ANNUAL REPORT

1998-99

INDIAN AGRICULTURAL STATISTICS RESEARCH INSTITUTE
(ICAR)
LIBRARY AVENUE, NEW DELHI - 110012

ANNUAL REPORT

1998-99

INDIAN AGRICULTURAL STATISTICS RESEARCH INSTITUTE
(I.C.A.R.)
LIBRARY AVENUE, NEW DELHI – 110 012

PREFACE

Indian Agricultural Statistics Research Institute is a premier Institute for promoting and conducting research and training in Agricultural Statistics and Computer Application in Agriculture. The Institute, as in the past, continued its service in research, teaching and training activities through its various divisions during 1998-99.

It gives me a great pleasure in presenting the Annual Report 1998-99 of the Institute. The report depicts a panorama of research activities and achievements of the Institute in the disciplines of Agricultural Statistics and Computer Applications. I hope that the scientific fraternity of NARS will find the information presented in the report quite informative and useful. Suggestions and comments, if any, for improvement in subsequent volumes of the reports are most welcome.

I wish to express my sincere appreciation to the Heads of the Divisions, Scientists, Officers and other staff members of the Institute for their sincere and whole hearted support and co-operation in carrying out the functions and activities of the Institute and for providing requisite material for compilation of this report.

I take this opportunity to put on record my appreciation for the sincere efforts put in by Dr HVL Bathla, Principal Scientist and Head, Research Coordination and Management Unit, Sh PP Singh and Sh J Srinivasan, Technical Officers for compilation and editing of the report and for bringing out this report in time. I express my thanks to Sh Mahesh Chander, Stenographer and Smt Rajni Gupta, Sr Clerk for type-setting the manuscript on computer.

SD SHARMA
Director

CONTENTS

EXECUTIVE SUMMARY

Indian Agricultural Statistics Research Institute (IASRI) established in 1959 was mainly responsible for promoting and conducting research and education/training in Agricultural Statistics. With the advances in information technology the institute has adapted itself to the current needs of agricultural research. In the changed scenario, the mandate of the Institute is, to undertake basic, applied and adaptive research in agricultural statistics, to assist in the development and strengthening of National Agricultural Statistics System, to conduct post graduate and in-service training courses in Agricultural Statistics and Computer Applications, to provide consultancy services, to act as a repository of information on agricultural statistics, to develop the Institute as an Advanced Centre of Excellence in education and training in Agricultural Statistics and Computer Applications and to undertake sponsored research and training of national and international organisations in these disciplines.

A number of research projects are undertaken in the different divisions of the Institute namely Sample Survey, Design of Experiments, Biometrics, Forecasting Techniques, Statistical Economics and Computer Applications. During the year under report, there were 38 ongoing research projects and one revolving fund project covering the main thrust areas, like poultry meat production, inland fish catch estimation, production and area estimation, assessment and evaluation studies, small area estimation, methodological studies in complex surveys, remote sensing technology applications, development of databases, cropping system research, information system for agricultural and animal experiments, experimental designs for agricultural, animal, agro-forestry and fishery research, statistical studies in animal and plant genetics, modelling for biological phenomena, studies in population biology, forecasting techniques in agricultural system, technological change and its diffusion in agriculture, resource use efficiency in agriculture, modelling for demand and training programs in information

technology. In some of these studies, Institute is collaborating with various Institutes and also user organisations. The Research Coordination and Management Unit (RCMU), apart from coordination and management work, brought out Annual Report of the Institute, Quarterly IASRI News, Monitoring Progress Reports and Golden Jubilee issue of Souvenir entitled, Advances in Agricultural Statistics and Computer Application.

The Division of Sample Survey is involved in the development of sample survey techniques for estimation of various parameters of interest relating to crops, livestock, fishery and allied fields. In the project on "Estimation of flow and change in dynamic populations" estimators for compositional changes in terms of number of units in dynamic population due to cross movements of units in two classes over the two occasions under general developmental phenomenon and various causal factors by adopting the successive sampling plan and by making use of projective geometry approach and transition matrix approach have been developed. The project entitled, "An analysis of yield gaps for buffaloe milk" has provided results which are useful to the feed manufacturers in formulating their concentrate. The results obtained from the study entitled, "Effect of various input components on the yield of important vegetable crops" will help the cultivators to understand the behaviour of various inputs towards cultivation of vegetables crops and economise the use of inputs for maximum benefits.

Designs have been obtained when the sets of treatments applied in succession are interacting . When the interactions are likely, then these sets of treatments form a factorial set up with the different sets of treatments representing factors and treatments within the set being the levels of the factors. The designs obtained have the orthogonal factorial structure. Two series of efficient asymmetrical designs viz. $q \times 2^n$ with q=5,6 and 7 and $q \times 3^n$ for q=5,6,7 and 8 levels have been developed. The most

suitable association schemes for different number of levels of factor of asymmetry were found out using the different optimality criteria A, D and E along with the criterian based on correlation of estimated contrasts. These designs are useful for the situations where levels of one factor are different from levels of other factors in the experiment. The data received from different collaborative projects under AICRP during the year were analysed using appropriate statistical techniques. Data structure of experiments available in AFEIS was modified so as to include the experiments planned for the study of diseases.

In the field of Biometrics, researches on contagious distributions and dynamical models for aphid population growth; Investigations on the properties of projection matrices in population biology; Application of bootstrap techniques for studying statistical properties of genetic parameters and Study to compare the performance of different methods of estimating repeatability and to assess their stability by bootstrap technique were undertaken.

Studies on Forecasting Techniques for developing statistical techniques in the field of forecasting crop yields and impending attack of crop, pests and diseases were undertaken. 'Study on development of forewarning system for aphids on potato', revealed that two types of models are suitable (i) Non-linear models in which different cosine functions have been used, (ii) Higher degree complex polynomial models developed using Group Method of Data Handling (GMDH) technique. The predicted values from these models are very close to the observed ones. It is possible to forewarn about aphid population two weeks in advance based on weather variables.

In a study, discriminant function has been used for developing forecast model for rice crop using weather parameter. Linear and quadratic functions were used for the development of weather score. The classification accuracy of linear weather score at active vegetative phase of the crop is 76.2% whereas that of the quadratic weather score is 95.24%. This indicates that the quadratic weather score is better as compared to linear one. The forecast model at this phase of the crop using weather score and the input variables could explain 87% of the variation in yield. If the weather score used in the model is of quadratic type, 92% of the variation in yield is explained by the forecast model.

Research work on estimation of technical efficiency in wheat production in Punjab and Haryana, resource use efficiency in poultry production and demand for foodgrains production using the National Sample Survey data were in progress. A Project is also in operation for examining the impact of micro-irrigation system on crop production, saving of resources, income and employment in Mahindergarh and Gurgaon districts.

Development work of a National Information System on Agricultural Education (NISAGE) was in progress. Advisory and Consultancy services were provided in the Computerisation and Processing of data of LDC-98 and ARS/NET/SRF-98 examinations for Agricultural Scientists Recruitment Board (ASRB). The Division continued to provide computer services in the Institute and strengthened the computing facilities in the Institute.

The scientists of the Institute participated in number of workshops, seminars, summer Institutes related to the disciplines of agricultural statistics and computer applications. A number of research papers highlighting the results achieved in various studies were published by the scientists of the Institute. Consultancy was given to different organisations. The meetings of Research Advisory Committee, Management Committee and Staff Research Council were held and decisions taken were implemented. The Institute organised national and international level training programmes in the discipline of Agricultural Statistics and Computer Application and also helped in planning of experiments surveys and data analysis to various organisations.

INTRODUCTION

Brief History

The Institute made a modest beginning in 1930 as a small Statistical Section, in the then Imperial Council of Agricultural Research, to assist the State Departments of Agriculture and Animal Husbandry in planning their experiments, analysis of experimental data, interpretation of results as also rendering advice on the formulation of the technical programmes and examining the progress reports of the schemes funded by the Council. The activities of the Section increased rapidly with the appointment of Dr PV Sukhatme as Statistician to the Council in 1940 and research was initiated for developing objective and reliable methods for collecting yield statistics of principal food crops. The efficiency and practicability of these methods were demonstrated in different states for estimating yield by crop cutting experiments. 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 and non-food crops. Research in sampling theory and training of field and statistical staff were the activities initiated in this period resulting in the re-organization of the Statistical Section into a Statistical Branch with permanent footing in 1945 accompanied by appropriate expansion in its strength. The designation of Statistician was changed to Statistical Advisor. The Statistical Branch soon acquired international recognition as a centre for research and training in the field of Agricultural Statistics. In 1949 it was named as Statistical Wing of the ICAR. During 1952 on the recommendations of two FAO experts, Dr Frank Yates and Dr DJ Finney, who visited the Council on the invitation of the Government of India, activities of the Statistical Wing were further expanded and diversified. In August, 1955, the Statistical Wing moved to its present campus. Subsequently, in recognition of its important role as a training and research institution, the Statistical Wing was re-designated as the Institute of Agricultural Research Statistics (IARS) on 2nd of July 1959. It is to commemorate this important event, that the Annual Day of the Institute is celebrated on this day every year. An important landmark in the development of the Institute was the installation of an IBM 1620 Model-II Electronic Computer in 1964. Another major landmark for the Institute was the signing of a Memorandum of Understanding with Indian Agricultural Research Institute (IARI), New Delhi in 1964, consequent to which new courses leading to M.Sc. and Ph.D. degrees in Agricultural Statistics were started in collaboration with IARI in October, 1964. In April, 1970, the Institute was declared as a full-fledged Institute in the ICAR system and is, since then, headed by a Director. Since 1st January, 1978, the name of the Institute was changed to Indian Agricultural Statistics Research Institute (IASRI) emphasizing the role of 'Agricultural Statistics' as a full fledged discipline by itself.

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 Burroughs B-4700 system was installed in March, 1977. A large number of computer programmes for specific problems as also general purpose application software were developed. The Burroughs B-4700 system was replaced in 1991 by a Super Mini COSMOS-486 LAN Server which was subsequently replaced by a PENTIUM-90 LAN Server, a more powerful system having state-of-art technology. Computer laboratories equipped with Pentium, 486, 386 PC/AT's, dumb terminals and printers, etc. have been set up in each of the six divisions as well as in Research Coordination and Management Unit of the Institute. Keeping eye on the technological developments in the Information Technology (IT) field, the new operating systems and the large number of machines connected on the network, 5 PENTIUM II 23'

MHz, 14 Celeron 266 MHz were purchased under Centre of Advanced Studies (CAS). 30 PENTIUM 166 MHz, 16 Celeron 266 MHz (under CAS) were upgraded. In addition to above, 1 digitizer, 1 Global Positioning Systems, 1 CD-Writer-Plus 45 UPS, 3 Colour ink jet printers and 38 DMPs were procured. User friendly software packages like operating system (MS DOS Ver. 6.2 and MS Windows 95), Word Perfect 6.0, E-mail Services, SPSS, SAS, Image Processing Software, Harvard Graphics, LOTUS, dBASE IV, SCO-UNIX, ORACLE, MS-Office Suite and a few others have also been made available. Microsoft Visual Studies 97, Microsoft Office 97, Microsoft Project 98, STAR3, Norton Anti-virus packages were also purchased to keep pace with the new emerging technology. Besides this, every section of the Institute has been equipped with PC AT's and printers.

