cultivators' fields	PN Bhargava HC Jain PP Rao Mahesh Kumar	Continuing
2.	Planning, designing and analysis of experiments planned under AICARP at cropping systems research centres	PN Soni Rajinder Kaur Ajit Kaur Madan Mohan	Continuing
3.	Agricultural field experiments information system	KS Krishnan RK Ghai PN Bhargava PK Batra MP Saksena PR Yeri	Continuing
4.	A study of factors in relation to homogeneity of error variances in groups of experiments on sugar-cane crop	PP Rao RK Ghai MP Saksena PR Yeri	Jan 86-Dec 87
5.	A statistical study for characterization of drought in relation to a crop	Asha Saksena PN Bhargava SC Mehta	Jul 84-Apr 87
6.	Yardsticks of additional production from the use of crop improvement measures	VN Iyer Onkar Swarup	Apr 85-Mar 88
7.	National index of animal experiments	GC Chawla A Dey	Continuing

1	2	3	4
8.	Change-over-designs, their construction and cataloguing useful in animal experimentation	GC Chawla A Dey VK Gupta	Nov 85-Dec 87
9.	Statistical analysis of intercropping data through bivariate technique	Basant Lal PN Bhargava Aok Lahiri	Jan 85-Apr 88
10.	Methodological studies and critical analysis of data relating to repeated experiments with some common treatments	JK Kapoor VK Gupta	Nov 85-Dec 87
11.	Statistical assessment of cropping sequences in different agro-climatic regions of the country	KC Bhatnagar GL Khurana CR Leelavathi	Jul 85-Dec 87
12.	Statistical studies on nitrogen economy through organic sources	Rajinder Kaur Ajit Kaur Madan Mohan PN Soni	Jul 85-Dec 87
13.	Over-view of the designs adopted in animal nutrition experimentation in India with recommendations of new designs in appropriate situations	SN Bajpai AK Nigam DK Bhatia	Feb 82-Dec 86
14.	Planning, designing and statistical analysis of the data relating to experiments conducted under the All India Coordinated Research Project on Long Term Fertilizer Experiments	PN Soni MR Vats DK Sehgal DK Mehta	Continuing
15.	Studies on designs for animal experiments	A Dey VK Gupta	Oct 85-Sep 88
<b>Division of Sample Survey Methodology and Analysis of Survey Data</b>			
16.	Pilot sample survey for estimation of cost of cultivation of oilseeds and pulses	AK Banerjee DL Ahuja OP Kathuria SK Raheja	Sep 84-Dec 88
17.	Pilot sample survey on cost of production of banana/mango and its marketing practices in Surat and Bulsar districts of Gujarat state	MS Batra OP Kathuria	Sep 78-Dec 86

1	2	3	4
18.	A study of variability of various components of cost of cultivation of vegetables at different stages of sampling and determination of sampling sizes at given levels of precision	Satya Pal AK Srivastava	
19.	Pilot sample survey to study the impact of flood on agricultural production in a region of UP	OP Kathuria AK Banerjee Jagmohan Singh	Oct 81-Sep 87
20.	Pilot sample survey for developing a sampling methodology for estimation of livestock products on the basis of data collected as a part of the normal work of field agency of animal husbandry department	RS Khatri JS Maini KB Singh	Nov 84-Feb 88
21.	A study of variability and trends of yield rates of high yielding varieties of rice during IV and V Five Year Plan periods	PC Mehrotra VS Rustogi SK Raheja Satya Pal	Jan 85-Sep 87
22.	Statistical summarisation of results on yield rates, area and extent of adoption of improved practices for HYV of millets (maize, jowar, bajra) during IV and V Five Year Plan periods	GS Bassi PC Mehrotra SK Raheja	Jan 84-Sep 87
23.	Pilot sample survey for developing sampling methodology for assessment of impact of National Demonstration Trial on crop yield	MG Mittal	Oct 81-Sep 87
24.	Sample survey for cost of cultivation, agronomic practices, area and yield rates of potatoes	SS Gupta SK Raheja AK Srivastava (PS Dahiya VP Malhotra of CPRI, Shimla)	Nov 83-Dec 87
25.	A study of variability of yields and acreage under HYV Cotton	VS Rustogi PC Mehrotra SK Raheja MS Narang	Jan 84-Sep 87

1	2	3	4
26.	Pilot sample survey for studying the relative merits of the data obtained by actual weighment and those through enquiry for estimation of milk-production	KB Singh JS Maini RS Khatri	Feb 85-Apr 88
27.	A study of yield trends of wheat in India during last three decades	DL Ahuja A Dey AK Banerjee SK Raheja	Jan 84-Mar 87
28.	Pilot sample survey to evolve an appropriate methodology for estimation of lac production	DC Mathur OP Kathuria AK Srivastava SC Sethi	Feb 84-Mar 92
29.	Pilot sample survey for estimation of area of grazing land and its utilisation-Tamil Nadu	Anand Prakash JS Maini BC Saxena	Dec 84-Dec 88
30.	Pilot sample survey for study of cost of production of chikoo and its marketing practices in Valsad district (Gujarat)	MS Batra OP Kathuria	Jun 82-Dec 87
31.	A study of employment and income of Small farmers and landless labourers	Randhir Singh AK Srivastava	Mar 83-Dec 87
32.	Pilot sample survey for estimation of production of hides and skins in Chingleput and North Arcot districts of Tamil Nadu and Surat district of Gujarat state	JS Maini KB Singh RS Khatri	Dec 84-Dec 87
33.	Sample survey for study of constraints in transfer of new agricultural technology under field conditions	SK Raheja PC Mehrotra VS Rustogi SS Gupta SS Shastri NK Ohri GS Bassi RC Gola MS Narang	Jan 84-Dec 90

1	2	3	4
34.	Pilot survey to develop statistical models for production and culling patterns in poultry	KPS Nirman JP Jain Balbir Singh	Jan 86-Feb 89
35.	Pilot studies for estimation of birth and death rates in ovines	UG Nadkarni SN Arya Balbir Singh	Feb 84-Mar 88
36.	Statistical investigations on economics of pig production	TB Jain UG Nadkarni	Feb 84-Sep 87
37.	Studies on comparative performance of mixed farming involving crops, livestock, poultry and fish	Shivtar Singh KC Raut RL Rustagi HO Agarwal	Sep 84-Sept 87
38.	A comparative study of some methods for estimating mortality rates in bovines	SN Arya UG Nadkarni	Sep 81-Aug 87
39.	Pilot study for developing a suitable methodology for estimation of cost of cultivation of fodder crops, Jalandhar (Punjab)	KPS Nirman Shivtar Singh HO Aggarwal	Apr 83-Sep 86
40.	Development of a suitable statistical methodology for estimating extent of labour utilization in livestock and poultry keeping in rural areas, Meerut (UP)	SP Verma JP Jain	Jan 85-Oct 87
41.	Study of distribution of age specific mortality and fertility rates in bovines	LBS Somayazulu SN Arya SC Agarwal	Mar 83-Sep 87
42.	Pilot survey to evolve a sampling methodology for estimating the resources and total catch of inland fish in a region of Orissa	OP Kathuria HVL Bathla	Dec 84-Dec 88
43.	Pilot sample survey for estimation of losses, price spread at various stages and cost of cultivation of vegetable crops, Pune	AK Srivastava SK Raheja DC Mathur Satya Pal	Feb 85-Mar 89

1	2	3	4
44.	Pilot studies for developing statistical methodology for assessing the losses due to diseases and pests in bovines	HP Singh JP Jain BC Saxena	Jan 85-Apr 88
45.	Pilot sample survey for estimating the energy utilization for different levels of adoption of modern technology in agriculture	KK Tyagi PC Mehrotra SK Raheja	Jul 83-Sep 87
46.	Pilot sample survey for determining the cost of production and to study the marketing practices of orange in Nagpur and Amravati districts of Maharashtra state	OP Kathuria B L Kaul MS Batra	Apr 78-Mar 87
47.	Pilot sample survey for estimation of post-harvest food grain losses	RK Khosla Prem Narain Rajendra Singh HC Gupta	Apr 85-Mar 89

#### Division of Bio-statistics and Statistical Genetics

48.	Estimation of genetic variability in crop plants	PS Rana LK Garg PN Bhargava	Oct 82-Sep 86
49.	Direct and maternal additive and heterotic effects in cross-bred dairy cattle	RK Jain LK Garg SD Wahi	Dec 84-Dec 86
50.	Statistical study of dynamical models for fishery growth and harvesting	Prajneshu	Oct 85-Sep 87
51.	Statistical analysis of cross breeding data at military dairy farms	BS Sharma Prem Narain	May 84-Apr 87
52.	Investigations on appropriate statistical methods for comparing genetic groups based on multiple traits in dairy animal	Lal Chand Prem Narain	Jun 85-May 88
53.	Growth studies on crossbred cows available at various military farms in the country	JC Malhotra Prem Narain JP Jain PK Malhotra	Apr 80-Dec 86

1	2	3	4
54.	Statistical studies in relation to crop insurance	JN Garg Prem Narain Shivtar Singh Mahesh Kumar	Oct 85-Mar 89
55.	Selection indices for economic merit in poultry	PK Malhotra Prem Narain	Aug 80-Sep 86
56.	Statistical studies in animal epidemiology	VK Bhatia PK Malhotra	Mar 86-Feb 89
57.	Use of discriminant function for comparing different grades in cross-breeding programme with sheep	SD Wahi Prem Narain LK Garg	May 84-Sep 86
58.	Statistical investigations in sensory evaluation of agricultural products	SC Rai VK Bhatia	Jul 85-Dec 87

#### Division of Forecasting Techniques for Crops, Diseases and Pests

59.	Pilot studies on pre-harvest forecasting of yield of groundnut crop on the basis of data on biometrical characters, weather variables and agricultural inputs, Rajkot district (Gujarat)	SR Bapat BH Singh RC Jain	Feb 84-Dec 88
60.	Studies to develop models for obtaining pre-harvest forecast of wheat yield on the basis of weather parameters	Ranjana Agrawal RC Jain	Mar 86-Feb 88
61.	Use of growth indices and principal component technique in yield forecast of sugarcane	RC Jain Ranjana Agrawal	Jul 84-Dec 86
62.	Yield forecast model based on biometrical characters and agricultural inputs for jowar crop	RC Jain Ranjana Agrawal KG Aneja	Jul 84-Dec 86
63.	Pilot studies on pre-harvest forecasting of apple yield in Shimla district (HP)	Chandras KG Aneja Prem Narain	Sep 83-Sep 88
64.	Pilot sample survey for estimating the incidence of pests and diseases and their consequent loss in high yielding varieties of paddy crop in South Arcot district of Tamil Nadu	KG Aneja GN Bahuguna VK Mahajan	July 76-Jun 86