In order to remove and rectify 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). The Institute is one of the National input centres, for adding our inputs to the System every month. The Institute provides selective information services to scientists in the ICAR Institutes and Agricultural Universities on references to documents relating to areas of their specific interest. The bibliographic databases in Biotechnology and Animal Science Research are being maintained in the Bio-Informatics Laboratory providing Selective Dissemination of Information (SDI) services on VETCD, BEASTCD and AGRICOLA databases.

From October, 1983 to March, 1992 the Institute also functioned as a Centre of Advanced Studies in Agricultural Statistics and Computer Applications under the aegis of the United Nations Development Programme (UNDP). This programme aimed at developing a Centre of Excellence with adequate infrastructure and facilities to undertake advanced training programmes and to carry out research on various aspects of agricultural statistics and computer application. Under this

programme, thirteen distinguished statisticians and computer experts from abroad (19 visits; over 21.5 man months) visited the Institute for a period of four to eight weeks with a view to interacting with the scientists of the Institute, giving seminars/lectures and suggesting improvements in the research programme of the Institute. Seventeen scientists from this Institute had received training (covering 80 man months) abroad, in different areas of research, extending over periods of 5-6 months each. In addition, a new course leading to M.Sc. degree in Computer Application in Agriculture was initiated from the session 1985-86 which was subsequently changed into M. Sc. (CA) from the session 1993-94.

With the advances in Information Technology and the requirements at IASRI, the new structured cabling for 65 nodes at IASRI's computer center building using the world class standard AMP products was done under the ARIS programme. The 65 nodes with the transfer speed of 100 MBPS were installed and for managing all these nodes the "NETCONNECT" rack was installed where the cables from different rooms terminate and the patch cords from these are used to connect in the 24 Port Bay Networks hubs. The two new 24 port Bay Networks hubs along with the existing two 16 port hubs were mounted on the rack for managing the whole network. All the four hubs are now cascaded and with this the Internet connection has become much faster.

In view of growing demand from various quarters, the Institute revived the Senior Certificate Course in `Agricultural Statistics and Computing' in 1997 with change in the course curriculum keeping in view the demand of well trained manpower in Agricultural Statistics.

The Institute has achieved international recognition for its high quality 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.

Heads of the Institute

Dr PV Sukhatme	Sep 1940 -Jul 1951
Dr VG Panse	Aug 1951-Mar 1966
Dr GR Seth	Apr 1966-Oct 1969
Dr Daroga Singh	Nov 1969-May 1971
Dr MN Das (A)	Jun 1971- Oct 1973
Dr Daroga Singh	Nov 1973-Sep 1981
Dr Prem Narain	Oct 1981- Feb 1992
Dr SK Raheja (A)	Feb 1992 -Nov 1992
Dr RK Pandey (A)	Dec 1992 -May 1994
Dr PN Bhat (A)	Jun 1994 - Aug 1994
Dr OP Kathuria	Aug 1994 -May 1995
Dr RK Pandey (A)	Jun 1995 - Jan 1996
Prof Bal BPS Goel	Jan 1996 - Oct 1997
Dr SD Sharma	Oct 1997 - onwards

Mandate

The mandate of the Indian Agricultural Statistics Research Institute (IASRI) is to promote and conduct research, education and training in agricultural statistics and computer application in agriculture. To achieve these objectives, the IASRI has the following functions:

- To undertake basic, applied and adaptive research leading to new developments in Agricultural Statistics and related fields for bridging gaps in the application of Statistical Techniques to the problems of Agricultural Research.

- To assist in the development and strengthening of National Agricultural Statistics System.

- To conduct post-graduate and in-service training courses in Agricultural Statistics and Computer Applications in Agriculture.

- To provide advisory/consultancy services to agricultural scientists, planners, policy makers and others on their statistical and computing requirements.

- To act as a repository of information on Agricultural Statistics for research and dissemination of such information.

- To develop the Institute as an Advanced Centre of Excellence for education and training in Agricultural Statistics and Computer Applications.

- To liaise with ICAR Institutes, SAUs and State Agricultural/ Animal Husbandry/ Veterinary Sciences departments etc. and undertaking sponsored research & training for national and international organisations.

Organisational Set-up

The Institute has six Divisions, a Unit and a Cell to undertake research, training, consultancy, documentation and dissemination of scientific output. As per the recommendations of Quinquennial Review Team (QRT) of the Institute and Council's approval, the names of the three Divisions namely SSM & ASD, DE&AED, and BS&SG have been changed. The new set up of the Institute is as follows *(Fig-1)*.

Divisions:

- Sample Survey,
- Design of Experiments,
- Biometrics,
- Forecasting Techniques for Crops, Diseases and Pests,
- Statistical Economics, and
- Computer Applications.

Unit:

- Research Co-ordination and Management

Cell:

- Training Administration

Financial Statement

Budget statement for the year 1998-99

(Rs. in lakhs)

Code	Head of Account	Budget		Expenditure	
		Plan	Non-Plan	Plan	Non-Plan
02	Establishment Charges	5.00	869.00	5.00	869.00
06	Overtime Allowance	0	0.89	0	0.89
10	Travelling Expenses	3.50	2.80	3.44	2.75
15	Other Charges Incl. Equipment	75.00	38.00	74.96	38.00
20	Works	56.50	10.31	56.50	10.30
25	Fellowships/Scholarship/Award	0	6.42	0	6.42
	GRAND TOTAL	**140.00**	**927.42**	**139.90**	**927.36**

Abstract (1998-99)

(Rupees in Lakhs)

	Budget	Expenditure
Plan	140.00	139.90
Non-Plan	927.42	927.36
Total	**1067.42**	**1067.26**

Staff Position

	Manpower	No. of posts sanctioned	No. of posts filled
1.	Director	1	1
2.	Joint Director	1	*
3.	Scientific	130	108
4.	Technical	290	218
5.	Administrative	124	113
6.	Auxiliary	14	10
7.	Unclassified	1	-
8.	Supporting	98	94
	TOTAL	**659**	**544**

ORGANISATIONAL CHART
of
Indian Agricultural Statistics Research Institute

FUNCTIONAL SET-UP

DIVISION

CELL

LIBRARY

ADMN.

Design of Experiments

Sample Survey

Biometrics

Forecasting Techniques for Crops, Diseases and Pests

Statistical Economics

Computer Applications

Research Coordination and Management Unit

Training Administration Cell

Libarary and Documentation

Establishment

General Administration

Audit and Accounts
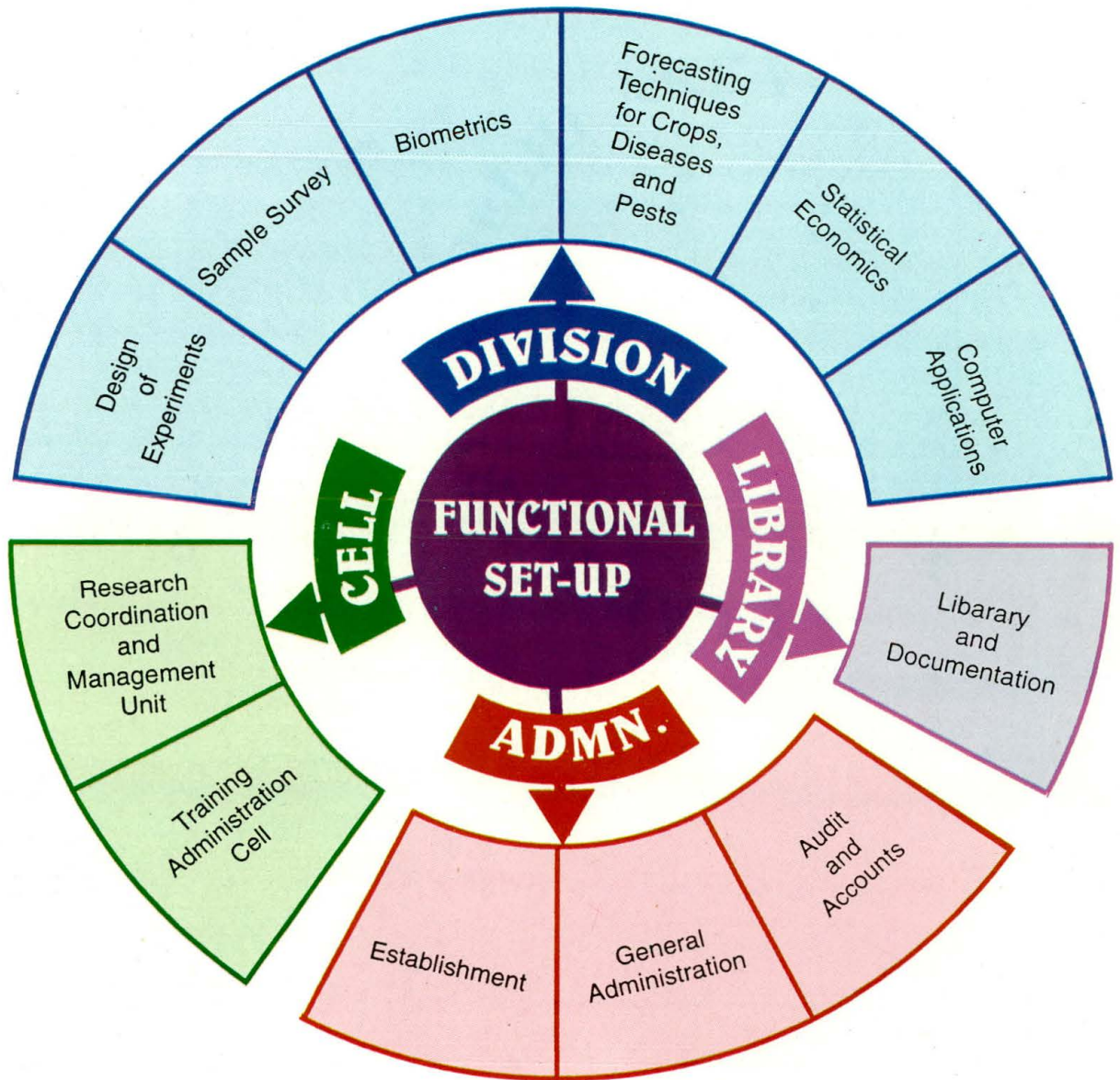
CADRE STRENGTH	
POST	NO.
DIRECTOR	1
JOINT DIRECTOR	1
PRINCIPAL SCIENTISTS	18
SENIOR SCIENTISTS	32
SCIENTISTS	80
	130+2