1	2	3	4
65.	Models for forecasting aphid pests of mustard crop	KG Aneja GN Bahuguna (KG Phadke of IARI)	Jan 87-Jun 89
66.	Tobacco yield forecast model based on principal components of biometrical characters and crop inputs	Chandrasah KG Aneja BH Singh	Apr 85-Sep 86
<b>Division of Statistical Economics</b>			
67.	Study of cost functions for milk production in rural areas	RK Pandey Sushila Kaul Ashok Kumar	Oct 85-Dec 86
68.	Economic analysis of acreage response for tur crop in India	Shanti Sarup	Jan 82-Mar 86
69.	A study on institutional credit in agriculture	Ashok Kumar RK Pandey Sushila Kaul	Oct 85-Sep 86
70.	Economic study of new farm technology with special reference to yield gap and associated factors in selected operational research project areas	RK Pandey Shanti Sarup Bhagat Singh HB Chowdhary BL Kaul	Oct 84-Apr 88
71.	Economic study of imbalances in rice and wheat production in India	RK Pandey Shanti Sarup	Jan 82-Sep 87
72.	Level of employment in modern farm technology	RK Pandey PC Mehrotra UN Dixit Bhagat Singh	Apr 86-Jun 89
<b>Division of Computing Science</b>			
73.	Development of software for construction of selection index as applicable to animal breeding data	OP Dutta	Dec 85-Dec 87
74.	A study of the use of split plot designs in agricultural field experiments	ML Sahni Mahesh Kumar	May 82-Dec 86
75.	Development of Computer software for cluster analysis	SP Doshi KC Gupta	Jan 85-Sep 86
76.	Computer software for quadratic programming techniques	Ram Kumar ML Choudhary	Jun 85-Mar 87

**DISTINGUISHED VISITORS**

**(a) Visitors from abroad**

*Feb*

Dr James E Gentle,  
IMSL, Houston,  
Texas, USA

*Mar*

Prof David Seckler,  
Executive Director,  
International School for Agricultural  
and Resource Development,  
Colorado State University,  
USA

Mr Giorgis Jingolani,  
Agricultural Economist of East  
European Commission on  
"Operation Flood"

*Jun*

Dr VPS Chauhan,  
Instt of Animal Science,  
Federal Institute of Technology,  
Zurich,  
Switzerland

*Aug*

Dr GK Kanji,  
Sheffield City Polytechnic,  
UK  
Dr Piet Terhal,  
East European Commission  
on "Operation Flood"

*Nov*

Dr Sun Xiang,  
Dy Director and Agronomist,  
and three members  
Deptt of Education  
Ministry of Agriculture,  
Animal Husbandry and Fishery,  
People's Republic of China,  
China

*Dec*

Dr James H Matis,  
Texas A and M University,  
Texas,  
USA  
Dr Th Bredero.  
World Bank

**(b) Visitors from Organisations within  
India**

*Jan*

Dr Blue Richardson,  
Dy Director  
and  
Mr MC Gupta,  
USAID,  
New Delhi

*Apr*

Dr Padam Singh,  
Jt Advisor, Prospective Planning,  
Planning Commission,  
New Delhi

**May**

**Dr Anatoly N Lukyanenko,  
Counsellor,  
Agricultural Attache,  
Embassy of USSR  
New Delhi**

**Dr Rolf Mueller,  
ICRISAT,  
Hyderabad**

**Oct**

**Dr JS Samra,  
Sr. Soil Scientist  
CSSRI, Karnal**

**Dec**

**Mr Byzovs and  
Mr Alexander P Sevostianov.  
Dip Eng and Eco  
USSR Embassy,  
New Delhi**

## DISSERTATIONS APPROVED

## Ph.D. Degree

1. **BALAKRISHNAN KA**—Studies on some aspects of genotype-environment interaction in vegetable crops

The objective of this dissertation is to evaluate the available techniques for studying GE interactions in vegetable crops and to develop some new concepts and methods to solve problems of non-linearity of GE interactions, non-orthogonality of data and dissimilar patterns of interactions observed for different traits of the same variety.

From the empirical studies made with multiculation trial data on onion, peas and tomato varieties, Hanson's (1970) single parameter approach for studying the stability and adaptability is found to be superior to Tai's (1971) two parameters model.

The proposed new model of exponential quadratic is seen to be more appropriate to explain the non-linear GE interactions that are observed in the three vegetable crops, onion, peas and tomato.

FITCON analysis (Patterson, 1978) is found to be as efficient as the operationally more difficult method of modified joint regression analysis (Digby, 1979) for esti-

imating the variety means when the data is non-orthogonal, unless the varieties show marked differences in their sensitivity to environment or the non-orthogonality is large.

When the different traits of the same variety show dissimilar patterns of GE interactions, a new composite index combining several traits, derived through principal component approach is suggested for undertaking simultaneous stability analysis for the various traits.

(Guide : Dr J.P. Jain)

2. **DHALL SP**—Some studies on robustness of designs

This thesis deals with certain aspects of robust designs with special reference to robustness against presence of systematic trends and missing observations in block designs. In the first chapter, an introduction to the problem of robust designs has been given alongwith a brief review.

In Chapter-II, the study of trend-free incomplete block designs has been initiated. A general algorithm for obtaining a trend-free designs with block size two has been given. A general result for obtaining incomplete block designs orthogonal to all trends is given which leads to a very large

number of designs. Trend-free BIB designs for linear trends with a block size six or less have also been constructed.

Further aspects of trend-free designs are studied in Chapter-III. It is shown that the trend-free BIB designs, free of linear trends, obtained in Chapter-II are in fact orthogonal to all odd ordered trends. The efficiencies of these designs in the presence of quadratic trends have been studied and it is seen that these efficiencies are very high. Finally, some designs fully orthogonal to quadratic trends have also been constructed.

In Chapter-IV, the robustness of argued BIB designs against the loss of observations pertaining to one (test) treatments, bounds for the variance of contrasts among test and control treatments are obtained and it is shown that argued BIB designs are highly robust.

Guide : Dr Aloke Dey)

### 3. JAISWAL UC—On some aspects of discriminatory analysis in studying divergence between different genetic groups of crossbred dairy cattle

This dissertation deals with various facets of discriminant analysis in studying the divergence between different genetic groups of crossbred dairy cattle. The data used are taken from the All India Coordinated Research Project on cattle located in Haryana Agricultural University, Hissar.

Almost all statistical procedures used in multivariate biometric analysis require the assumptions of multivariate normality and homogeneity of covariance matrices.

Accordingly, a critical appraisal of various methods of assessing univariate and multivariate normality is made. A simple and approximate method of testing multivariate normality has been proposed. In case of small departures from normality logarithmic transformation has been found appropriate to render the breeding data to nearly normal.

The genetic groups included in the study were significantly different in their mean vectors. The geometrical portrayal of separation of groups showed that three-fourths are very close to each other in comparison to the half-breds.

For measuring distances among different genetic groups with heterogeneous covariance structure, an empirical study was made to judge the robustness of Mahalanobis'  $D^2$ -statistics vis-a-vis  $D_{*2}$  statistics of Anderson and Bahadur. The closeness in their numerical values indicated that  $D^2$ -statistics can safely be used in measuring distance between two populations with heterogeneous covariance structure for equal and unequal sample sizes.

The testing of genetic groups for homogeneity of covariance structure revealed that the genetic groups with 50% exotic inheritance are homogeneous among themselves irrespective of the exotic breeds involved and so are the genetic groups with 75% exotic inheritance. Genetic groups with different levels of exotic inheritance were generally found heterogeneous. This important finding leads to an equally important conclusion viz., that for studying the divergence among half

bred and three-fourth genetic groups separately one can safely use Fisher's linear discriminant function. For studying the usefulness of Fisher's LDF vis-a-vis QDF when the assumption of identical covariance matrices is violated while multivariate normality remains intact, the covariance structure were reduced to canonical form to examine the patterns of diagonal elements. None of the pairs conform to the patterns obtained by earlier workers. Two new patterns were obtained for which Monte Carlo studies will have to undertaken to investigate the usefulness of LDF vis-a-vis QDF.

Stepwise regression method was used to select the most effective subset of variables because of its greater versatility. Out of the four traits considered viz. fat percent, age at first calving, first lactation yield and calving interval, the first three traits in decreasing order of their importance are seen deficient for discrimination.

Three multi-traits genetic group indices of both specific and general nature appropriate to different situations have been developed for ranking the different genetic groups in order of their overall merit. Their use has been illustrated with live data.

(Guide : Dr J.P. Jain)

#### 4. VERMA DEVENDRA—On improved estimation of heritability

The dissertation is a comprehensive investigation on various methods of heritability estimation including development of improved estimators of heritability for both continuous and quasi-continuous characters and as also for all commonly used data designs.

Four new regression estimators of heritability viz. minimum quadratic loss estimator, minimax linear restricted estimator, logistic transformation estimator and modified range restricted estimator have been proposed. In addition these estimators have been illustrated numerically. A two-stage regression method of estimation of heritability has also been indicated which besides providing a robust estimate is applicable for a wider class of error distribution.

For the estimation of heritability from half-sib and full-sib data designs four new estimators viz. non-negative estimator, minimum mean square error estimator, restricted estimator and admissible estimator have been suggested. Further the mean square error expressions of these estimators have been derived. Lastly, these estimators have been illustrated with a numerical example.

Since the scale of measurement and the mode of gene action have an important bearing on the heritability estimates, a number of procedures for obtaining improved estimates of heritability through scale transformations of both direct and indirect types have been discussed and illustrated with live data.

Assuming normality of observations two unbiased correlation estimators of heritability have been obtained. In addition the sampling distribution of classical correlation estimator of heritability has been worked out. In addition the Bayesian approach has introduced in the heritability estimation.

Finally, two non-parametric regression and correlation estimators of heritability have been developed and illustrated with the help of different sets of live data.

(Guide : Dr J. P. Jain)

#### 5. MAHAJAN VK—Some contributions to the theory of successive sampling

Usually, successive sampling is used to obtain improved estimators of population parameters of interest using the information collected on all the occasions. The common technique in this has been to use double sampling technique using ratio and regression method of estimation.

It is well known that the least square principle under Gauss Mark-off linear model yields the best estimator for the parameter of interest. In this thesis, the least square principle has been used in successive sampling under Aitken's general linear model. The chief merit of this principle is that it does not require any assumption about the distribution of population and also it yields the best linear unbiased estimators of population parameters on different occasions simultaneously. This technique is also used in the case of two stage sampling on successive occasions and the results are obtained for both the occasions simultaneously. Also, this has been used for studying two characters simultaneously on two occasions for unistage design. The results obtained by this are in agreement with those obtained earlier using the usual methods in all the situations.

Taylor's linearization technique is used to study the bias and mean square

error of ratio and regression estimators upto second order of approximation. It has been found that the precision of ratio and regression estimators increases if mean square error is worked out and upto second order of approximation. The results have been verified empirically by taking 25 real finite populations from the published sources for samples of sizes 4, 5 and 6 respectively. Taylor's technique is also used in successive sampling for calculating the mean square error of regression estimators for the matched sample on two occasions.

(Guide : Dr O.P. Kathuria)

#### 6. SAXENA BC—Some investigations in multiple frame surveys

The thesis deals with some aspects of the problem of multiple frames in sample surveys arising in different forms in various situations. In practice, in most of the sample surveys multi stage design usually two or three stages are commonly used. Multi stage sampling involves sampling frames at each stage of selection. The problem of multiple frame naturally multiplies when applied to multi stage designs. Availability of sampling frame is an important consideration in choice of multi stage designs. There are situations when more than one frames are available at the first stage of selection while only a single frame may be available at the second stage or vice-versa. Also more than one frames may be available at each stage of selection. Estimation

of population total for such surveys is considered herewith unequal first stage units when selection at either stage is with equal probabilities. Advantages through multiple frames are illustrated using two frames at the first and a single frame at the second stage.

In addition to dealing with the problem of multiple frame in two stage sampling designs for single character, some aspects of multi characters study in multiple frame surveys are investigated for uni-stage as well as two stage designs. The gain due to two characters study in a common surveys over separate surveys for individual characters has also been obtained.

An attempt has also been made to examine the robustness of Hartley's estimator for multiple frame surveys. It is found that the estimator appears to be fairly robust with respect to moderate departures in the values of 'p' but it is not so with departures in optimality of sample sizes.

(Guide : Dr Prem Narain)

#### 7. SHARMA BS—A statistical study of quantitative inheritance in cross-breeding programme with cattle

The thesis deals with the study of gene action and interaction using the data of Military Dairy Farms for the period 1945 to 1979. The general formulae for obtaining expected generation means were derived separately for additive-dominance, digenic interaction, trigenic

interaction and linked digenic models. A procedure for deriving expected generation variances in terms of the parameters D, H and F was also given.

Adjusting the data for non-genetic factors of farms, periods and seasons the linear and quadratic curves of the economic traits on levels of exotic inheritance were fitted and it was found that yield traits increased with the increase in the percentage of Holstein inheritance upto 74% and decreased thereafter. The reverse was the case with age at first calving. As grades having Holstein inheritance ranging from 1/2 (50%) to 5/8 (62.5%) seemed to more adaptable to the environmental changes, it can be said that for cross-breeding programme in cattle, the level of Holstein inheritance should be preferably between 1/2 and 5/8. Using the generation means obtained from adjusted data, the additive-dominance, digenic, trigenic and linked digenic models were fitted by weighted least squares technique, weights being the square of inverse of standard errors of generation means and estimates of the parameters, [d], [h] etc. of components of mean were obtained. Based on the tests of significance of the estimates of the parameters [d] and [h], it can be said that the polygenes controlling the production traits whole lactation yield 300-day yield, yield per day of lactation, yield per day of calving interval and the reproduction trait age at first calving have significant additive and dominance effects. Further on the basis of chi-square values measuring the improvement in goodness of fit, the presence of both the digenic and trigenic

interactions is suspected to be there in case of all the above production traits, while in case of weight at first calving only digenic interactions and in case of dry and intercalving periods, only trigenic interactions seen to be present. The additive-dominances model has been found to be adequate for age at first calving although linked digenic model has not been found adequate in any of these characters indicating the absence of linkage among polygenes controlling these traits.

(Guide : Dr Prem Narain)

## M. Sc. Degree

### 1. DAS ASHISH-Incomplete block designs for comparing treatments with a control

In the present thesis, the A-optimally of augmented BIB designs have been studied. An augmented BIB design, where each block of a BIB design (v, b, k-t) is augmented by t controls is denoted by ABIB (v, b, k-t; t). In this thesis, a catalogue of all A-optimal ABIB (v, b, k-t; t) designs for  $t=1$  is provided. Families of BIB designs leading to A-optimal ABIB designs for  $t=2$  are identified. For any  $t \geq 1$ , two series of A-optimal ABIB designs are discovered.

(Guide : Dr Alope Dey)

### 2. DAS MANAS-Statistical studies in animal epidemiology

In this study a number of useful and informative parameters relating to the cause of diseases in population were derived. With the help of these parameters,

the fatality/epidemicity of the diseases can be studied and corrective measures can be undertaken in advance to prevent the diseases and check the losses. The course of spread of 5 diseases namely : pneumonia, parasites of gastro-intestinal tract, breeder, anorexia anoestrons prevailing in Hissar district (Haryana) were studied through discrete-determination models. For testing the theoretical models, the data collected by IASRI for 'developing the statistical methodology for assessing the losses due to diseases and pests in Bovines' was analysed. Some of the broad conclusions drawn are as under:-

Under the assumption of constant contact rate (.001) for all five diseases taken for study, the average time taken for a susceptible individual to get infected has been calculated. It is minimum (5.60 rounds) for the diseases Anoestrons and maximum (14.65 rounds) for the diseases Anorexia. Against the number of individuals which will be removed at infinity (z) is maximum (495) for the disease Anoestrons. Considering these two statistics it can be concluded that the diseases Anoestrons spreads more rapidly than any of the other four diseases studied here. In the cattle population under study, pneumonia is also showing similar picture but severity is less. On the other hand, the other three diseases namely : parasites of gastro-intestinal tract, repeat breeder and anorexia are not serious on the basis of the findings of this study and they may not take the form of an epidemic in near future.

(Guide : Dr H.P. Singh)

### 3. GUPTA MANISHA-Estimation of losses caused by floods in agricultural production

The estimation of crop area affected by floods and the extent of crop damage available are generally based on visual assessment by persons of repute at the village level like patwari, gram pradhan, etc. Being subjective such estimates are generally not reliable. The Government of India (Rashtriya Barh Ayog 1980) also felt concerned about the need for reliable estimates of crop losses due to flood mainly from the point of view of providing relief to the affected people. It was in this context that the Indian Agricultural Statistics Research Institute, New Delhi implemented a project 'Pilot sample survey to study the impact of floods on agricultural production in a region of Uttar Pradesh'. The present disseration deals with the problem of estimation of losses caused by floods in agricultural production. The study attempts to estimate the area affected and the loss of inputs and other assets of the cultivators selected under the above mentioned project in Faizabad district of Utter Pradesh during Kharif 1981-82.

(Guide : Dr A.K. Banerjee)

### 4. SINGH CHANDRA-Use of auxiliary variables in sampling and estimation

The use of auxiliary variable in probability sampling either for stratification of the population or for selection of units or for estimation, is commonly used device for improving the precision of the estimate

of the population mean or total obtained from probability sample. Much of work done so far related to the availability of an auxiliary variable for a particular use. More complex problems which arise with the use of more than one variable have been attempted in this dissertation by studying empirically on one set of data. The empirical studies have been carried out by using three auxiliary variables in all combinations of their roles.

The role of auxiliary variables has been studies under four categories. One, in which no auxiliary variable has been used to construct the estimator of population total, the estimator being the one based on the simple random sampling without replacement. In the second category on auxiliary variable has been used either for stratification or for selection or estimation. The third category involves the use of two auxiliary variables in their different roles. In the last and fourth category all the three variables have been used in their different roles. For selection the Rao, Hartley and Cochran procedure and for estimation the ratio estimator have been considered for empirical study.

For empirical study, 48 districts of Uttar Pradesh have been considered which have been growing rice for the past many years. The total fertiliser consumption (N+P+K) of the district (1982-83) ( $X_1$ ), area under rice (1982-83) ( $X_2$ ) and the total production of rice (1982-83) ( $X_3$ ) have been used as auxiliary variables.

It has been observed from the results that (i) the estimators using auxiliary vari-

ables/variables are more efficient than the estimators based on the simple random sampling without replacement, (ii) the auxiliary variable  $X_1$  is best suited for stratification,  $X_2$  is suited for constructing ratio estimator and variable  $X_3$  is best suited for the selection, (iii) In the class of estimators using two auxiliary variables either for stratification or selection or for estimation, the estimators using one auxiliary variable for selection of unit with PPSWOR and another for estimation have the least variances, (iv) when all the three auxiliary variables have been used in their different roles, the estimator using auxiliary variable  $X_1$ , for stratification, variable  $X_2$  for estimation (ratio estimator) and variable  $X_3$ , for selection with Rao, Hartley, Cochran (PPSWOR) yields the maximum percentage gain in efficiency over SRSWOR than all the other estimators, (v) when another variable was introduced in the estimator either for stratification or for selection or for estimation, the percentage increase in efficiency over SRSWOR increased in most of the cases.

(Guide : Shri V.S. Rustogi)

#### 5. GUPTA ATUL KUMAR-Some investigations on the pooling of results in groups of experiments

In agricultural research programme, experiments are generally repeated over different places or over years to assess the efficacy of the treatment over a wide range of conditions. To carry out the statistical analysis for these experiments, a good number of research workers namely

Cochran, and Kempthorne have provided the detailed methods of analysis.

While carrying out the analysis, two cases arise. One, when the errors are homogeneous and the other, when the errors are heterogeneous. The homogeneity of the errors can be tested by Bartlett's test. In the present dissertation, the case when the errors are heterogeneous has been taken. To find out whether  $(N \times L \times P \times Y)$ ,  $(N \times P \times Y)$  and  $(L \times P \times Y)$  interactions are significant or not the weighted analysis has been carried out. It was found that  $(N \times L \times P \times Y)$  and  $(N \times P \times Y)$  interactions are present while  $(L \times P \times Y)$  interaction is absent. This information was used to find out the significance of different interactions in the unweighted analysis of variance. It was found that the average effect of  $(N)$  and  $(N \times L)$  interactions taken over all the places and years are not significant. From the weighted analysis, since  $(L \times P)$  and  $(L \times Y)$  interactions were also found to be absent, it was concluded that, the testing of the effects of  $L$  is not possible.

Sometimes, it is also important to ensure that the superiority of a recommended treatment persists from year to year as also from place to place. For this the concept of regression coefficient as a measure of stability of the performance of any treatment has been used. It was found that treatment  $N_2L_1$  is least affected by the environmental changes while the treatment  $N_2L_0$  proved highly mobile. It means  $N_2L_1$  is the most stable treatment and  $N_2L_0$  is the least stable treatment. In adverse con-

ditions, the best choice is the  $N_1L_1$  treatment since it is fairly stable and has quite high average yield. The analysis of variance of the regression coefficients has shown that the regression coefficients do not show any variation from level to level for nitrogen and lime.

(Guide: Shri V. S. Rustogi)

**6. DUTT GANESH—Comparison of ratio-type estimators for two-stage design in costing of maintenance of pigs**

The purpose of this thesis is to make an empirical study in the relative performances of number of unbiased/almost unbiased ratio-type estimators vis-a-vis classical ratio estimator in costing of maintenance of adult pigs. The data came from the research project, 'Statistical investigations on economics of pig production', conducted by IASRI from October 1978 to Dec., 1979 in two tehsils of Aligarh district and pertained to 140 households spread over 28 villages.

The different unbiased ratio-type estimators included those suggested by Hartley-Ross (1954) and Mickey (1959). Among the almost unbiased ratio-type estimators were those suggested by Quenouille (1956), Beale (1962) and Tin (1965).

The data under reference were collected using two-stage design with probability proportional to size at first stage, while the above mentioned unbiased/almost unbiased ratio-type estimators as available in the literature assume simple random sampling. In view of the complexity involved in developing the estimators under pps. for

two-stage design a simple heuristic approach of obtaining the estimators and their estimated variances was adopted.

Of the eight different estimators considered, the three estimators namely, Hartley-Ross, Beale's and Tin's estimators were seen to be equally efficient. However, keep in view the computational load of work involved in using these estimators, Hartley-Ross estimator is recommended for costing studies on pigs.