Fig. 1

SCIENTIFIC STRENGTH (SANCTIONED AND IN POSITION)
FROM THE YEARS FROM 1994-95 TO 1998-99

Legend:
- Sanctioned
- Total in Position
- Principal Scientist
- Senior Scientist
- Scientist (Sr Scale)
- Scientist
- Experimental Scientist
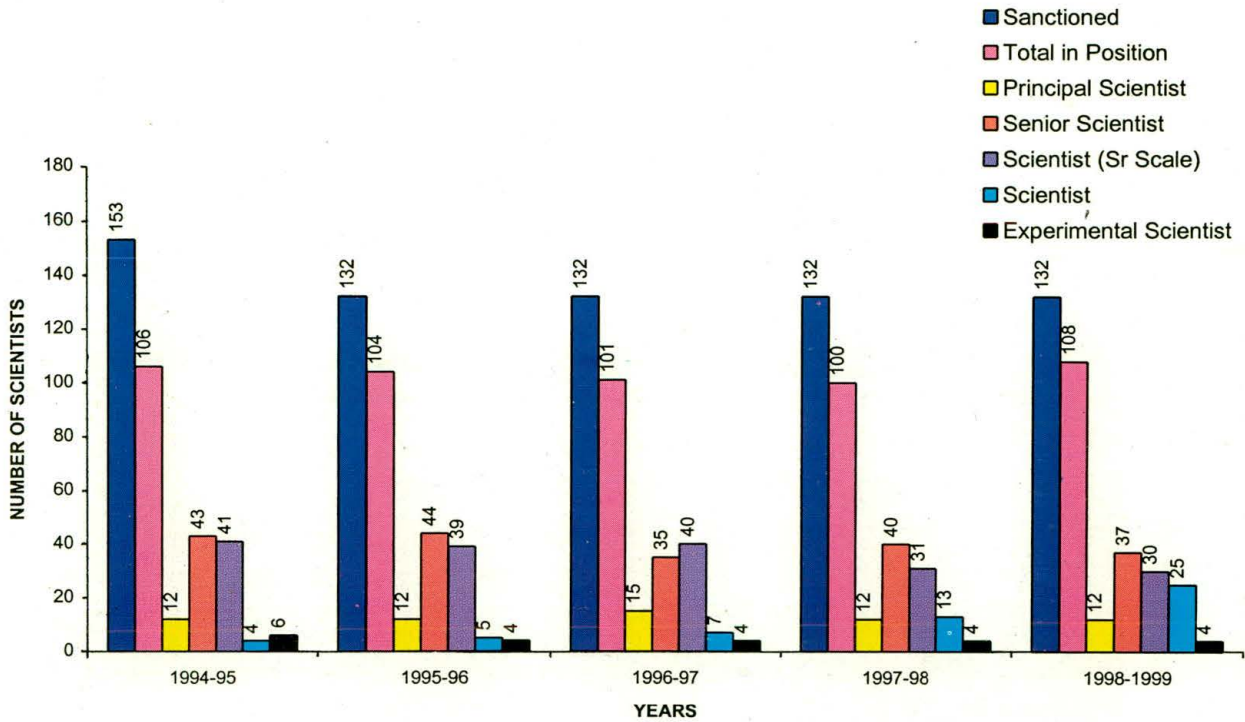
STAFF STRENGTH IN POSITION
AS ON MARCH 31,1999

Legend:
- Scientific
- Technical
- Administrative
- Auxiliary
- Supporting
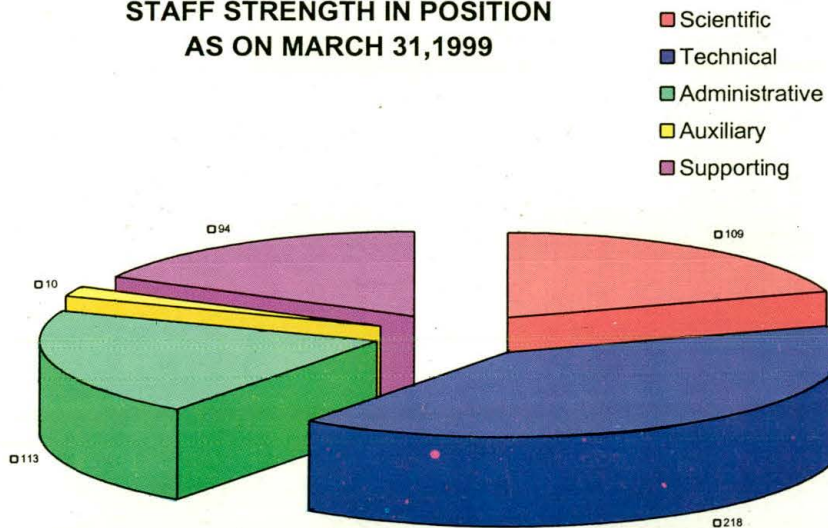
BUDGET FOR THE YEARS FROM 1994-95 TO 1998-99

Chart legend:
- Non-Plan Funds
- Non-Plan Expenditure
- Plan Funds
- Plan Expenditure

Rs. IN LAKHS vs YEAR

Year	Non-Plan Funds	Non-Plan Expenditure	Plan Funds	Plan Expenditure
1994-95	421.00	417.60	82.00	80.60
1995-96	486.50	484.90	115.00	110.20
1996-97	502.70	503.40	72.00	72.00
1997-98	649.08	636.67	147.00	146.94
1998-99	927.42	927.36	140.00	139.90
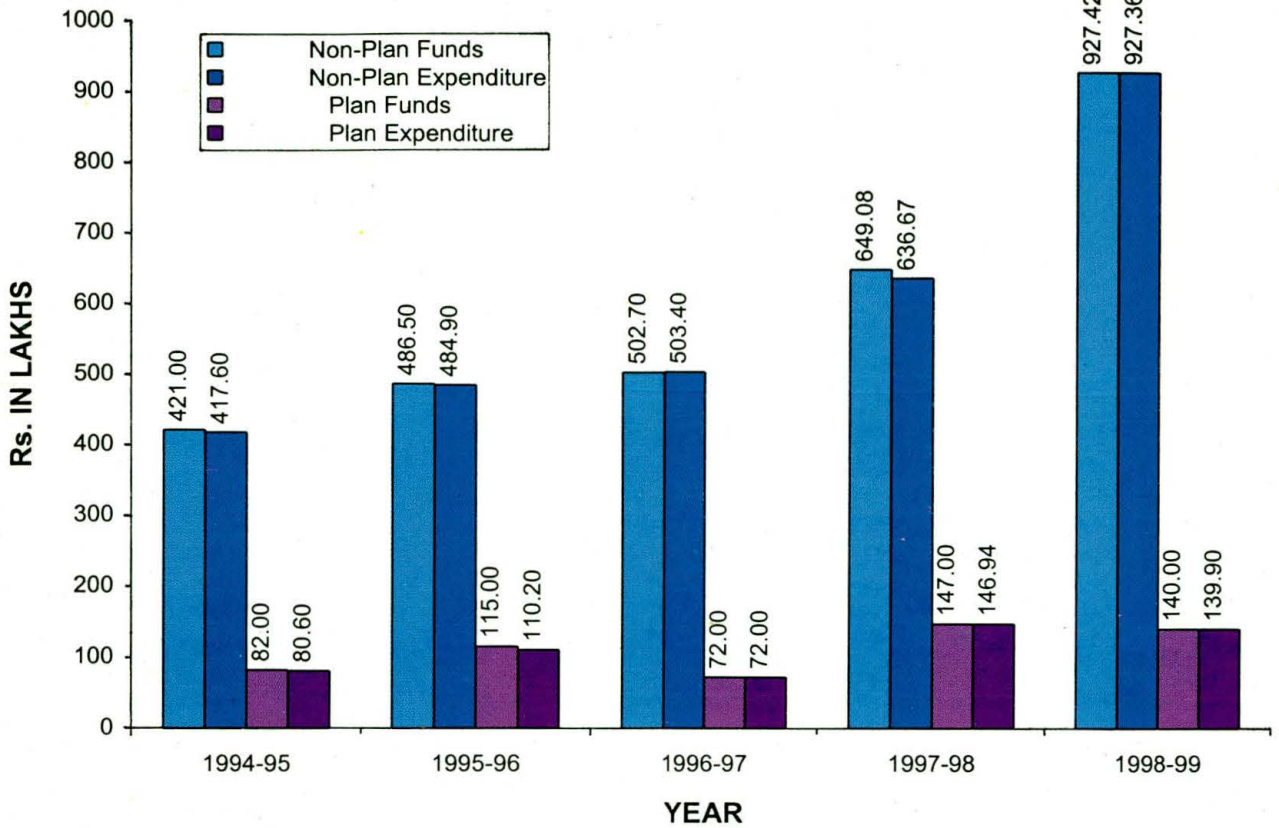
TRAINING COURSE ORGANISED FROM 1994-95 TO 1998-99

NUMBER vs YEAR

Year	TRAINING	PARTICIPANTS
1994-95	12	271
1995-96	16	299
1996-97	12	311
1997-98	34	505
1998-99	33	579
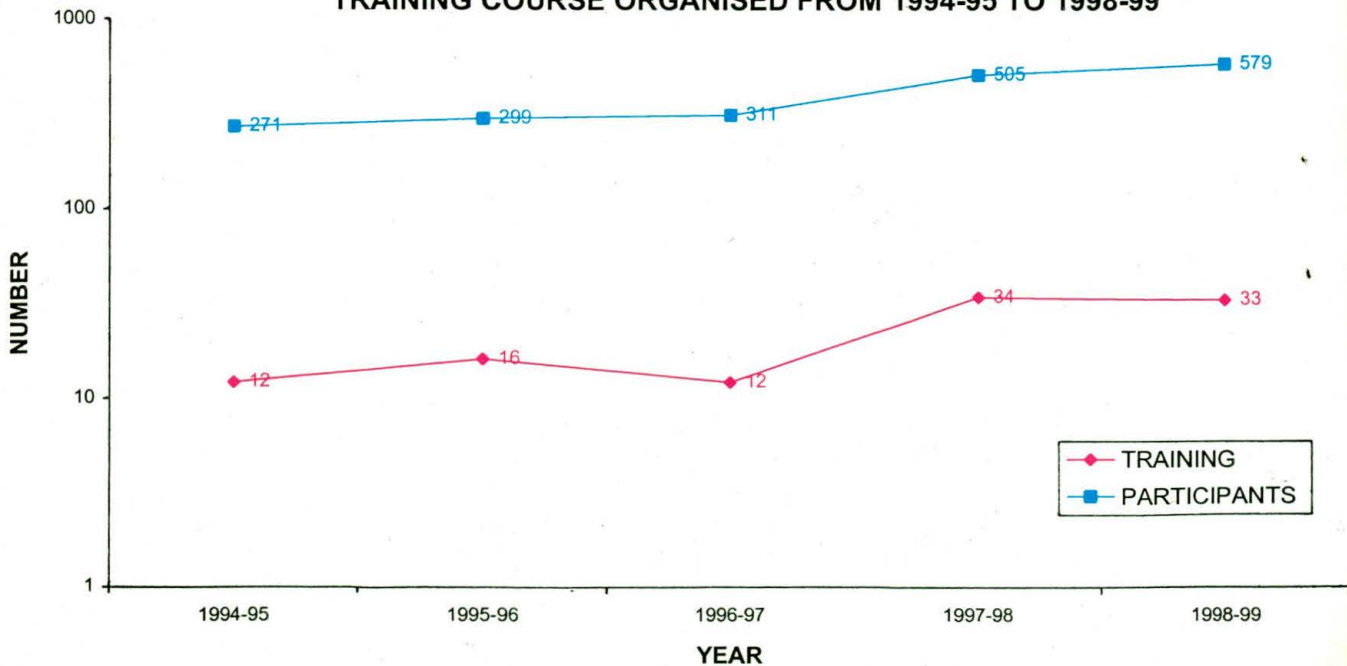
RESEARCH ACHIEVEMENTS

DIVISION OF SAMPLE SURVEY

Mandate	Thrust Areas
To evolve sample survey techniques for estimation of various parameters of interest relating to crops, livestock, fishery, forestry and allied fields and to develop techniques for analysis of survey data.	• Poultry meat production • Inland fish catch estimation • Production and area estimation • Assessment and evaluation studies • Small area estimation • Methodological studies in complex surveys • Remote sensing technology applications • Development of database

Thrust area-wise list of projects in operation is given in **Appendix-II**. The progress of the projects is given below:

Poultry Meat Production

1. Pilot sample survey to develop a sampling methodology for estimation of poultry meat production

The objectives of the study are (i) to estimate the poultry meat production through existing integrated sample surveys for estimation of livestock products, (ii) to estimate the poultry meat production through organised farms and (iii) to develop a suitable sampling technique for estimating the poultry meat production integrating the results obtained under (i) and (ii) above.