(Guide: Dr J. P. Jain)

**7. GARG PANKAJ—Crop insurance premium and methodology for its determination**

Crop insurance is one of the effective measures of protecting the farmers against crop losses which are caused by factors beyond human control. There are various plans of crop insurance. The participation of the farmer in a scheme of crop insurance could be voluntary or compulsory. In U.S.A. it is voluntary whereas in Japan it is compulsory. The nature of participation by the farmers depends upon the socio-economic and political conditions prevailing in the country. A voluntary scheme has several disadvantages where the farm holdings are small and numerous. Apart from these disadvantages all those who require insurance protection, may not come forward to participate in such a scheme. Therefore, in a country like India where small and marginal farmers dominate, insuring complete participation of all farmers in the area of insurance is most desirable.

In a country like India where farming is done on a very small scale by vast number of farmers who are mostly illiterate, it is not possible to obtain information on the yield rates of crops of each individual holding. To secure such information for all the holdings is not only very costly but also practically not feasible. Therefore, approach has to be taken to have the unit of insurance as a homogeneous area comprising a large number of holdings. Practical considerations dictate that a community development block/taluka could be taken as a unit of insurance under Indian conditions. For such a unit of insurance it is easier to determine the seasonal yields and assessment of losses based upon crop cutting experiments.

Experience in U.S.A., has shown that all risk crop insurance would become more stable in the long run rather than insuring individual risks separately. The all risk insurance has got further advantage of determination of crop losses much more easily.

In this dissertation three methods of calculating premium and indemnity rates have been examined, keeping in view comprehensive crop insurance scheme launched by Government of India from kharif season of 1985. Crop insurance programme is based on area approach. The method for computing premium for crop insurance by the U.S.A. method is based on the idea that set of yields obtained during a representative period in the past will be repeated over a similar period in future. Hence, the average indemnity that would have been payable in case the 'defined area' had been

insured during the past representative period is taken as the appropriate premium for the insured area. As an alternative, a method which takes into account every variation in the yield which occurs during the period is expected to provide a more stable estimate of seasonal variability. The coefficient of variation or mean percentage deviation is used as an estimate of seasonal variation and premium are derived by assuming that the deviation from the average yield of the 'define area' in normally distributed. This method is termed as M.P.D. Method. Third method takes into account any trend in seasonal yield due to technological innovations such as introduction of high yielding variety of seeds, fertilizers etc. This is termed as regression method of calculating premium rates at different level of indemnity. These methods were tested on the 10 years data collected on rice crop for 178 tehsils in U.P., at three levels of indemnity viz. 80%, 85% and 90%.

Regression method was found to be better than both M.P.D. and U.S.A. methods. It was superior to M.P.D. method in about 75% cases and to U.S.A. method is about 80% cases. M.P.D. method was found so be better than U.S.A. method is about 60% of cases.

Tehsils were then grouped into different groups depending upon the range of M.P.D.'s. It was seen that the method of grouping further lowered the premium rates in each case except in U.S.A. method where they remained unaffected. After grouping it was seen that regression method was better than M.P.D. method in about

72% cases and it was better than U.S.A. method in about 80% cases. M.P.D. method was better than U.S.A. method in 64% cases i.e. efficiency of M.P.D. method increased by grouping the tehsils on the basis of M.P.D. Hence regression method should be chosen for calculating the pre-

mium rates when a linear trend is observed in seasonal yields. Otherwise M.P.D. method proves to be good specially after grouping the tehsils on the basis of range of M.P.D.

(Guide: Dr J.N. Garg)

## PAPERS PUBLISHED

1. Agrawal, Ranjana; Jain, RC and Jha, MP 1986. Models for studying rice crop weather[relationship. *Mausam*, 37 (1) : 67-70.

Various models to study the effects of weather variables on rice yield at different stages of crop growth and to forecast its yield for Puri district have been attempted.

The results indicated that above average maximum daily temperature had beneficial effects during ripening stage, detrimental effects during reproductive stage of the crop while in the initial growth, active and lag vegetative phase effects were fluctuating. The effect of increase in minimum temperature was beneficial during initial, lag vegetative and reproductive stages, detrimental during ripening stage and fluctuating during active vegetative stage. Above average relative humidity and rainfall had beneficial effects throughout the growth and detrimental effects during ripening phase of the crop in general. The effects of increase in number of rainy days were fluctuating upto lag vegetative, beneficial during reproductive and detrimental during ripening stage of the crop. Effects of increase in sunshine hours were detrimental during initial growth, active veget-

ative and reproductive stages, fluctuating during lag vegetative and beneficial during ripening stage of the crop.

Study of forecast model revealed that the model using data on maximum temperature and sunshine hours upto 12th week (i.e. third week of August) was appropriate for forecasting rice yield as it explained 91% variation in yield. This suggests that forecasting rice yield is possible for Puri district 2½ months before harvest.

2. Agrawal, Ranjana and Singh, Padam 1986. A sampling scheme with inclusion probability proportional to size using pps systematic sampling. *J. Indian Soc. Agri. Statist.*, 38 (2) : 153-160.

A  $\pi$ PS sampling has been proposed by modifying the usual pps systematic sampling which while maintaining the simplicity and efficiency of the  $\pi$ PS systematic sampling also provides estimate of variance.

3. Agrawal, SB; Bhatnagar, KC and Singh, Bhupal 1986. A comparison of estimators of total lactation yield. *J. Indian Soc. Agri. Statist.*, 38 (2) : 237-239.

The present study deals with the efficiency of ratio estimate in estimating

total lactation yield using farm data for the period 1977-82 on two crossbreeds of cows viz., Karan Swiss and Karan Fries developed at NDRI farm, Karnal. Separate ratio estimate was found about 100 percent more efficient over simple estimate for Karan Swiss and 38 percent more efficient for Karan Fries. The correlation coefficients between lactation yield and lactation length were worked out to 0.6495 for Karan Swiss and 0.5176 for Karan Fries which were positive and highly significant. Thus to get quicker estimates of lactation yield of animals, ratio estimate could be used to improve upon the single estimate using lactation length as an auxiliary variable.

4. Ashok Kumar 1986. Imbalances in pulse productivity. *J. Agri. Situ. India* 1(1) : 23-27.

In this paper an attempt has been made to examine the relative performance of pulses during various plan periods, the extent of yield potential and to measure the yield gap or performance gap. It has been observed that most of the states have not achieved even the national average figure of potential yield, the potential yield for each state is derived by using the results of National Demonstration Trials on pulses conducted during the triennium ending 1980-81. However, very few states have shown good performance in respect of productivity of a particular pulse crop, but the area under pulses in such states is quite less. Wide 'performance gap' between potential and average yields of states indicates the extent of potential of crop yield that is yet to be tapped. Where

the performance gap is minimum, the area under pulse in such states may be increased to obtain higher level of production.

5. Ashok Kumar and Pandey, RK 1986. Rural road transport impact on crop productivity. *The Economic Times* : 7

In this paper an attempt has been made to examine the road development under the plan periods in general and rural road network in particular in various states. Regression analysis has been used to examine the effect of rural road network in rural areas on crop productivity. It was found that good road network in rural areas certainly contributes towards the adoption of new modern technology in the agricultural sector, agricultural production and gross cropped areas.

6. Bhargava, PN and Saksena, Asha 1986. An approach to crop planning through moisture availability analysis in dryland areas. *J. Indian Soc. Agri. Statist.*, 38 (2) : 211-217.

Variations in the moisture availability were examined for Jamnagar utilising weekly rainfall data and U.S. pan evaporation data for a number of years when sowing commenced early, normal or late during kharif season. In the years of early sowing, sufficient moisture is available from 6th to 28th week after sowing. When sowing commences at the normal time assured adequate moisture is available till 18 weeks after sowing where as for late sowing years it is available for 15 weeks after sowing. Considering the pattern of moisture availability groundnut is suitable for early sowing, jowar, bajra

and groundnut are suitable normal sowing years and a short duration pulse is suitable for late sowing years.

7. Bhatnagar, KC; Agrawal, SB; Singh, Bhupal and Ram, Kuber 1986. The effect of non-genetic factors on production performance characteristics of crossbred cows. *Indian J. Dairy Sci.*, 39 (3).

In the present investigation, to study the effect of non-genetic factors like order of lactation and season of calving on production performance characteristics, data pertaining to Karan Swiss and Karan Fries crossbreeds of cattle maintained at NDRI, Karnal farm were utilized.

Total lactation yield, lactation yield of 305 or less days, yield per day of lactation and yield per day of calving interval were worked out to  $3733 \pm 53$  kg,  $3284 \pm 39$  kg,  $10.7 \pm 0.1$  kg and  $8.8 \pm 0.1$  kg respectively for Karan Swiss and  $4174 \pm 58$  kg,  $3884 \pm 49$  kg,  $12.9 \pm 0.2$  kg and  $10.8 \pm 0.1$  kg respectively for Karan Fries. These figures were consistently higher for Karan Fries compared to Karan Swiss in all the lactations as well as in all the three seasons of calving. Analysis of variance of lactation yield based as 305 or less days, yield per day of lactation and yield per day of calving interval revealed that lactation number showed significant effect on these traits of production performance both for Karan Swiss and Karan Fries while season of calving did not show any significant effect on these characteristics.

8. Bhatnagar, KC; Agrawal, SB; Singh Bhupal and Ram Kuber, 1986. Effect of non-genetic factors on performance of crossbred cows. *Indian J. Animal Sci.*, 56 (11) : 1152-1155.

The precise estimates of performance characteristics and the effects of non-genetic factors were determined using least squares estimates by Harvey (1966) technique. The overall lactation length worked out to  $346 \pm 6$  days for Karan Swiss and  $322 \pm 4$  days for Karan Fries. The average calving interval was  $416 \pm 6$  days for Karan Swiss and  $387 \pm 5$  days for Karan Fries. Lactation length and calving interval generally decreased with increase in the order of lactation in both the breeds of cows over all the seasons. The season of calving did not show significant effect on the production traits in either of the breeds while a significant effect of lactation number on lactation length and calving interval was observed. In Karan Swiss a significant interaction effect of lactation number and season of calving on calving interval was observed.

9. Bhatnagar, KC; Khurana, GL and Bapat, SR 1986. Economics of fertilizer application to mustard. *J. Agri. Situ. India*, 41 (3) : 135-138.

The study of data of experiments on mustard crop conducted on cultivators' fields under All India Co-ordinated Agronomic Research Project during 1977-78 to 1982-83 in the three states of U.P., Haryana and Rajasthan has shown that the scope and

extent of fertilizer use that would bring equitable profits to farmers has been quite substantial. On the basis of average responses obtained for various fertilizer doses it was found that the absolute net returns increased with the increase in fertilizer doses. However, the corresponding net return per rupee of investment (CBR) decreased as the level of fertilization increased. A lower dose of  $N_{20}$  in U.P. and Haryana and  $N_{40}P_{20}$  in Rajasthan was found to be adequate so as to make application of fertilizer remunerative to a farmer in this region. Thus a marginal or a small farmer especially under dryland agriculture with limited resources can earn more profit on mustard by investing less on fertilizers. To get adequate remuneration by the application of fertilizers at higher doses the two points needing attention are:

- i) improving factors affecting fertilizer use efficiency like variety, season and time of sowing and water management, plant protection measures and fertilizer levels, etc.
- ii) restructuring of prices of fertilizers and the produce.

10. Chawla, GC and Rai, T 1986. Use of oil cakes in the ration of livestock. *Indian Dairymen*, 38 (4).

Oil-cakes form important constituents of any concentrate mixture for livestock both ruminants and non-ruminants. This paper deals with various types of oil cakes being used in various ingredients, their merits and demerits. The nutritive values

of oil-cakes and composition of some important of them for some typical concentrate components with equivalent DCP (in kg unit) have been worked out.

11. Choudhary, BL and Bhargava, PN 1986. Statistical assessment of effect of sowing and fertilizer application on the yield of sorghum and pigeonpea intercrops. *Indian J. Agri. Sci.*, 56 (9) : 629-634.

Bi-variate analysis of variance of an intercropping experiment conducted at Parbhani indicated that yield of pigeonpea was influenced by the method of planting pattern for sorghum and was the highest when sorghum was planted by skip-row. Yield of sorghum was also slightly affected by the fertility level of pigeonpea being lower when pigeonpea received a lower dose of fertilizer.

12. Choudhary, BL; Soni, PN and Ajit Kaur 1986. Effects of herbicides application in comparison to hand weeding in crop sequences. *J. Agri. Sci. Digest*, 6(3) : 166-168.

Effect of hand weeding and herbicides singly and in combination was studied on rice-wheat, maize-wheat and rice-groundnut crop sequences adopted at different cropping systems research centres. Study revealed that hand weeding in combination with herbicides given during kharif followed by hand weeding alone during rabi proved to be useful for increased productivity.

13. Choudhry, H.B. and Pandey, RK 1986. Study of yield constraints of wheat crop in Chittorgarh (Rajasthan). Seed and Farms, 12 (10)

The main objective of yield constraints study is to quantify the gap in yield existing between potential farm yield and average farm yield of wheat on cultivators field. The potential farm yield was estimated to be 50.6 qts/ha, 49.5 qts/ha and 61.0 qts/ha in three panchyat samities through agronomical experiments conducted in this area. The estimated yield gap were 12.0 qts/ha, 7.8 qts/ha and 2.5 qts/ha. It was observed that contribution to insect control, fertilizer and weed control, was of the order of 2.0 qts/ha, 6.7 qts/ha and 1.0 qts/ha respectively in chittorgarh panchyat samiti.

Socio-economic factors effecting the yield were non-availability of credit, non-availability of sprayers in time and traditional attitude of farmers. Among major biological factors affecting the yield were inadequate irrigation facilities, low level of nitrogenous fertilizer application and non-adoption of plant protection measures.

14. Dey, A and Gupta, VK 1986. Another look at the efficiency and partially efficiency balanced designs. Sankhya, 48 : 437-438

The concept of efficiency-balance and partially efficiency balance are re-examined in this paper. It is shown that the concept of partially efficiency-balance with  $m$

efficiency classes is rather a weak concept because every connected, conceivable block design is partially-efficiency balanced with  $m$  efficiency classes, for some integer  $M$  ( $1 \leq m \leq v-1$ ). The partially efficiency-balanced designs, however, have a simplified analysis and as such many partially balanced designs, Kronecker product designs and dual designs can have a very simple analysis once these designs are identified as partially efficiency balanced.

15. Jain, TB; Nadkarni, UG and Kumar, Ramesh 1986. Survivorship for some breeds of bovines in Punjab. Indian J. Animal Sci., 56 (11).

Survivorship measures viability of the species in different environments. The survivors ( $l_x$ ) to any age  $x$  from a given short depend on the mean length of life of the species. For comparison of survivorship of bovines of different breeds, percentage deviations from mean length of life are first obtained. The curves drawn for survivorship against these percentage deviations for Haryana, Sahiwal and non-descript breeds of cattle and Murrah, Nili and non-descript breeds of buffaloes found in ICD and non-ICD areas of Punjab are discussed.

16. Leelavathi, CR and Bapat, SR 1986. Yardsticks of additional production from the use of zinc on rice. Fertilizer News, 31 (10).

Data of 8289 experiments obtained on cultivators' fields on direct response of rice to zinc have been summarised and yard-

sticks of additional production from the use of zinc in the form of zinc sulphate are worked out. In the light textured soil, yardsticks of additional production were 9.7 kg/kg zinc sulphate in Kharif season and 10.1 kg/kg zinc sulphate in rabi season. In the heavy textured soils, they were 7.9 and 7.2 kg/kg zinc respectively. Efforts to improve the efficiency of use of zinc need greater attention.

17. Leelavathi, CR; Mehta, SC and Saran, SMG 1986. Lessons from a river valley project. *Intensive Agri.* 24 (3).

An investigation on the response to irrigation on wheat, jowar and gram from experiments conducted at Agricultural Research Station, Dharwar located in the command area of Malaprabha-Ghataprabha river valley project shows that the productivity of crops that could be obtained with irrigation, at times even with limited supply, to be higher, sometimes more than double the targets envisaged for the command for cereals and pulses.

18. Leelavathi, CR, Mehta, SC and Saran, SMG 1986. Winning the grace of Krishna. *Intensive Agri.*, 24(1).

Experimental data obtained at research centres closest to the command and on cultivators' fields in the command of the Krishna river valley project show that higher production would have been possible even with constraints in inputs like irrigation, fertilizers, etc.

19. Narain, P 1986. Some aspects of applied stochastic processes. *SCIMA, J. Management Sci. Applied cybernetics*, 15 (1-2): 1-10.

The paper discusses some applications of stochastic processes in some problems in agriculture, biosciences and genetics. The aspects of stochastic modelling in real-life problems have also been dealt with.

20. Narain, P 1985. Progeny testing with auxiliary traits. *Biom. J.*, 41: 895-907.

The problem of determining the breeding worth of a male on the basis of the phenotypic values of his female progeny is discussed. The use of one or more auxiliary traits in conjunction with the main trait for progeny testing seems to have an edge over the conventional method in which no auxiliary traits are used. A general expression for the accuracy of selection based on the progeny test is derived and a generalised sire index is proposed. Detailed numerical investigation with one auxiliary trait reveals that the accuracy of the progeny test in such a case is always increased. The maximum gain in accuracy is found when the phenotypic and additive genetic correlations between the main and the auxiliary traits are of opposite signs. The number of progeny required to attain a preassigned value of accuracy is determined for several cases. It is found that the use of auxiliary trait reduces this number resulting in decreased cost of the progeny testing programme. The effect of the number of auxiliary traits

on the gain in accuracy is also studied under some simplified situations.

21. Narain, P and Bapat, SR 1985. **Statistical methodology for 'On Farm' cropping system research. Proceeding of national symposium on cropping systems. Indian Soc. Agronomy, CSSRI, Karnal: 67-75**

Cropping system research seeks the technology that will increase the crop production by growing two or more crops in succession within a year. The agronomic technology arising from research at experimental stations does not transfer easily to farmers' fields due to non-availability of inputs and sociological constraints. The technology of cropping system has, therefore, to be investigated in the farmers' fields so that emerging recommendations have wider practical applicability and use. Carrying out 'On Farm' research trials in specific recommendations domain, characterised by homogeneous farming systems associated with similar agroclimatic conditions is, therefore, necessary. This requires statistical skill in planning the investigation as well as collection, analysis and interpretation of the experimental data. A statistical methodology for carrying out such a programme on farmers' fields has been presented which includes statistical model, essential data to be collected, different performances characteristic to compare the cropping patterns, procedure of selection of experimental sites and method of statistical analysis of the data.

22. Narain, P and Malhotra, JC 1983. **Optimum group size for efficient pro-**

**geny testing in terms of costs and returns under Indian conditions. Indian J. Animal Genetics and Breeding, 5(1-2): 29-34**

The various physical, economic and genetic parameters of progeny-testing programmes which together enable us to do cost-benefit evaluation of such programmes particularly under Indian conditions have been discussed. The total cost (C) of running a progeny-testing programmes can ultimately be expressed as  $C = Kr + \frac{1}{P}$  where K is the ratio of number of daughters to be milk recorded to number of proven bulls, r is the ratio of costs of a completed milk lactation record and the summed cost of a bull in purchasing, maintaining, processing his test results, collecting and storing his semen till he is progeny tested, and p is the proportion of bulls selected. For cost-benefit evaluation of a progeny-testing programme, the discounted cash flow method widely used in industry and management for comparing the relative merits of alternative investment possibilities is recommended. A general procedure is discussed for the problem of optimum group size in a progeny-testing programme when the aim is to minimize the cost of the programme at a given rate of genetic improvement. The optimum structure of the population is dependent on W, the expected genetic superiority of the selected sires expressed in units of additive genetic standard deviation, the heritability  $h^2$  and the cost ratio which is the ratio of the cost involved in securing a daughter with at least first lac-

tation record to the cost involved in maintaining a sire till he is progeny tested.

23. **Narain, P and Sharma, BS 1986. Heterozygosity and optimum level of exotic inheritance in crossbred cattle. Indian J. Dairy Sci., 39 (4): 373-377.**

Attempts have been made in this paper to relate the level of exotic inheritance and heterozygosity with the performance traits in dairy cattle with the help of data of military farms pertaining to different grades resulting from Friesian × Sahiwal crosses spread over the period 1945 to 1979. The relationship between the level of exotic inheritance and heterozygosity has been examined. The half-bred, which is strictly heterozygous at all the loci involved, is found to be optimum for stabilising the breed resulting from Friesian × Sahiwal crosses.

24. **Narain, P; Singh, KB and Jain, JP 1986. Human resources development in animal husbandry. Dairy Guide, 8: 19-22**

This article, with the help of a couple of past studies, highlights the potentialities that exist for enhancing animal productivity through better feeding and management particularly under field conditions. In addition it indicates the nature and extent of the technical personnel required at different levels in livestock sector for research and extension.

25. **Pandey, RK and Dixit, UN 1986. Industry agriculture interaction. Commerce, 152 (3917)**

It is an established fact that agriculture and industry must flourish together

for rapid and sustained economic development. Agricultural products are used as raw material in various industries. With the advent of new technology in agriculture, the production in agricultural sector has become highly dependent on Industries. Thus, policies and problems for the development of agriculture cannot be considered in isolation from the development strategies of industry and other sectors of the economy. Keeping in view, the significance of inter-dependence between the output of both the sectors, a study on industry and agriculture interaction has been undertaken. The study is confined to the analysis of the production of sugar and sugarcane, cotton and cotton textile, wheat and wheat products, oilseeds and vanaspati, foodgrain production and the output of tractors, chemical fertilizers, other farm machinery and pesticides.

The study shows that during the period 1960-61 to 1982-83, the foodgrains production has increased from 82 million tonnes to 128 million tonnes whereas the production of chemical fertilizers in the country has grown up from 0.1 million tonnes to 4.45 million tonnes. The production of sugarcane has increased from 110 million tonnes in 1960-61 to 189 million tonnes in 1982-83 whereas during the same period the production of sugar has increased by 2.7 times. The production of jute has increased by 1.5 times. The output of jute products in the industrial sector has gone up by the similar extent during 1960-61 to 1982-83. It has also been observed that agriculture sector exerts a positive and significant influence on the output of industry

and industrial production significantly affects the agricultural output by supplying various inputs. The study emphasises that the harmonious development of agriculture and industry is an essential requirement for sustained growth of the Indian economy.