To estimate the total poultry meat production in Gurgaon, district of Haryana, a sampling methodology was adopted at two levels. At first level, samples of organized poultry farms of each type and size, were selected separately by the method of uni-stage stratified sampling. Similarly, at second level, sample of villages at first stage and households rearing poultry birds in their backyard at second stage were selected by the method of two-stage stratified sampling. Information on some vital characteristics of poultry birds were collected throughout the year at regular intervals. Estimates of poultry meat production were estimated at the two levels separately and the total poultry meat production was estimated by integrating the estimates obtained at two levels. The project report was finalized.

Inland Fish Catch Estimation

2. Sample survey to evolve methodology for estimation of fish catch from rivers and streams of the hilly areas

The objective of the project is to evolve suitable sampling methodology for estimation of fish catch from rivers and streams of the hilly areas. This study is being undertaken in three districts of Himachal Pradesh viz. Bilaspur, Kangra and Mandi. Field work for the collection of fish catch data commenced from Nov. 1997. Data received from all the three selected districts have been scrutinized and coded. The coded data have since been transcripted on floppy diskettes and work on the comparison and correction of data files so created is in progress. The estimation procedure for the analysis of data is being worked out.

Production and Area Estimation

3. Study for estimation of area and production of important vegetable crops on the basis of partial harvest

The objectives of the study are (i) to develop a suitable theoretical frame work for sampling from two dimensional population spread over space and time with particular reference to vegetable crops, (ii) to apply and test the theory on secondary data collected under earlier vegetable surveys at IASRI in

order to develop a suitable methodology for estimating the production of vegetable crops based on partial harvests, and (iii) to estimate the total production of important vegetable crops and their yield rates on the basis of partial harvest.

In view of multiple pickings of vegetable crops, the observations on selected fields for estimation of production of vegetable crops is spread over time. The project study was planned in two phases. In the first phase of the study, the methodological aspects of the problem for estimation on the basis of first phase study were tackled. The problem was tackled in a general perspective for sampling from two dimensional populations where, in one of the dimension, selection of sampling units were considered while in the other dimension sampling was spread over time in which the selected units were observed. An approach for a variety of sampling designs associated with sampling over time was developed using the varying probability sampling methods. This method was tested on secondary data in which the different duration of time intervals on which data were to be collected and also the periodicity for the systematic sampling interval were tackled. It was found that a span of 7 days in the gap of 14 days was a suitable plan for observing partial harvest data for different vegetable crops. The vegetables considered for the study were tomato, brinjal, tori, loki and karela.

In the second phase, a pilot survey was conducted in rural areas of Delhi. During the reported period, the project report was finalised. The results have been reported earlier. The theoretical frame work will lead to suitable methodology for estimating the production of crops and commodities with multiple observations. The methodology will provide estimates on the basis of partial harvest data.

4. **Pilot sample survey for estimating the area and yield rates of ginger and potato in hilly areas**

The objective of the project is to develop sampling methodology for estimating the area and yield rates of ginger and potato.

The design adopted for the survey was stratified multi-stage random sampling, the strata being Community Development Blocks. The villages growing ginger / potato were the primary stage sampling units. For area estimation enquiry, cultivators in the villages growing ginger/ potato were second stage sampling units. For crop cutting experiments, fields and a plot / sub-plot were selected. The usual method for estimating the area and average yield will be adopted.

The data on ginger crop for the district of East Garo Hills and potato for East Khasi Hills were received during the year. The data were scrutinized, coded and sent for data entry. The data entry work was also completed. The tables to be included in the report were finalized. The computer programs for analyzing the data are being prepared.

Assessment and Evaluation Studies

5. **Studies on feed intake by bovines through stall feeding and grazing**

The main objective of the project was to estimate the intake of herbage by bovines through grazing as well as through stall feeding in different seasons. The field work was carried out in Dharmapuri district of Tamil Nadu. The productivity of bovines was studied with reference to feeding. The sampling design followed was stratified two-stage random sampling with tehsils as strata, villages as first stage units and households as second stage units. For estimation of intake of herbage, one square metre cuts before grazing as well as after grazing were taken. The project was completed. The results have been reported earlier. Similar studies should be taken up in other areas also, in order to suggest concrete methodology for estimation of intake by bovines through both the sources.

6. **Estimation of flow and changes in dynamic population**

The objectives of the project are (i) to estimate the structural changes in the population due to cross-movements of units in various classes between two occasions under general developmental phenomenon; (ii) to

estimate the structural changes in the population due to various causal factors, (iii) to estimate the parameter for characteristic of interest in respect of a stationary population and structural changes occurring in that population and (iv) to estimate the changes in the parameter for the characteristic on account of the structural changes occurring in the population due to cross-movements of units in various classes between two occasions.

An attempt has been made to develop the estimators for compositional changes in terms of number of units in dynamic population due to cross movements of units in two classes over the two occasions under general developmental phenomenon and various causal factors by adopting the successive sampling plan and by making use of projective geometry approach and transition probability matrix approach. Transition Probability Matrix approach has dealt only with the estimation of flow of units in various classes of the population over time. Estimators of the population parameters, such as mean for the characteristic under study on the two occasions, the change therein and the average thereof for the class I population, class II population and the population as a whole along with their variances have been developed. The study would be useful particularly in the field of agriculture and planning from the view point of knowing the socio-economic status of various classes of the farming community in the country.

7.   **To study the effect of various input components on the yield of important vegetable crops.**

The objectives of the project are (i) to study the functional relationship between the yield of important vegetable crops and various input components and (ii) to study the response of changing levels of different inputs on the yield of vegetable crops.

The project is based on secondary data collected under the project "Pilot sample survey for estimation of losses, price-spread at various stages of marketing and cost of cultivation of vegetable crops, Pune" during 1986-88. Linear, square root, semi-log and double-log functions have been fitted to data pertaining to the selected vegetable crops under study and the

statistical analysis to study the functional relationship between yield and various inputs is performed with the statistical package PC CARP. Estimates of short-run elasticity together with 95% confidence limits of the regression coefficients for the models fitted have been analyzed to study the response of changing levels of different inputs on the yield of selected vegetable crops.

The results reveal that irrigation, fertilizer and labour had contributed significantly in cultivation of most of the vegetable crops under study. Insecticides and pesticides had significant effect in cultivation of tomato while bullock labour affected potato only. It is also observed that regression coefficients are significant mostly in case when double-log model is fitted. The value of multiple R^2 is observed high and significant in case of double-log function. It indicates that double-log model has better specification towards the yield of vegetable crops than the other models studied.

To study the response of changing levels of inputs on the yield of vegetable crops, short-run elasticity as well as 95% confidence limits of regression coefficients have been estimated as the positive effect towards the yield of all the vegetable crops. Increase in human labour adversely affected the cultivation of brinjal. In case of tomato, if the use of insecticides and pesticides is increased by 100%, approximately four-times increase in the yield of tomato crop is expected. Irrigation and fertilizer used have also indicated the positive effect on the yield of vegetable crops under study except tomato and gowar. The estimates of short-run elasticity were observed to be positive and just significant. The changing levels of fertilizer, irrigation and human labour indicated that with an increase in these components separately, an increase in the yield of vegetable crops would be expected.

Small Area Estimation

8.   **Small area estimation of milk production**

The objectives of the project are (i) to identify the symptomatic variables for stratification (ii) to obtain small area estimates

by synthetic method of estimation and (iii) to obtain direct estimates for small areas by usual method and to compare it with the results obtained in (ii) above.

For estimating the total milk production for cows as well as for buffaloes at district level, some of the estimators available in the literature were considered. Breed of the animals has been used as auxiliary (symptomatic) variable in obtaining different estimators. Model based synthetic estimates were quite precise. Model based direct estimators also brought out precise estimates. The composite estimator was a better choice when the assumption of Model-I is not satisfied.

Methodological Studies in Complex Surveys

9. Estimation of regression coefficients from sample survey data

The objectives of the project are (i) to study the performance of alternative estimates of regression coefficients for survey data, (ii) to examine the problem of multi-collinearity in the context of survey data and (iii) to estimate the regression coefficients when the variables are in errors.

The problem of estimation of finite population regression coefficient has been examined when the variables were subject to measurement error. For this purpose a simple measurement error model was considered. Kish and Frankel's estimator was found to be biased. Two different unbiased estimators were developed. An empirical study based on simulated data revealed that the unbiased estimators score over the Kish and Frankel's estimator in terms of mean square error. The project was completed. The achievements have been reported earlier.

10. An analysis of yield gap for buffaloes milk

The objectives of the project are (i) to identify the factors to the gap, (ii) to estimate the contribution of each factor to the gap and (iii) to compare different procedures through simulated data.

The statistical procedures viz. path coefficient analysis, multiple regression technique and principal component analysis were used to identify factors and also to estimate the contribution of each factor to the gap in milk yield. By making use of path coefficient analysis, it was found that the direct effect of green fodder and concentrate on milk yield is positive whereas the dry feed fed to the animal contributed negatively towards milk yield. The overall direct effect of green fodder was 0.1276, that of concentrate was 0.6534 but the effect of dry fodder was -0.0222. All these factors together accounted for 52.19% variation in milk yield. Considering the milk yield is dependent upon feed intake and the various management factors, a multiple linear regression technique is used to know the contribution of each factor individually as well as the joint effect of all these variables together on milk yield. An increase of 1.4 Kg in milk yield may be achieved by feeding additional 1Kg of concentrate followed by an increase @ 0.029 Kg in it for an unit increase in feeding of green fodder. The negative coefficient of order of lactation indicates the declining trend as the lactation number increases. All these variables together account for 45.82% variation in milk yield. The linear combination of all these variables are obtained in the form of principal components which are themselves uncorrelated and independent if the variables under study follow normal distribution. Thus all these variables are reduced to four such components which accounted for 67.1% of the total variation. These techniques were further employed on the same data set in which the nutritive values of the feed fed to buffaloes were computed in terms of DCP, TDN and DNN and were replaced for feed consumption along with the other included variables. DCP contributed 0.6387 to the maximum towards milk yield. The contribution of TDN other than DCP was found to be negative indicating that increase in it may have adverse effect on milk yield. All these variables explained together about 47.93% of the variation in it. The multiple linear regression analysis indicated that the contribution of DCP towards milk yield for an unit increase was 5.20 whereas DNN contributed negatively @ -0.02 in it. The negative values of feed and other management factors accounted together for 42.87% of variation in milk yield. The four principal components accounted for 74.7% of the total variability.

11. A study of variance estimation in complex surveys

The objectives of the project are (i) to examine the effect of sampling designs on variance estimators of complex surveys, (ii) to examine the relative performance of different variance estimators in complex surveys for non-linear statistics and (iii) to modify above estimators for reducing higher order biases in complex surveys.

The methodology is based on the simulated data following multivariate normal, beta, gamma and uniform distributions. In this methodology different samples of various sample sizes by using 8 different sampling designs are selected to compare the performance of four methods: (i) Balanced Repeated Replication, (ii) Jackknife Repeated Replication, (iii) Generalized Repeated Partial sample scheme, and (iv) Taylor series linearization method for various estimators for estimating the population parameters viz. mean, ratio, regression coefficients and coefficient of correlation along with the estimate of their variances. The project is complete. The results have been reported earlier.

Remote Sensing Technology Application

12. Use of remote sensing technology in crop yield estimation surveys

The main objectives of the project are (i) to test the methodology of stratification based on satellite data in crop yield estimation surveys, (ii) to obtain improved estimator of crop yield from crop yield estimation surveys using post-stratification based on spectral data and (iii) to examine the usefulness of spectral data under study for stratification in crop yield estimation surveys for subsequent year.

As per the recommendations in the previous study conducted in Sultanpur district of U.P., it was suggested that the study might be repeated on more locations and over different periods before this technique can be recommended for operational use. District Rohtak was selected to repeat the study.

The satellite data in the form of vegetation indices has been utilized for stratification of crop area in homogeneous crop condition areas like high growth, average growth, poor growth etc. Crop yield data based on crop cutting experiments have been used to develop post-stratified estimator of crop yield.

The satellite data and also the crop yield data based on crop cutting experiments for wheat crop for district Rohtak have been collected and data analysis was in progress.

The project has been taken up in district Rohtak of Haryana to test the usefulness of satellite spectral data for stratification in crop surveys. The crop yield data based on crop cutting experiments have been collected from the Directorate of Agriculture, Haryana and IRS-IB/ satellite data of the corresponding areas have been obtained from NRSA, Hyderabad. The selected villages for crop cutting have been identified using topographic maps. The digital image processing has been done using ER-MAPPER computer software. The selected villages which were earlier identified on the topographic maps were identified on the imagery with the help of Global Positioning System (GPS). Further digital image processing like generation of boundary mask, generation of FCCs and vegetation indices like RVI and NDVI of the corresponding spectral data. The density slicing technique for stratification of crop area based on vegetation indices has been adopted to develop a post stratified estimator of crop yield. Crop yield estimators at Tehsil level have been developed using satellite data along with survey data based on crop cutting experiments. The project has been completed.

13. Use of Remote Sensing satellite data in crop surveys (Funded through ICAR A.P. Cess fund)

The objectives of the project are (i) to develop sampling design (involving planning of the surveys and method of estimation) for estimation of crop acreage & crop yield and crop yield modelling based on the combined use of satellite data (IRS) and ground survey data on crop yield obtained from crop cutting experiments, (ii) to evaluate the efficiency of the proposed sampling design based on a simulation study and (iii) to develop suitable

crop yield models using multi-date spectral data.

The satellite data in the form of vegetation indices and ground survey data based on crop cutting experiments will be used. The crop cutting sites will be identified with the help of a Global Positioning System (GPS). Suitable sampling design for acreage and yield estimation will be developed and crop yield forecasting model based on satellite data will be developed.

Field survey data on crop cutting experiments for wheat crop for the year 1995-96, and 1996-97 have already been collected for Rohtak district of Haryana which is a major wheat growing and mainly irrigated area. Statistical analysis of the data is in progress.

The villages selected for crop cutting experiments have been identified on the topographic maps in the scale of 1: 50,000 procured from Survey of India.

Satellite based spectral data for Rohtak district of IRS-IB, LISS-II for Feb, 1996 was procured form NRSA, Hyderabad which contains one full scene of LISS-II of size of 2520-2500 pixels. The Satellite data was received from NRSA, Hyderabad in raw form which have been registered and rectified applying Geometric connections and digital images have been developed with different combination of different levels data using ER-MAPPER computer Software.

The images have been masked to cover the area of Rohtak district from the whole scene. The villages selected for crop cutting experiments which were identified on topographic maps have been identified in the spectral imagery with the help of Global Positioning System (GPS) and the village boundaries have been created using GIS Software PC-ARC/INFO. Various image enhancement techniques are being studied during different filters. False Colour Composites (FCC's) have been generated using different band data. To further enhance the image for vegetation classes, Vegetation Indices like RVI and NDVI have been generated using Red band and Infra-red band.

The concept of Density Slicing is being applied to stratify the RVI and NDVI images generated for different vegetation classes.

Further, the corresponding satellite data of IRS-ID, LISS-III for Rohtak district for February 1998 have also been recently acquired from NRSA and have been loaded on the computer. This will be used to examine the performance of the developed methodology for crop yield estimation and also to study the changes taking place in land use and cropping pattern in the district.

Development of Data base

14.   Development of database relating to basic and current agricultural and allied statistics over time and space.

The objectives of the project are (i) to develop and establish an agricultural database for the country, (ii) to develop appropriate software for storage and retrieval of data and (iii) to develop appropriate software for using primary statistical tools for analysis of data.

For development of database, data on following variables were taken: (i) area, production and yield of total foodgrains, major cereal-wise, pulse-wise etc., (ii) area, production and yield of fruits and vegetables, spices, oilseeds etc., (iii) information and production and consumption of fertilizers - straight, mixed and complex, (iv) information on area irrigated - gross, net, by source and cropping intensity, (v) information on production of milk, eggs, wool and meat, (vi) information on live-stock numbers under various categories/ classifications, and (vii) information on land use statistics. In this study, it is aimed to provide a prototype database on the basis of readily available information on All-India basis with flexibility to incorporate future data availability on smaller area level.

A total of 40 data files have been generated in respect of the published data on the above variables starting from the year 1980-81 to the latest year for which the same data were available and stored in respective files. The necessary software for storage and retrieval of data from the database has been developed using dBASE IV. For the analysis of data using primary statistical tools, the appropriate

software has been developed. The analysis of data includes calculation of mean, standard deviation, coefficient of variation, correlation and regression coefficients. The trends study based on the method of least squares as also based on the method of moving averages has been included. The trends study has been represented graphically also.

The results of this project will be useful in national agricultural research system.

Agricultural Research Data Book 1998

Agricultural research is a vital input for planned growth and sustainable development of agriculture in the country. Indian Council of Agricultural Research being an apex scientific organisation at national level, plays a crucial role in promoting the accelerating the use of science and technology programme relating to agricultural research and education. It also provides assistance and support in demonstrating the use of new technologies in agriculture.

Information pertaining to agricultural research, education and related aspects available from different sources is scattered over various types of published and unpublished records. The Agricultural Research Data Book 1998, which is third in the series is an attempt to put together main components / indicators of such information. The Data Book is organized, for the purpose of convenience of the users into six sections namely, Natural Resources, Production and Productivity, Agricultural Inputs, Produce Management, Investment in Agricultural Research & Education and Human Resources under National Agricultural Research System (NARS). It also contains at the end, list of important National and International Institutions associated with agricultural research and education along with their addresses and contact points.

The Data Book has been compiled through the joint efforts of the Indian Agricultural Statistics Research Institute (IASRI) and the Computer Centre of the Indian Council of Agricultural Research. The third edition contains the latest information / data as available in the country at the end of October, 1998. The first edition of the Data Book had the information up to the end of 1995 while the second edition contained the information up to July, 1997.

DIVISION OF DESIGN OF EXPERIMENTS

Mandate	Thrust Areas
To develop statistical designs and methodologies for analysis of data relating to field and laboratory experimentation in agriculture and animal sciences.	- Cropping systems research - Information system for agricultural and animal experiments - Experimental designs for agricultural, animal, agro-forestry and fisheries research

Thrust area-wise list of projects in operation is given in **Appendix-II.** The progress of the projects is given below:

Cropping Systems Research

1. Planning, designing and analysis of experiments planned on - stations under the Project Directorate for Cropping Systems Research

Complex experiments were conducted at 37 research stations under All India Coordinated Research Project on Cropping Systems during 1997-98. These experiments were planned with the objectives of (i) development of new cropping systems (ii) nutrient management in cropping systems (iii) development of system based management practices, and (iv) maximum yield research. Design adopted for these experiments were RBD, split plot, strip plot, Factorial RBD, Split-Split plot, 3^2 x 2 partially confounded, BIBD and Balanced confounded ($4x2^2$). The data of about 250 experiments pertaining to 1997-98 crop year were received during 1998-99 and analysed.

Experiments to identify the need based cropping systems for different agro-climatic conditions were conducted during 1997-98. Cropping systems include varieties of crops whose agronomic productivity cannot be directly aggregated, conversion on univariate basis in terms of monetary returns and calories equivalents was done. Soyabean-Wheat-Pearlmillet (F) was found superior in terms of monetary return and Rice - Wheat in terms of calories at Ludhiana. Soyabean-Wheat at Indore and Rudrur, Maize-Sunhemp (GM) -

Sunflower at Kathalgere, Maize-Toria-Patato at Palampur, Rice-Potato-Wheat at R.S. Pura, Rice-Potato+Mustard-Blackgram at Masodha and Rice-Mustard-Groundnut at Chiplima were found superior in terms of monetary return as well as calories.

2. Planning, designing and analysis of on-farm research experiments planned under Project Directorate for Cropping Systems Research

Under Project Directorate for Cropping Systems Research five types of on-farm research experiments were laid out in 32 NARP Zones during 1996-97 *viz.* (i) Crop Intensification (ii) Intercropping (iii) Performance of Crop varieties and their nutrient requirements (iv) Integrated nutrient management under irrigated/rainfed conditions and (v) Experiments on component technology based on regional constraints were planned at different centres on various crops. The data of 3502 experiments conducted during 1996-97 were received and analysed and also results were sent to different officers-incharge. About 2500 experiments conducted during 1997-98 were received and are being processed for statistical analysis.

The promising crop sequences showing high returns are G-Nut-Wheat in S.East Plateau of Bihar , Rice-Pea in Sonitpur, Rice-Potato - Blackgram in Gonda (U.P.) and Soyabean-Wheat in Igatpuri (Western Maharashtra Scarcity). The consolidation of results of experiments conducted during the period 1990-97 on (a) Crop intensification (b) Intercropping and (c) Performance of crop varieties and their

nutrient requirement for optimization of crop production of farmer's field is in progress.

3. Planning designing and statistical analysis of data relating to experiments conducted under 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 analysis of data and (iii) to coordinate the work relating to statistical requirement of the project with the Project Coordinator(LTFE), scientists-in-charge of the Cooperating centres and ICAR.

The data received under the project were analysed using the appropriate statistical techniques to examine the effects of years, blocks within years and treatments, further subdivided into contrasts of interest in interaction with year effects. Data of superimposed treatments in bifurcated plots were analysed using nested two-way design model. Yield and soil nutrients trends over years were obtained with regression models. Residual effects of applied fertilizers on the succeeding crops were studied using analysis of co-variance technique.

Based on the analysis of 25 years (1972-96) data following are some of the salient results achieved: (1) Consequent to twenty five years of continuous cropping and manuring yield levels of maize at Ludhiana and of rice at Pantnagar have started declining rapidly due to the deficiency of micronutrient zinc in their soils. Thus making application of zinc unavoidable for having sustainable yields. (2) For optimum productivity of Kharif rice at Bhubaneswar, Barrackpore and Pantnagar and of Soyabean at Jabalpur, application of secondary nutrient sulphur has become very important. (3) Incorporation of FYM alongwith balanced application of NPK fertilizers has proved to be beneficial for obtaining higher and sustainable crop yields at several locations. This treatment has also left significant residual effects on the succeeding crops in the sequences. (4) Continuous application of NPK fertilizers at optimum and superoptimum levels have resulted in huge built up of phosphorus in soils of Ludhiana,

Coimbatore and Bhubaneswar. The analysis of superimposed treatments data over four years(1993-96) in bifurcated plots have shown that phosphorus application can be reduced upto 50% of the recommended without any adverse effects on yields and soils.

Analysis of 1997-98 data of various characters to be received from the existing locations would be taken up for study of various statistical aspects viz. yield and soil trends, residual effects of treatments, plant nutrient use efficiency, weather effects on crop yields etc. Modification of the on going experimental programme at New Delhi Centre would be undertaken in consultation with PC(LTFE). For this the layout plan for superimposed treatments and the analysis procedure for the subsequent data would be finalized.