26. **Pandey, RK and Sarup Shanti 1986.** Analysis of productivity and constraints of rice production in Orissa. Proceeding of national conference of agriculture productivity, IAPQR, Calcutta.

Rice is the major foodgrain crop of Orissa occupying 70 percent of the area under foodgrains and contributing more than 75 percent towards the total foodgrain output of the state though this state is the pioneer in the cultivation of rice in India, it is unfortunate that the productivity of the crop in the state continues to be considerably low even when compared with the productivity levels of rice of some of the neighbouring states as well as for the country as a whole. It would, therefore, be of interest to study the trends and variability in area, production and productivity of this vital crop during different plan periods. An attempt has also been made in this paper to examine the factors which are hindering the growth of productivity and production of rice in the state. Performance of rice productivity and resource use in Orissa and some of its neighbouring states have also been discussed.

27. **Prajneshu; Gupta, CK and Sharma, U 1986.** Stochastic analysis of environ-

mental fluctuations in a compartmental system. *Biol. Cybernetics*, 53: 343-346.

In this paper the general two-compartment system with environmental stochasticity is investigated. The transfer rates and outputs are assumed to be dichotomic Markov processes. The Laplace-transform of the mean-value function of the amount of substance present in the two compartments is evaluated. The Gaussian white noise limit case is also discussed and the stability of the system is examined. It is shown that while the deterministic model is stable, environmental stochasticity may induce in the mean-value function all sorts of behaviour—stable, unstable and oscillatory. This is in contrast to the intrinsic stochasticity in linear models where for the mean-value function is the same as the solution of deterministic counterpart.

28. **RAI, SC and SARUP, SHANTI 1986.** Measures and trends in groundnut production. Proceeding of National Conference of Agriculture Productivity IAPQR, Calcutta

Groundnut plays an important role in agricultural economy of our country. India ranks first in the production of groundnut and contributes one third of the world production. It is also main oilseed crop of our country accounting for almost half of the acreage and two-third of the total oilseeds production. Realizing the economic importance of oilseeds in general and groundnut in particular, several intensive oilseeds development programmes have been initiated at the national level for stepping up its production in the various states

of the country. The paper examines the trends and variability in area, production and productivity of groundnut crop in different states of the country. An attempt has also been made to study the factors responsible for low productivity of the crop. The results of this study would be useful in classifying regions which are favourable or otherwise for groundnut production.

29. Saxena, BC; Narain, P and Srivastava, AK 1986. Robustness of Hartley's estimator for multiple frame surveys. *J. Indian Soc. Agri. Statist*, 38(3): 370-378.

For estimating the population total in multiple frame surveys, Hartley [1], [3] considered the optimum values of 'P' and the sample sizes. The departures in these optimum values are likely to vitiate the optimum nature of Hartley's estimations. In this paper the effect of such departures on the efficiency of the estimator has been investigated. The Hartley's estimator appears to be fairly robust with respect to moderate departures in the values of 'P' but it is not so with departures in optimality of sample sizes.

30. Saxena, BC; Narain, P and Srivastava, AK 1986. Estimation of total for two characters in multiple frame surveys. *Survey Methodology*, 2(2) : 119-132

In this paper estimation of multiple characters in multiple frame surveys has been investigated. The gain due to two character study in a common survey, over separate surveys for individual characters, has been obtained. Cost comparison is

also made between two characters multi frame survey and two characters single frame survey.

31. Sharma, BS and Narain, P 1986. A study of gene action in crossbred cattle. *J. Indian Soc. Agri. Statist.*, 38(3): 410-416.

This paper derives the expected means of various crossbred generations utilising the relationships between the levels of exotic inheritance and the coefficients of the parameters [h] and [d], representing respectively the dominance and additive effects of genes involved. The estimates of these parameters have been obtained and tested for the economic traits of crossbred cows belonging to different grades, originated from Holstein Friesian X Sahiwal cross, maintained at the military dairy farms. It is inferred that the poly-genes controlling the milk yield traits and age at first calving have probably significant additive and dominance effects, while dry period and calving interval have significant dominance effect only.

32. Singh, GB; Bhargava, PN and Kaur, Rajinder 1986. Comparative performance of phosphal and single superphosphate in different agro-ecological situations. *Fertilizer News*, 31: 33-37.

Phosphal, a clacined calcium aluminium phosphate (27 percent citrate soluble), was evaluated at 11 centres in the country for its comparative response against single super phosphate (SSP) during the years 1980-81 to 1982-83. Direct, cumulative and residual responses were worked out in a number of cropping

systems. Phosphal gave better direct response in deep black soil at Banswara as well as in medium black and laterite soils, the direct response was similar in deep black soil of Siruguppa and alluvial soil, and the direct response was lower in chestnut brown soil and submontaneous soil. The cumulative response of phosphal in alluvial soil, medium black soil and submontaneous soil was higher, in deep black soil of Banswara and laterite soil was similar and in chestnut brown soil and sierozem soil was lower than single superphosphate. In general, rice system responded better to phosphal.

33. Singh, HP; Narain, P and Jain, JP 1986. The value of blood group information in predicting breeding value of quantitative traits in dairy cattle and buffaloes. *J. Indian Soc. Agri. Statist.*, 38(3): 363-369.

The importance of blood group information in predicting breeding value of the quantitative traits in dairy animals has been studied in this investigation. From the accuracies of indirect selection obtained from the data on dairy cattle and buffaloes, it can be concluded that blood group information can be used with advantage for making preliminary selection only when the heritability of the trait is less than or equal to 0.1 and percentage genetic variation controlled by blood group loci is beyond 5 percent.

34. Singh, Bijay; Katyal, JC; Malhotra, PK and Vlek, PLG 1986. Path coefficient analysis of N nutrition on yield and yield components for rice in a

highly percolating soil commun. *Ann. Soil Sci. Plant*, 17(8): 853-867.

Data pertaining to grain yield, parameters, and N uptake during different period of rice growth, in three field experiments, were subjected to the statistical procedure of path coefficient analysis. The observed grain yield response to the applied fertilizer N was predominantly reflected in an increased panicle density and spikelet number. The 1000 grain weight was only slightly influenced by N fertilization. Since both panicle density and spikelet number are known to be largely determined within 70 days after transplanting (DAT), N uptake during this period was found to be critical to achieve a maximum grain yield response to applied N. The N uptake during 0-40 DAT correlated positively with panicle density, whereas absorption of N during 40-70 DAT determined both panicle density and spikelet number. Since N uptake during 0-20 DAT exerted a significant positive influence on grain yield through increased panicle density, the basal application of a part of fertilizer at the time of transplanting was justified.

35. Singh, VPN 1985. A sequential method for construction of a class of B.I.B. designs. *J. Indian Soc. Agri. statit.*, 37(3) : 276-279

This paper proposes a method for construction of B.I.B. designs with the parameters  $v = s^2$ ,  $b = s(s+1)$ ,  $r = s+1$ ,  $k = s$  and  $\lambda=1$  when  $s$  is a prime. The proposed technique is sequential in nature.

36. **Srivastava R; Ray, AK and Singh, Gordhan 1986. Trend studies of the livestock population vis-a-vis human population in India. J. Indian Soc. Agri. Statist., 38(2) : 22-229.**

In this paper an attempt has been made to compare trend of livestock population and human population. Besides studying the growth pattern of populations, the position of present and projected milk supply and demand has also been discussed.

37. **Suman, CL; Wahi, SD and Srinivas, K 1986. Size and shape of experimental plot for brinjal crop. Indian J. Agri. Res., 20 (3) : 167-170**

The optimum size and shape of experimental plot for brinjal crop has been worked out by using the Fairfield Smith law, which gives the relationship between plot size and variance of means per plot. For this study two plants per row were clubbed to form the basic unit of observation. The study revealed that a plot of 32 units arranged in four rows of eight units each will be an optimum plot size for field trials of brinjal crop.

38. **Vats, MR and Iyer, VN 1986. N-carriers in rice based cropping systems. Seeds and Farms, 12(9) : 9-15**

The results of a study on relative efficiency of different slow release N-carriers on rice and their residual effect on the succeeding crop in rice-rice and rice-wheat sequences at a number of locations during the period 1979-80 to 1981-82 showed that

urea briquettes at Thanjavur (TN), Palampur (HP) and Kharagpur (WB), rock phosphate coated urea at Bhavani-sagar (TN) and Mangalore (Karnataka) and sulphur coated urea at Maruteru (AP) and Ludhiana (Punjab) are more beneficial in comparison to urea as basal or split application and they had considerable residual effect on the succeeding crop. In rice-wheat sequence the residual effect of sulphur coated urea on wheat was considerable and resulted in an increase of 10% in yield.

39. **Wahi, SD and Bhattacharjee, SK 1986. Component analysis for economic traits in Gerbera. Indian J. Agri. Res., 20(3) : 154-159**

Thirty one strains of Gerbera were evaluated for nine different characters. There was a wide range of variability for number of shoots, number of leaves, average leaf length and number of flowers per plant. Heritability estimates were also high for all the traits except for number of flowers per plant. Number of flowers per plant was positively associated with number of leaves, length of flower stalk, flower diameter, days taken from flower bud appearance to its opening and longevity of flowers. Path analysis revealed that flower diameter, length of flower stalk and days taken from flower bud appearance to its opening had high direct effects on the number of flowers per plant. The important component characters of length of flower stalk, flower diameter and longevity of flower were also studied.

## PAPERS ACCEPTED

1. BHARGAVA, PN; NARAIN, P and RAJINDER KAUR—Response of bio-fertilizer azolla on rice. *Indian J. Agri. Res.*
2. BHARGAVA, PN and SAKSENA, ASHA—An approach to crop planning through moisture availability analysis in dryland areas. *J. Indian Soc. Agri. Statist.*
3. CHANDOK, RR and KATHURIA, OP—Optimum allocation for cluster sampling on two occasions. *J. Indian Soc. Agri. Statist., Dec., 1986.*
4. DEY, A; DAS, AS and BANERJEE, AK—Construction of nested balanced incomplete block design. *Cal. Statist. Assoc. Bull.*
5. DUTTA, OP—Inter-strain-variations in heritability estimate for some economic traits in 4-strains of white leghorn breeds. *III World Congress on Genetics Applied to Animal Breeding, LINCOLN, NEBRASKA (U.S.A.).*
6. DUTTA, OP and NARAIN, PREM—Some reflections on data base for water management. *Economic and Political Weekly, Bombay.*
7. JAIN, JP and SAXENA, BC—Milk production and its utilization in the milkshed areas of Dudh Sagar Dairy, Mehsana (Gujarat). *Indian J. Animal Prod., Vol. 9 (3,4), 1986.*
8. NARAIN, P; WAHI, SD; MALHOTRA, JC and GARG, LK—Minimax linear procedure for comparing different grades of sheep in cross-breeding programmes. (*SABRAO*).
9. PANDEY, RK; KAUL, SUSHILA and ASHOK KUMAR—Economic study of agricultural wages of women labour in Orissa. *Manpower J.*
10. PRABHAKARAN, VT and JAIN, JP—Probability of inadmissible estimates of heritability from full-sib analysis under a general model of gene action. *Biom. J.*
11. PRAJNESHU; GUPTA, KC and SHARMA, U—A stochastic epidemic model with seasonal variations in infection rate. *Biom. J.*
12. PRAJNESHU and HOLGATE, P—A prey predator model with switching effect. *J. Theor. Biol.*

13. PRASAD, SHIV; SINGH, VPN and SINGH, DINESH—Strategy for increasing pulses production. *J. Agri. Situ. India, 1986.*
14. RAHEJA, SK; MEHROTRA, PC and TYAGI, KK—Construction of index of adoption rate of improved agricultural technology. *J. Indian Soc. Agri. Statist.*
15. RAHEJA, SK; SAMPATH, RK and SEEKLER, DAVID—Methodology for monitoring performance of large scale irrigation system—A case study of the warabandi system of N. W. India (Part B.) *Agri. Admn., England.*
16. RAI, SC—Multi-sample slippage test for ordered observations. *Biom. J.*
17. RAI, SC—Rank analysis of block designs having different cell frequencies. *Biom. J.*
18. RAI, SC—Multi-character sensory evaluation in paired comparisons. *J. Indian Soc. Agri. Statist.*
19. SINGH, BH—Growth rates, trends and fluctuations in acreage production and productivity of groundnut. *J. Agri. Sci. Digest.*
20. SINGH, JAGMOHAN and MEHROTRA, PC—A study on impact of improved practices in cultivation of cereal crops in India. *Ann. Agri. Res.*
21. SINGH, RANDHIR—A study of income and expenditure of rural labour households in different regions of the country. *Manpower J.*
22. SINGH, RN; MISHRA, RR; DUTTA, OP; PRABHAKARAN, VT and MALHOTRA, JC—An investigation on the viability among indigenous crossbred cows with special reference to mortality and culling. *Indian J. Animal Sci.*
23. SINGH, RN; MISHRA, RR; DUTTA, OP; PRABHAKARAV, VT and MALHOTRA, JC—Health disorders in Zebu and exotic × Zebu crosses. *Indian J. Animal Sci.*
24. SONI, PN and SEHGAL, DK—Manurial requirements in rice-rice sequence on coastal alluvial soil. *Indian J. Agronomy.*
25. SONI, PN; SIKARWAR, HS and MEHTA, DK—Long term effects of fertilizer application on productivity in rice-wheat sequence. *Ann. Agri. Sci.*
26. SONI, PN and VATS, MR—Suitable cropping system under resource constraints. *Ann. Agri. Sci.*
27. SONI, PN and VATS, MR—Cropping systems in relation to irrigation fertilizer constraints. *Indian J. Agronomy.*
28. SUMAN, CL; WAHI, SD; PETER, CLEARANT, and NAGARKATTI, SUDHA—Distribution pattern of the cotton leaf hopper. *Amrasca Biguttula Biguttula* (Nymphs and adults) under natural conditions. *South Indian Horticulture.*
29. VERMA, SP; SAXENA, BC and SINGH, HP—A critical aspect of the rural employment. *Manpower J.*

APPENDIX-VIII

**APPOINTMENTS, PROMOTIONS, TRANSFERS,  
RETIREMENTS AND RESIGNATIONS**

**Appointments**

<i>NAME</i>	<i>GRADE</i>	<i>w.e.f.</i>
1. Shri Banwari Lal Koli	700-1300*	14.07.1986 (A.N.)
2. Shri Man Singh	2000-3500	14.07.1986
3. Shri Mukesh Kumar Bhatt	1640-2900	28.01.1986

**Promotions**

<i>NAME</i>	<i>GRADE</i>	<i>w.e.f.</i>
1. Shri Rajendra Singh	1300-1700*	01.01.1983
2. Shri B.L. Kaul	1100-1600*	01.01.1984
3. Shri S.K. Sublania	1100-1600*	01.01.1986
4. Shri S.D. Sharma	1100-1600*	01.07.1982
5. Shri P.K. Azad	2000-3500	01.01.1986
6. Shri Om Prakash	2000-3500	01.01.1986
7. Shri S.S. Kutaula	2000-3500	01.01.1986
8. Shri D.D. Arora	2000-3500	01.01.1986
9. Shri Chait Ram	1640-2900	01.07.1985
10. Shri D.P. Singh	1640-2900	01.07.1985
11. Km Vijay Bindal	1640-2900	01.07.1985
12. Shri S.K. Bhatnagar	1640-2900	01.07.1985
13. Shri R.K. Jain	1640-2900	01.07.1985
14. Shri Dipti Singh	1640-2900	01.07.1985
15. Km Sheela	1640-2900	01.01.1986
16. Smt Meena Nanda	1640-2900	01.07.1985
17. Smt Neelam Malhotra	1640-2900	01.07.1985
18. Smt Geetam Johri	1640-2900	01.07.1985
19. Shri Ved Prakash	1640-2900	01.07.1985
20. Shri Mohan Lal	1640-2900	01.07.1985
21. Shri S. Sen Gupta	1640-2900	01.07.1985
22. Shri P.K. Awasthi	1640-2900	01.07.1985
23. Shri P.P. Singh	1640-2900	01.01.1986
24. Shri A.P. Singh	1640-2900	01.07.1985



Farewell to Shri U P Sharma, Chief Administrative Officer  
on his retirement

## Transfers

### (a) On transfer from other Institutes

<i>NAME</i>	<i>GRADE</i>	<i>FROM</i>	<i>DATE OF JOINING</i>
1. Shri J.P. Goyal	700-1300*	IVRI, Izatnagar	01.08.1986
2. Shri V.K. Jain	1640-2900	CIRG, Mathura	01.05.1986
3. Shri R.M. Sood	1640-2900	IGFRI, Jhansi	01.08.1986

### (b) On transfer to other Institutes

<i>NAME</i>	<i>GRADE</i>	<i>PLACE OF JOINING</i>	<i>DATE OF RELIEVE</i>
1. Smt Rama Sharma	1400-2300	CIFE, Bombay	10.01.1986
2. Smt Urmila Madan	1400-2300	ICAR Hq., New Delhi	11.07.1986
3. Shri K.G. Dewale	1400-2300	CICR, Nagpur	29.11.1986

## Retirements

<i>NAME</i>	<i>GRADE</i>	<i>DATE OF RETIREMENT</i>
1. Shri K.V. Sathe	1500-2000*	31.03.1986
2. Shri K.C. Raut	1800-2200*	31.03.1986
3. Shri K.S. Krishnan	1800-2200*	31.05.1986
4. Shri U.P. Sharma	1300-1700*	30.09.1986
5. Smt Rekha Kool	1400-2300	29.11.1986

## Resignations

<i>NAME</i>	<i>GRADE</i>	<i>DATE OF RESIGNATION</i>
1. Shri S. Sen Gupta	1640-2900	10.02.1986
2. Dr. Karmeshu	1500-2000*	23.04.1986
3. Smt Suman Gupta	1100-1600*	10.02.1986
4. Km Hem Lata Makavana	1400-2300	07.08.1986
5. Shri V.K. Pandey	1400-2300	12.08.1986
6. Shri S.K. Madan	1400-2300	22.08.1986
7. Shri B.V.V. Naidu	1400-2300	13.11.1986
8. Shri B.L. Koli	700-1000*	31.12.1986

## Induction into A.R.S.

<i>NAME</i>	<i>GRADE</i>	<i>DATE OF INDUCTION</i>
1. Shri K.K. Kher, T-5	1640-2900	30.09.1980
2. Shri S.S. Kutaula, T-5	1640-2900	25.09.1980

\*Pre-revised scales

## PRIMARY DATA COLLECTION

Projects for which primary data were collected either through Institute's own field staff or through ad-hoc staff of the collaborating agencies are as follows :

**(a) Institute's own staff**

- Pilot survey to develop statistical models for production and culling pattern in poultry, Delhi
- Development of a suitable statistical methodology for estimating extent of labour utilization in livestock and poultry keeping in rural areas in Meerut (UP)
- Pilot sample survey for estimation of post-harvest foodgrain losses in Bulandshahr (UP)
- Level of employment with new farm technology in Muzaffarnagar (UP).

**(b) Ad-hoc state staff**

- Planning, designing, analysis of experimental data relating to experiments conducted under All India Co-ordinated Research Project on Long Term Fertiliser Experiments
- Pilot sample survey for estimation of cost of cultivation of oil seeds and

pulses—Bharatpur (Rajasthan) and Vidisha (MP)

- Pilot sample survey for developing a sampling methodology for estimation of livestock products on the basis of data collected as a part of the normal work of field agency of A.H. Department in Trichur (Kerala)
- Pilot sample survey for evolving a sampling methodology for estimation of area of grazing land and its utilisation in Chingleput (Tamil Nadu)
- Pilot sample survey for estimation of production of hides and skins in Surat (Gujarat)
- Sample survey for study of constraints in transfer of new agricultural technology under field conditions
- Pilot sample survey to evolve a sampling methodology for estimating the resources and total catch of inland fish in a region of Orissa
- Pilot sample survey for estimation of losses, price spread at various stages and cost of cultivation of vegetables crops in Pune (Maharashtra)

- Pilot studies for developing statistical methodology for assessing the losses due to diseases and pests in bovines in Hissar (Haryana)
- Pilot studies on pre-harvest forecasting of groundnut yield on the basis of observations made in biometrical characters, weather variables and agricultural inputs in Rajkot (Gujarat)
- Pilot studies on pre-harvest forecasting of apple yield in Simla (HP)
- Economic study of new farm technology with special reference to yield gaps and associated factors in **ORP** on pulse production.