Information system for agricultural and animal experiments

4. Agricultural field experiments information system (AFEIS)

Information system of agricultural experiments for diseases management in crops

- The information system is a Sub-System of AFEIS contains the information of about 600 experiments. Data structure of experiments was modified so as to include the diseases on which experiments have been planned. With this modification it has been possible to retrieve the information of experiments conducted on various diseases.

- The database of Agricultural experiments information system was updated with 2600 experiments.

- Software for AFEIS has been modified using Fox-Pro from its early version based on DBASE IV.

- Working of the system was demonstrated in 3 training programmes held for Scientists of ICFRE, Dehradun and Summer School in Design of Experiments, meeting of management Committee and training programme under CAS, IASRI.

- Seminar was delivered to acquaint the scientists of the Institute with working of the project.

- Software of the system, in tune with the latest available technology in computers and Information System focusing on some specific aspects of Agro-technology like crops, nutrient management, weed, management, water management will be developed.

- Information system for experiments on varietal trials, cropping systems etc. will be initiated.

- Studies on Status of Agricultural experiments in different regions of the country by taking state as a unit will be undertaken.

5. Agricultural Experiments Information System for Animal Sciences

The objectives of the project are (i) to collect and compile the experimental data in the various disciplines of animal science research carried out by various Research Organizations / SAUs in the country; (ii) to put the data and results in an approved format; (iii) to prepare coding sheets and store the data through computer; (iv) to prepare index of animal experiments and (v) to prepare database for storage and retrieval of information and other miscellaneous activities related to the project.

An Instruction Manual for storage of data was prepared. It includes schedules, instructions, coding lists, coding sheets and other record formats for storage device. Computer programmes in FORTRAN have also been developed for storage and retrieval of the data.

During 1998, the work on the preparation of format of presentation of results and index for about 525 experiments was completed. Their scrutiny, coding and corrections are under process.

Creation of the computer based data of animal experiments during year 1999 has been initiated.

6. Cataloguing and construction of variance Balanced Block Designs-Computer

algorithms for construction

The objectives of the project are (i) to review the available literature on the methods of construction of variance balanced block designs, (ii) to prepare a catalogue of available variance balanced block designs and their efficiency factor, (iii) to make an attempt to fill the gaps by giving some new methods of construction, and (iv) to give computer algorithms/programme to generate variance balanced block designs.

New methods of construction of binary variance balanced block designs through the use of two partially balanced incomplete block designs with two associate classes, PBIB(2), two balanced incomplete block (BIB) designs and resolvable BIB designs have been obtained. Through these designs it is possible to construct the design for more number of treatments than the number of treatments in the original designs viz. PBIB (2) designs, BIB designs. A catalogue of binary variance balanced block designs upto a replication number of 30 for equireplicated and average replication number of 30 for unequireplicated designs have been prepared. The project has been completed as per objectives.

7. A statistical investigation on the Long-term effects of fertilizers on productivity of cereal crop sequences

The objectives of the project are (i) to estimate the overall fertilizer treatment effects for each crop sequences, (ii) to study the effect of long-term fertilizer use on the yield of different crops, (iii) to develop methodology for (a) determining optimal fertilization practice for each of the crop sequences and (b) estimation of average annual net returns and variance of annual returns for the crop sequences and (iv) to develop yield prediction models for crops included in different sequences.

Literature on Long-term experiments was reviewed since the beginning of its appearance in 1930s Under All India Co-ordinated Agronomic Research Project, permanent plot experiment was initiated during 1983-84 at 35 research centres including all the major crop sequences. After scrutiny, data for 6 centres namely, Akola, Rahuri, Jabalpur, Karamana, Pantnagar and Navsari was

considered for study. Data were available for 10-14 years for these centres. Data were put on floppies for individual year and season. Design adopted was Randomized Block Design and each set of data was analysed accordingly. Bartlett's χ^2 test was applied to study the homogeneity of error variances. Linear and curvilinear trends were fitted and examined for the plot-wise data over the years for both the seasons and for all the centres under study.

8. Construction of efficient designs for asymmetrical factorial experiments

The objectives of the project are (i) to study the possible associations between the combinations of the levels of factor of symmetrical factorial of 2^n and 3^n series and level of factor of asymmetry and (ii) to suggest the most suitable association for given number of factors of asymmetry.

For finding best association scheme the criteria of minimum trace of C-matrix similar to A-optimality was conducted and the other optimality criteria-D and E were also considered.

One of the methods of construction of asymmetrical factorial experiments of $qx2^n$, $qx3^n$ with smaller number of experimental units, involve obtaining first a suitable confounded design for symmetrical factorial experiment (2^n or 3^n) containing a group of pseudo factors for each factor separately. Each pseudo factor is at two or three levels. Next a many to one (one or two) correspondence between the levels of factors of symmetry and the combination of pseudo factors corresponding to that factor has been set up. Since we have several choices for many to one correspondence, one would like to look for one choice which is best in some sense. For finding the best association, the criteria of minimum trace of C-matrix, similar to A-optimality was considered and it was observed that this criteria could only distinguish between the types of association which were equally good. Further efforts were initiated to choose among them. For this purpose the components for linear, quadratic, cubic etc. were considered and criteria based on determinant value of variance-covariance matrix of corresponding estimates of linear, quadratic,..., components were considered. The other criteria based on eigen value and correlations of the estimated contrasts

were also considered. The schemes only provide the answer to the association of how many to how many. This does not, however answer the question of which of the combinations of the levels of pseudo factors are to be used to denote which levels of two factor of asymmetry. This aspect is likely to be significant depending on the interaction component confounded in the symmetrical factorial before using the merger of combinations of pseudo factors to get the levels of factor of asymmetry. This aspect has been considered in the construction of various designs viz. $5x2^2$, $6x2^2$ etc.

9. Study of designs for two or more sets of treatments applied at different periods of experimentation (AP Cess fund, ICAR)

The objectives of the project are (i) to study the characterization properties of the designs for the multistage experiments on the same experimental material with different non-interacting sets of treatments in one-way and two-way elimination of heterogeneity setting (ii) to construct designs under (i) above any d to study their efficiency (iii) to study the optimality aspect of designs under (i) and (ii) above, and (iv) to prepare a catalogue of available designs and those obtained under objectives (ii) and (iii) above.

Designs have been obtained for the situations when the sets of treatments applied in succession are interacting. When the interactions are likely, then these sets of treatments form a factorial set up with the different sets of treatments representing factors and the treatments within the set being the levels of the factors. The designs obtained have orthogonal factorial structure (OFS) with balance and hence all main effects i.e. 1st set of treatments, 2nd set of treatments and interaction effects can be estimated orthogonally. The writing of the report has been completed.

10. Designs for fitting response surfaces in Agricultural Experiments (AP Cess Fund, ICAR)

The objectives of the project are (i) to obtain response surface designs for response optimisation and slope estimation when factors are with equispaced levels and /or have unequal

dose ranges for both symmetrical as well as asymmetrical factorial (ii) to obtain response surface designs for qualitative-cum-quantitative factors (iii) to study the robustness aspects of response surface designs against non-availability of data on some point(s) (iv) to prepare a catalogue of response surface designs suitable for agricultural experiments and (v) to develop a computer software for the analysis of the designs obtained and catalogued and to illustrate empirically.

Some methods of construction of slope rotatable designs with equispaced doses have been obtained.

The work on obtaining response surface designs for asymmetrical factorials is in progress.

DIVISION OF BIOMETRICS

Mandate	Thrust Areas
To conduct basic & applied statistical research in the fields of Biostatistics and Statistical Genetics	▪ Modelling for biological phenomena ▪ Studies in population biology ▪ Statistical studies in animal and plant genetics

Thrust area-wise list of projects in operation is given in **Appendix-II.** The progress of the projects is given below:

Modelling for biological phenomena

1.   Study of contagious distributions and dynamical models for aphid population growth

The objectives are (i) to study various contagious distributions and to critically evaluate their relative merits and demerits (ii) to develop appropriate dynamical models for aphid population growth (iii) to investigate estimation procedures for (i) and (ii) above and (iv) to develop relevant computer programs for fitting the distributions and models and to give illustrations from aphid population data.

Aphid is a small insect which infests almost every plant. It is among the most conspicuous and important pests. In India, aphids are recognized as serious pests of cereals, oilseeds, pulses, and vegetable crops. They cause damage to host plants by sucking the plant sap and thereby arrest their growth and development. It is highly desirable to investigate optimal control policies for controlling this pest. To this end, description of spatial and temporal aspects of an aphid population is of considerable importance.

To describe the spatial spread of aphids, one aspect of interest is aggregation or clustering pattern of population over an area, for which negative binomial distribution is extensively used. However, there are situations in which this distribution does not provide a good fit. Therefore, more advanced contagious distributions like Neyman Type A, Thomas distributions are discussed. Relative merits and demerits of these distributions are highlighted. A listing of computer programs is provided for fitting of these distributions by 'Method of moments' as well as by 'Method of maximum likelihood'. An illustration for fitting of contagious distributions to aphid data on rapeseed crop is also given. To study the temporal spread of an aphid population, a dynamical model is developed in terms of an integro - differential equation. The deterministic model is solved analytically. The corresponding nonlinear statistical model is applied to ten data sets using the procedures of 'nonlinear estimation'. Examination of residuals is carried out to study the validity of the underlying assumptions and subsequently the goodness of fit statistics are computed. The proposed model is found to be quite successful in describing the dynamics of the aphid population growth. As an application of the model, optimum time for insecticidal spray is determined. The above nonlinear dynamical model assumes that the variances of the error term are homogeneous. However, in most applications, this is taken for granted. It is noticed that this assumption of homogeneity of error variances is quite often violated in practice. The procedure for its detection is outlined. Further, in order to stabilize the variance and make the distribution approximately normal, the procedure for obtaining the optimum transformation from the Box - Cox family of power transformations is discussed. As an illustration, aphid population count data on Brown seeded (Pusa Kalyani) mustard crop variety is considered. The

nonlinear dynamical model is fitted to the transformed data by employing the procedures of 'nonlinear estimation.'

Studies in population biology

2.   Investigations on the properties of projection matrices in population biology

The objectives of the project are (i) to study the properties of the population projection matrix with special reference to stable population structures (ii) to arrive at stable population structure using the findings of (i) above and (iii) to study the behaviour of projection matrices and their limit properties when the matrix elements are non stationary over time and stochastic in nature.

Some salient results are that the proportionality factor equalizing the herd strength with the powers of eigen vector is highly sensitive to the changes in population structure. The intrinsic rate obtained as the growth rate of average population size was found higher than one obtained as the average of growth rates of population sizes while studying the effect of stochasticity on the projection matrices. The project is complete.

Statistical studies in animal and plant genetics

3.   Application of bootstrap techniques for studying statistical properties of genetic parameters

The project aims (i) to examine different procedures for assessing the accuracy of genetic parameters, heritability and genetic correlation (ii) to study the sampling distribution of estimates of genetic parameters and (iii) to obtain the optimum number of bootstrap replications for getting the satisfactory estimates of sampling variance and confidence intervals.