## IASRI PUBLICATIONS

### (a) Priced

- Sample Survey for Estimation of Milk Production in Punjab (1956-57)**  
by VG Panse, Daroga Singh and VVR Murty  
*Price Rs 5.50*
- Sample Survey for Estimation of Milk Production in Eastern Districts of UP (1957-59)**  
by VG Panse, Daroga Singh and VVR Murty  
*Price Rs 4.25*
- Cost of Milk Production in Madras (1963)**  
by VG Panse, VN Amble and KC Raut  
*Price Rs 4.75*
- Green Manuring of Crops (1965)**  
by VG Panse, TP Abraham and CR Leelavathi  
*Price Rs 2.50*
- Cost of Milk Production in West Bengal (1967)**  
by VG Panse, VN Amble and KC Raut  
*Price Rs 5.50*
- Monograph on Estimation of Wool Production (1970)**  
by Daroga Singh, M Rajagopalan and JS Maini  
*Price Rs 2.60*
- Monograph on Estimation of Milk Production (1970)**  
by Daroga Singh, VVR Murty and BBPS Goel  
*Price Rs 4.10*
- Survey on Mango and Guava in UP (1971)**  
by GR Seth, BV Sukhatme and AH Manwani  
*Price Rs 3.50*
- Cost of Milk Production in Delhi (Revised in 1972)**  
by D Singh and KC Raut  
*Price Rs 9.00*
- Survey on Vegetables in Rural Areas of Delhi (1973)**  
by BV Sukhatme, AH Manwani and SR Bapat  
*Price Rs 3.50*
- Monograph on Sample Survey Techniques for Estimation of Egg Production (1975)**  
by D Singh, BBPS Goel, JN Garg and DVS Rao  
*Price Rs 5.00*
- Survey on Fresh Fruits in Tamil Nadu (1976)**  
by D Singh, AH Manwani and AK Srivastava  
*Price Rs 5.00*
- Handbook on Methods of Collection of Agricultural Statistics in India (1978)**  
by KC Raut and D Singh  
*Price Rs 4.00*
- Handbook on Sampling Methods (1978)**  
by D Singh, Padam Singh and Pranesh Kumar  
*Price Rs 10.00*
- A Handbook on Statistical Genetics (1979)**  
by P Narain, VK Bhatia and PK Malhotra  
*Price Rs 31.00*
- A Handbook on Analysis of Agricultural Experiments (1979)**  
by AK Nigam and VK Gupta  
*Price Rs 22.00*
- User's Manual for B-4700 Computer (1980)**  
by Ram Kumar  
*Price Rs 3.00*

User's Manual and Fortran Subroutine for Matrix Algebra (1981)

by SP Doshi  
Price Rs 3.00

User's Manual for Classificatory Analysis (1981)

by SP Doshi, D Jain and ML Choudhary  
Price Rs 5.00

User's Manual for Line x Tester and Hybrid Analysis (1981)

by SP Doshi and Ram Kumar  
Price Rs 5.00

Computer Programmes for Animal Breeding Data Analysis (1982)

by OP Dutta  
Price Rs 10.00

Handbook on methodology of Sample Surveys for Estimation of Livestock Number and Products (1984)

by P Narain, BBPS Goel and JN Garg  
Price Rs 13.00

(b) Unpriced

Incidence of Pests and Diseases on Paddy (1971)

by GR Seth, D Singh, MG Sardana, and RK Khosla

Economics of Raising Cattle and Buffaloes (1973)

by KC Raut, VN Amble and Shivtar Singh

Estimation of Availability and Cost of Production of milk (1975)

by KC Raut, D Singh and Shivtar Singh

Monograph on Study on Size and Shape of Plots for Field Experiments on Vegetable and Perennial Crops (1975)

by D Singh, PN Bhargava, RK Khosla and Asha Saksena

Function and Activities of IARS (1976)

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Monograph on Statistical Studies on the Behaviour of Rainfall in a Region in Relation to a Crop (1977)

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Estimation of Production of Cultivated Fodder Crops (1977)

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Monograph on Sample Survey Techniques for Estimation of Meat Production (1977)

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Sampling Methodology for Estimation of Egg Production and Study of Poultry Keeping Practices (1977)

by D Singh, BBPS Goel, JN Garg, KB Singh and M Rajagopalan

Impact of Milk Supply Schemes on the Rural Economy in Milk Collection Areas (1978)

by JP Jain, KPS Nirman, KG Aneja and Prem Narain

Estimation of Area of Grazing Land and its Utilization, Jhansi District, UP (1978)

by KC Raut, UG Nadkarni, PR Srinath and BC Saxena

Estimation of Production of Lac (1978)

by DVS Rao and SD Bokil

Sampling Methodology for Estimation of Meat Production (1978)

by D Singh, JS Maini, BBPS Goel and GS Bassi

Report on Sample Survey for Estimation of Production of Hides and Skins in Punjab during 1974-76 (1978)

by JS Maini, BBPS Goel and DC Dahiya

Pilot Sample Survey for Estimating Yield of Cotton in Hissar (Haryana) during 1976-77 (1978)

by SK Raheja, BBPS Goel, PC Mehrotra and VS Rustogi

Impact of Milk Supply Scheme on Rural Economy in Milk Collection Areas of Madhavaram Milk Supply Scheme, Chingleput (Tamil Madu)-A Bench Mark Survey, IASRI Bulletin (1978)  
by HP Singh, BC Saxena, Prem Narain and SP Verma

Estimation of Birth and Death Rates in Bovines-A Pilot Survey in Andhra Pradesh (1979)  
by T Jacob, B Marutiram and SN Arya

Impact of Milk Supply Schemes on the Rural Economy in Milk Collection Areas of Dudhsagar Dairy, Mehsana, Gujarat (1979)  
by JP Jain, BC Saxena and P Narain

Souvenir Volume of IASRI, New Delhi Released on the Occasion of ICAR Golden Jubilee, 1929-1979  
by P Narain, RK Khosla, DS Aneja and RS Khatri

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by D Singh, BBPS Goel, JN Garg and KB Singh

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by D Singh, CR Leelavathi, KS Krishnan and Shanti Sarup

Forecasting of Rice Yield Based on Weather Parameters, Raipur District. (1980)  
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Estimation of Genetic Trend in Beetal Goats (1980)  
by LK Garg, PS Rana and Lal Chand

Methodology for Improvement of Data Base on Livestock Resources-IASRI Publication (1980)  
Pilot Sample Survey to Study the Impact of New Technology on Crop Production, its Disposal and Employment in Agriculture in Delhi State, Annual Report, 1976-77 (1980)  
by PC Mehrotra, SK Raheja, VS Rustogi and KK Tyagi

✓ Monograph on Estimation of Incidence of Crop Pests and Diseases and Yield Losses (1981)  
by Daroga Singh and RK Khosla

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by KC Raut, Shivtar Singh and RL Rustagi

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by Shivtar Singh, RL Rustagi

Souvenir Volume of IASRI, New Delhi Released on the Occasion of IASRI, Silver Jubilee, 1959-1984 (1984)  
by P Narain, BBPS Goel, KC Raut and BS Sharma

Research Highlights-25 years (1959-1984) of Indian Agricultural Statistics Research Institute (1984)  
by P Narain and KC Raut

Quality of Sample Survey Data (Guidelines for Improvement)-IASRI Bulletin No. 2 (1984)  
by P Narain, KC Raut, SD Bokil and MP Jha

Preharvest Forecasting of Jowar yield in Sangli District, Maharashtra, 1976-77 to 1979 (1984)  
by RC Jain, MP Jha and Ranjana Agrawal

✓ 10  
Combination of Results from Ordered Observations in Split Plot Designs (1984)  
by SC Rai and PP Rao

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A study of Suitable Sampling Methodology for Estimating the Yield of Vegetable Crops on the Basis of Partial Harvests (1984)  
by Satya Pal and AK Srivastava

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Pilot Sample Survey for Studying the Relative Merits of the Data Obtained by Actual Weighment and those through Enquiry for Estimation of Milk Production-District Rohtak, Haryana and Barabanki, UP (1984)  
by BBPS Goel, KB Singh and JP Goel

✓ 10 P-77  
Sample Survey for Methodological Investigations into High Yielding Varieties Programme. Final Report 1977-78 to 1979-80, Volume I Area Estimation Enquiry (1984)  
by SK Raheja, AK Banerjee, PC Mehrotra, VS Rustogi, SS Gupta, NK Ohri, SS Shastri, GS Bassi and DL Ahuja

✓ 10 P-168  
Pilot Sample Surveys for Estimating Yield of Cotton in Hissar Haryana 1977-78 and 1978-79 (1984)  
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Impact of Greater Calcutta Milk Supply Scheme on Rural Economy in Milk Collection Area, Calcutta WB (1985)  
by HP Singh, BC Saxena, SP Verma and Balbir Singh

Pilot Survey to Study the Performance of Cattle Under Village Conditions, Palampur Area, HP (1985)  
by Shivtar Singh, KC Raut and JP Jain

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Study on Changes in Distribution Pattern of Land Holdings and Tenancy Structure in India (1986)  
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Revised Yardsticks of Additional Production due to Improvement Measures (1986)  
by CR Leelavathi, SR Bapat and P Narain

✓ 10  
L & Jalgaon  
(Maharashtra)

## NATIONAL INDEX OF ANIMAL EXPERIMENTS

Compendia Volumes available on animal and poultry experiments are :

No.	Discipline/s	Name of Research Institute	Period Covered	No.	Discipline/s	Name of Research Institute	Period Covered
1.	Animal nutrition	IVRI, Izatnagar	1945-70	10.	Animal and poultry nutrition	CS Azad [University of Agriculture and Technology, Kanpur	1963-80
2.	—do—	UP College of Veterinary Science and Animal Husbandry, Mathura	1960-70	11.	—do—	College of Animal Sciences, HAU, Hissar	1967-79
3.	—do—	NDRI, Karnal and its regional stations	1960-70	12.	—do—	Allahabad Agricultural Institute, Naini, Allahabad	1956-78
4.	—do—	CSWRI, Avikanagar	1966-75				
5.	—do—	RBS College, Bichpuri (Agra)	1956-76	13.	—do—	JNKVV College of Veterinary Science and Animal Husbandry, Jabalpur, MP	1963-80
6.	—do—	GAU, Anand (Gujarat)	1960-74	14.	—do—	Madras Veterinary College, Madras	1960-75
7.	—do—	APAU College of Veterinary Science, Rajendra Nagar, Hyderabad	1964-81	15.	—do—	KAU, Manuthi, Trichur (Kerala)	1960-78
8.	—do—	College of Veterinary and Animal Sciences, Bikaner	1960-79	16.	—do—	UAS Hebbal and Dharwar	1967-78
9.	Poultry nutrition	IVRI, Izatnagar	1952-70	17.	*	Gujarat Agriculture University, Anand (Gujarat)	1975-82

\* includes disciplines of nutrition, physiology, breeding, genetics, management, reproductive biology, surgery and pathology

## NATIONAL INDEX OF AGRICULTURAL FIELD EXPERIMENTS

Following Compendia Volumes are available in respect of agricultural field experiments :

<i>No.</i>	<i>Region</i>	<i>Period Covered</i>	<i>No.</i>	<i>Region</i>	<i>Period Covered</i>
1.	Andhra Pradesh	1948-65	10.	North-Western Region	1948-65
2.	North-Eastern Region	"	11.	Tamil Nadu	"
3.	Bihar	"	12.	Uttar Pradesh	} 1948-59
4.	Gujarat	"			
5.	Kerala	"	13.	West Bengal	1948-65
6.	Madhya Pradesh	"	14.	Central Institutes	1948-59
7.	Maharashtra	"			
8.	Karnataka	"			
9.	Orissa	"			

### IASRI RESEARCH PAMPHLETS

<i>No.</i>	<i>Title</i>	<i>No.</i>	<i>Title</i>
1.	Estimation of Availability and Cost of Milk Production and its Index Why & How?	7.	Assessment and Evaluation of High Yielding Variety Programme
2.	Estimation of Cost of Production of Poultry and Eggs	8.	Integrated Technique for Estimation of Principal Livestock Products
3.	Securing Livestock Data Through Self-Respondents	9.	Estimation of Production of Cultivated Fodders
4.	Estimation of Rates of Fertility and Mortality in Bovines	10.	Due to Milk Supply Schemes in a Dynamic Population
5.	Measurement of Yardsticks of Additional Crop Production	11.	National Index of Animal Experiments
6.	Estimation of Extent of Cultivation and Production of Fruits and Vegetables		

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