The estimates of genetic correlation from the population simulated under parent-offspring model for different combinations of heritability, genetic and phenotypic correlations were obtained. The estimates of genetic correlation were found inadmissible for sample of size 50, the increase in sample size to 100 could provide admissible estimates only for highly heritable traits. Further increase in sample size from 100 to 200 could provide admissible estimate of genetic correlation only for moderately heritable traits. The distribution of genetic correlation as expected was found to be non-normal and skewed in about 95% of cases. The bootstrap estimates of genetic correlation was almost unbiased where the heritabilities of both the correlated traits were high. The bias increased with decrease in heritability of correlated traits. But at the same time the increase in sample size helped to contain the bias within reasonable limits. The bootstrap estimates of standard error were found always higher as compared to their usual estimates. The role of sample size on the estimates of genetic correlation by parent-offspring method needs further investigations. The project is complete.

4.   A study to compare the performance of different methods of estimating repeatability and to assess their stability by bootstrap techniques

The main objectives of the project are (i) to estimate the repeatability by different methods for important traits of some breeds of indigenous cows (ii) to estimate the variance of repeatability of milk yield by the usual methods and also by the new technique called bootstrap and (iii) to compare the efficiencies of different procedures and to estimate the relative variance by bootstrap to assess the stability of the estimate of variance.

The study was undertaken to compare the performance of two methods namely the Fisher's traditional method using Analysis of Variance and multivariate method applying Principal Component Analysis. To give the comparisons for assessing the stability of two methods, the computer intensive bootstrap technique was utilized. It was found that Principal Component Analysis method was more stable and efficient for the adjusted data. The results are based on the investigations made on three breeds of cattle namely Sahiwal, Hariana and Red sindhi using data from military dairy farms at Agra, Bangalore and Meerut. The project is complete.

DIVISION OF FORECASTING TECHNIQUES FOR CROPS, DISEASES & PESTS

Mandate	Thrust Area
To develop statistical models for obtaining pre-harvest forecast of crop production on the basis of biometrical characters, weather parameters and agricultural inputs and also to develop forecast models for incidence and intensity of pests and diseases.	• Forecasting techniques in Agricultural Systems.

Thrust area-wise list of projects in operation is given in **Appendix-II.** The progress of the projects is given below:

Forecasting techniques in Agricultural Systems

1. Yield forecast based on weather variables and agricultural inputs on agro-climatic zone basis

Pre-harvest forecast of production of major crops are of immense value to the Government for deciding policies regarding storage, distribution, price fixation, export-import, marketing of the crop produce, etc. At this Institute, the studies have been carried out to develop forecast model based on time-series data on weather parameters and agricultural inputs for rice and wheat. However, these studies have been carried out at district level only. Moreover, such studies require a long time series data of 25-30 years which are not available for most of the locations. Therefore, present study has been taken up with a view to pool the data of various districts within the agroclimatic zone so that long series can be obtained in a relatively short period and thus, to develop a combined model for agroclimatic zone by introducing some parameters which may take care of variation between districts within the agroclimatic zone. The study has been taken up for wheat in Vindhyachal Plateau and rice in Chattisgarh Plain Zone and Bastar Plateau zone (taken together) in Madhya Pradesh. The methodology utilised district-wise weekly weather data on maximum and minimum temperature, rainfall and percent relative humidity (at 8.30 a.m. and 5.30 p.m.)

area under irrigation, percent area under high yielding varieties, N, P and K for a period 1971-90. Data starting from a fortnight before sowing upto one month before harvest have been utilised. The models similar to ones developed for district level studies have been attempted. For each weather variable two variables were generated, one as simple accumulation and the other one as weighted accumulation of weekly weather variables, weights being correlation coefficients of weather variable in respective weeks with yield or yield adjusted for trend and place effect. Similarly, for interaction of weather variables, weekly interaction weather variables were generated using weekly products of weather variables taking two at a time. Generated variables were obtained either from data pooled over districts within the zone or for each district separately and then pooled for developing the model for agroclimatic zone. Previous years yield, moving averages of yield and agricultural inputs were taken as the variables taking care of variation between districts within agroclimatic zone. Year variable was included to take care of technological changes.

Results indicated that reliable forecasts can be obtained when the crops are 12 weeks old i.e. around two and a half months before harvest. The models using weather and agricultural inputs where weather variables were generated separately for each district within the agroclimatic zone after adjusting yield for place and trend effect were found best for both the crops. Further, the methodology will be useful to forecast yield for the zone even if data on some districts are not available either at the stage of developing the model or at forecasting stage.

The report has been finalised after incorporating referee's comments. To extend the study at state level, a project has been formulated based on the findings of this study for forecasting yield of wheat, rice and sugarcane in U.P. and submitted for funding from AP Cess fund.

2. Study to develop model for assessing effect of floods on yield of crops

So far, no attempt has been made to develop methodology for forecasting crop yields in flood prone area. As a first step towards this, a study has been carried out in order to explore the feasibility of modelling the yield loss due to flood and to develop flood index which could be used as a parameter indicating impact of flood in yield forecast model in flood prone areas. The study was carried out using secondary data already collected at the Institute in Faizabad and Ballia districts of U.P. Models were developed for various tehsils within the districts and also for different scenarios based on texture and topography of the soil. Various crops considered were paddy, arhar, sugarcane and wheat. Flood indices were developed as weighted accumulation of flood parameter at different stages of crop growth, weights being respective correlation coefficients of yield with flood parameters. Another index was developed as sum of products of depth and duration of flood at different stages. These indices were utilised to develop the models. The study reveals the possibility of modeling yield losses due to flood and development of flood indices which could be used as one of the parameters in the models for forecasting crop yields in flood-prone areas. However, this was a preliminary study based on secondary data. More extensive studies are required in this area. Report has been finalised.

3. Use of discriminant function of weather parameters for developing forecast model of rice crop

The objectives of the project are (i) to categorise the year into three groups on the basis of weather parameters (ii) to develop yield forecast model using the discriminant score of weather parameters and the input variables and (iii) to examine the validity of forecast model.

The methodology consisted of (i) development of weather scores: The weather scores based on discriminant analysis are to be obtained on the basis of weather variables so as to maximise the ratio of mean squares of between and within groups. (ii) Testing the significance of centroids: The test statistics proposed by Bartlett (1947) is used to test the significance of discriminant functions based on the null hypothesis that group centroids are all equal. (iii) Classificatory analysis: The classificatory procedure for classifying the individual crop year into three groups involve the computation of distances between each individual observation and each group centroid in discriminant function. (iv) Development of forecast model: A linear multiple regression model is to be developed using weather score, input variables and trend.

Computation of weather score for each individual year and each group centroid was carried out to classify the individual crop year into three groups i.e. congenial, normal or adverse. These discriminatory weather scores alongwith input variables were used for the development of forecast model for rice crop.

4. Pilot study for developing Bayesian probability forecast model based on farmers' appraisal data on wheat crop

The study was conducted with two objectives viz., (i) to develop the Bayesian probability model for forecasting the wheat crop yield and (ii) to enlist the factors affecting the crop yield based on farmers' appraisal.

The methodology consisted of conducting a survey in Muzaffarnagar district following a stratified multistage random sampling design. Taking tehsils as strata, villages as first stage units and farmers as experts, a random sample of 90 experts was selected. The expert opinion data are to be collected in a number of rounds by interviewing the selected experts regarding their assessments about the likely crop production and chances of occurrences. In the first round requisite information were collected for establishing an approximate distribution of crop yield. After summarising the responses in various yield classes, each expert was asked in round two to estimate the chances in favour of getting yield in various classes. From these responses

average prior probabilities were computed. At harvest, wheat yield data were obtained by enquiring the selected farmers. Actual harvest yield and farmers' appraisal data on yield were taken into account to obtain the posterior probabilities.

The work of collection of data for the year 1997-98 is over. The collected data have been scrutinised and the discrepancies observed were rectified. The schedules to be used in the collection of field data during the third round of survey have been finalised. Further collection of data for the year 1998-99 was in progress. During the period under report the data collected earlier during the crop seasons 1996-97 and 1997-98 were analysed. An open seminar was also delivered on the basis of the results obtained with the first round of data.

During the next year survey will be repeated and Bayes yield forecast for wheat will be developed.

5. Development of Forewarning System for Aphids, Myzus persicae (Sulzer) on Potato

Aphid free period during the growth period of potato is very important for growing virus-free potato seed tubers. However, it has been found that a low aphid population (20 aphids or less per 100 leaves) is not harmful for growing potato seed tubers. To study the behaviour of aphids, aphid populations alongwith various weather parameters, viz. maximum temperature, relative humidity, minimum temperature, rainfal have been collected over a long period of time from different parts of the country, such as, Pantnagar, Kalyani, Deesa etc. under All India Potato Improvement Project. It is desirable, to develop a forewarning system to warn the potato seed growers well in advance, about the possible aphid population. With this view, the data on aphid population as well as weather parameters were grouped according to weeks. Various models were tried to develop suitable models for different weeks. To develop a model for a particular week, the aphid population of that week over the years have been taken as a dependent variable. One week and two weeks lagged weather variables have been considered as independent variables. However, to reduce the number of variables, only best four variables have been selected through step-wise regression

analysis for inclusion in the final model. Finally, non-linear models and the models using Group Method of Data Handling (GMDH) technique were fitted.

For example the suitable non-linear model fitted for January 1st week in Kalyani is as follows :

$$ y = a + b \cos \left(\sum_{i=1}^{4} c_i x_i \right) + e $$

where y = Aphid population of current week.

x_1 = Maximum temperature of the previous week

x_2 = Minimum relative humidity of the previous week (14 hrs.)

x_3 = Minimum temperature in previous to previous week

x_4 = Maximum R.H. of the previous to previous week.

a, b and c_i 's are constant to be estimated and e is the error term. The predicted values from this model are very close to observed ones. Models fitted for other weeks are same except the independent variables included are different for different weeks. So far development of models for the centres Pantnagar and Kalyani has been completed. Fitting of models for other centres is in progress.

Using GMDH technique the week-wise models have been fitted for the centres Pantnagar (U.P.), Kalyani (West Bengal), Dessa (Gujarat), Chhindwara (M.P.) for which the data for each week was available for sufficient number of years. Wherever the data were inadequate, the models were fitted by combining the data points from different weeks. Consequently, the week-wise models could not be fitted. These centres were Modipuram (U.P.) and Hissar (Haryana). The results are encouraging because the value of R^2 in most of the cases is around 0.80-0.95 and the observed and predicted values are quite close to the extent that the per cent deviation is less than 20-25% in majority of the cases. The validation of the models is in progress.

6. Development of early warning and yield assessment models for rainfed crops based on agrometeorological indices.

The objectives of the project are (i) to prepare agrometeorological indices for early

warning and yield assessment of rainfed crops (ii) to develop models using agromet indices for early warning and yield assessment and (iii) to validate the models and provide early yield assessment. Water balance technique will be used to prepare agrometeorlgical indices.

Meteorological data for Raipur (M.P.), New Delhi and Parbhani (Maharashtra) were collected. Preparation of data files for computer analysis is in progress. Information regarding water holding capacity of soils, crop growth phases, rooting pattern, crop coefficients and critical stages of crop growth is being collected.

DIVISION OF STATISTICAL ECONOMICS

Mandate	Thrust Areas
To develop appropriate Stochastic Models and Methods for Quantification of Economic Phenomena related to agriculture	▪ Technological change and its diffusion in agriculture ▪ Resource use efficiency in agriculture ▪ Modelling for Demand

Thrust area-wise list of projects in operation is given in **Appendix-II.** The progress of the projects is given below:

Technological change and its diffusion in agriculture

1.   Estimation of farm level technical efficiency and its related parameters under error decomposition methodology of stochastic frontier in the production of wheat

The objectives of the project are (i) to examine production elasticity of various inputs (ii) to estimate the related parameters of technical efficiency, namely, variances of one-sided error term and symmetric error term and ratio of standard error of one-sided error term to symmetric error term (iii) to identify the discrepancy parameter of finding discrepancy between observed actual output and maximum output   (Frontier) (iv) to measure mean technical efficiency of sample farm and (v) to estimate the technical efficiency of individual farms.

The corrected least square (COLS) estimator was used to estimate the stochastic frontier production functions using data for Haryana and Punjab farms for the years 1985-86 and 1986-87.

The research findings associated with Punjab farmers reveal that there is a little scope for increasing technical efficiency. They have proved to be the efficient managers of wheat production. Study also revealed that there is a considerable scope of increasing technical effciency on farms in Haryana state.

2.   Economic Study of micro-irrigation systems on farmers' fields

The objectives of the project are (i) to study the impact of micro-irrigation on crop production/productivity, saving of resources, income and employment (ii) to estimate the credit needs for adoption of micro irrigation technology on farmers' fields (iii) to examine the effects of subsidy on adoption of micro-irrigation technology and (iv) to explore the potential of the micro-irrigation technology, constraints in its adoption and production measures to be adopted in future.

Impact of micro irrigation system was studied by estimating the benefit cost ratios on farms with and without this technology. Credit need was also evaluated. The effect of subsidy on benefit-cost ratio was also examined. The data for this purpose was collected through a survey in Gurgaon and Mahendergarh district for 1996-97 and 1997-98.

With the advent of micro-irrigation in Gurgaon and Mahendergarh districts of Haryana the benefits of drip irrigation in orchards are taken by only large farmers while sprinkler irrigation is being used by farmers irrespective of size of holdings. The benefit/cost ratios were computed for Guava, Ber, Aonla, Kinnow, Mausami and Anar orchards which are popular in the area. In Gurgaon some of the farms have introduced strawberry and Gladiolus and it was found that both crops are more profitable under drip irrigation.

(b) Consultancy in Agricultural Research Data Processing

Eight M.Sc./Ph.D./research workers were provided help in data processing and interpretation of results as per details given below:

1. Sh. Manoj Kumar Rana, K.P.G College, Simbhaoli.
2. Dr. B. Ramesh, Lecturer, Department of Agricultural Botany, CCS University, Meerut
3. Dr. Vinay Dubey, Plant Breeder, Ghaziabad.
4. Sh. Jagdish Narvariya, College of Agriculture, Indore (M.P.)
5. Sh. Pradeep Kumar, CCS University, Meerut
6. Sh. Inder Singh, I.A.R.I., New Delhi
7. Sh.Rakesh Dhanjal, J.V.College,Baraut, Baghpat
8. Sh.M.Amin Zargar, S.K.Univ. of Ag. Sci. & Tech., Shalimar, Srinagar, Kashmir

(c) Guidance to students from other Universities

Guidance provided for Industrial Training Programme to Ms. Anjali Sehgal , Sinhgad Institute of Management, PUNE for the project on "Telephone and Library Reprint Information System (WEB BASED)" from 1.7.98 to 18.11.98 as a part of Degree Programme of Master of Computer Application.

To provide computer services in the Institute

(a) Selective Dissemination of Information

Bioinformatics Centre provided services to Scientists in the NARS in terms of searching from the bibliographic databases and to the scientists of the Institute for colour output of certificates, cover pages and laser outputs for various documents. It received 41 requests from other institutes of ICAR and output of 35,728 abstracts were provided to them.

(b) Data Entry

Personal Computers in the division were used to prepare data records on floppies as under:

Total jobs	:	143
Total records created	:	96,993
Total records corrected	:	27,145

(c) New Computing Facilities Provided in the Institute

(i) Purchase of Computer Hardware and other Peripherals

Keeping eye on the technological developments in the IT field, the new operating systems and the large number of machines connected on the network, it was necessary to upgrade/replace the existing computer hardware and also purchase new computers. Accordingly, the following computer hardware and related equipment has been procured and installed:

S. No.	Equipment/Software	No.	Purchased or Upgraded/ Replaced
1.	PENTIUM II 233 MHz, 32 MB RAM, 3.2 GB Hard disk, 1.44 MB FDD, 32 X CD-ROM Drive and 10/100 MBPS Ethernet card, Multimedia kit	5	Purchased Under the Centre of Advanced Studies
2.	Pentium 166 MHz speed, 32 MB RAM, 2.1 GB hard disk, 1.44 MB FDD, CD-ROM Drive, 10/100 MBPS Ethernet card	30	Replacement/ Upgradation
3.	Celeron 266 MHz speed, 32 MB RAM, 2.1 GB hard disk, 1.44 MB FDD, CD-ROM Drive, 10/100 MBPS Ethernet card	30	16 systems as replacement/ upgradation and 14 systems Purchased Under the Centre of Advanced Studies
4.	Digitizer	1	AP-Cess Funded Project
5.	Global Positioning System	1	AP-Cess Funded Project
6.	CD-Writer-Plus (Rewritable)	1	New Purchase
7.	UPS 0.45 KVA	15	New Purchase

8.	UPS 0.5 KVA	30	26 from the Institute funds and 4 under the Centre of Advanced Studies
9.	A2 size Colour Inkjet Printer	1	AP-Cess Funded Project
10.	A 4 size Colour Inkjet Printer	1	Under the Revolving Fund Scheme
11.	A4 size Colour Inkjet Printer	1	National Fellow
12.	Dot Matrix Printers Epson LQ 1050+	10	Replacement
13.	Dot Matrix Printers Epson LX 300	28	Replacement
14.	Upgradation of RAM in two systems from 32 MB to 64 MB/96 MB	-	Upgradation in two Pentium II 233 MHz

(ii) Structured Cabling at IASRI

With the advances in Information Technology and the requirements at IASRI, the new structured cabling for 65 nodes at IASRI's computer center building using the world class standard AMP products was done under the ARIS programme. The 65 nodes with the transfer speed of 100 MBPS were installed and for managing all these nodes the "NETCONNECT" rack was installed where the cables from different rooms terminate and the patch cords from these are used to connect in the 24 Port Bay Networks hubs. The two new 24 port Bay Networks hubs along with the existing two 16 port hubs were mounted on the rack and the whole network was manageable. All the four hubs are now cascaded and with this the Internet connection has become much faster.

(iii) Software Packages

Following new software packages were purchased in this year. These new packages were necessary so as to keep pace with new emerging technologies:

(a) Microsoft Visual Studio 97 (Enterprise Edition)

The Visual studio 97 is the complete suite of various software packages namely: Visual Basic (5.0), Visual C++ (5.0), Visual J++ (JAVA), Visual FoxPro. Apart from the development tools it also has the Visual InterDev, Visual Source Safe and the Transaction Server and SQL Server. Now with this suite the students doing Masters degree in Computer Application can concentrate on the latest technology and IASRI can develop the application, which are related to INTERNET and INTRANET.

(b) Microsoft Office 97 (Enterprise Edition)

The new Office 97 suite was purchased at IASRI and it has more capabilities as compared to the older MS-Office version 4.3. Apart from the existing capabilities it has many more facilities in Word, Excel, Power Point, Access. It has the new Outlook Express (used for the POP facility of electronic mail) and the scheduler for time and schedule management. It has facility to make Internet ready databases, spreadsheets, word documents and the power point slides developed using the MS-Office 97.

(c) Microsoft Project 98

The latest Microsoft Project 98 was purchased for IASRI. This software package is very useful for planning and managing the research and development activities. This software helps us to plan a research activity and take decision in a proper way. MS-Project 98 will be used for training the ICAR and the SAU's staff in the project management field.

(d) STAR 3

A user friendly, menu-driven interactive microcomputer statistical package containing the computing package and some of the data sets from Non-Linear Time Series: A dynamical System Approach.

(e) Norton Antivirus

Latest antivirus computer software on CD purchased.

Activities relating to resource generation

A total amount of Rs.6,87,805=00 has generated through training programmes, analysing data on computers and sale of SPAR1 package.

Short Term Training Programs in Information Technology (Revolving Fund Scheme)

The objectives are (i) to train manpower in the field of Information Technology and (ii) To expose the Scientists of NARS to latest developments in Information Technology.

The Council approved a Revolving Fund Project entitled Short Term training programs in Information Technology at IASRI, New Delhi, and sanctioned Rs. 40,00,000/=(Rupees forty lakhs only) vide No. F.No. 30-1/98-AE dated 05.02.99. The modalities and the process of recruitment, procurement of materials was to be completed in the first six months of the 1st year of the project. Five persons on contract basis (1 year contract extendable upto the maximum period of 3 years) were selected out of which three were selected as teaching assistant and two as teaching associates II. Out of five candidates selected for Teaching only four joined the Scheme in the month of November, 1998.

These four faculty members were asked to prepare the training program presentation scripts in Microsoft Power Point along with the lecture notes in the form of a Reference Manual. In the meantime Project Leader and Director, IASRI was contacted by the CCS HAU, Hissar for the training of their scientists/staff going abroad for AHRD training.

The program for the ten trainings till 31st march, 1999 on "Microsoft OFFICE (97) & SPSS" were finalised for the faculty of CCS HAU, Hissar as below:

Training for the faculty of CCS Haryana Agricultural University was planned as per their demand covering the topics i) Windows, ii) Microsoft -Word 97, iii) Microsoft -Excel 97, iv) Microsoft -PowerPoint 97, v) E-mail, vi) Internet and vii) SPSS. The first training program was started from 7th December to 12th December 1998. It was inaugurated by the Director, IASRI. The valedictory function for this training program was arranged on 12th December, 98. The certificates to the participants were distributed by Prof. Anwar Alam, DDG(Engg.), ICAR as Chief Guest. The training program was well received by the participants with appreciation for the efforts of young faculty as indicated in the feed back received.

Institute completed 5 training courses for CCS HAU, Hisar in the batches of 20 each upto 20th February 1999.

The detailed training schedule under RFS till 30th September, 1999 was prepared and sent to all the ICAR institutes and all the State Agricultural Universities of the country for inviting nominations of the participants in the year 1999-2000.

LIBRARY AND DOCUMENTATION SERVICES

Library and Information Services plays an important role in serving the Institute's scientific, technical and student community as a Centre for Scientific Literature and Information related to the Institute's mandate. The Library System of the IASRI is one of the resourceful centres in the country, specialised in Agricultural Statistics and Computer Application and allied fields. The library system of the Institute provides documentation and information services to in house scientists, students and researchers as well as users from ICAR Institutes and Agricultural Universities.

The Library Advisory Committee plays a advisory role in the management of the Library System and all proposals relating to enrichment of resource base of the Library pertaining to the scientific books, journals and major equipments etc. are finalized by this body. During 1998-99 consitution of the Library Advisory Committee has been as under.

1.	Dr SD Sharma	Chairman
2.	Dr Prajneshu	Member
3.	Dr AK Srivastava	Member
4.	Dr RK Pandey	Member
5.	Dr RC Jain	Member
6.	Dr VK Sharma	Member
7.	Dr PK Malhotra	Member
8.	Dr HVL Bathla	Member
9.	Sh Mahesh kumar	Member
10.	Sh SN jha	Member
11.	Sh VR Srinivasan	Member
12.	Dr SS Srivastava	Convenor

Library Information Services

The reprographic section of the Library is meeting, day to day requirements of scientific, technical, administrative and students community efficiently.

To keep informed with latest development in their field following documentation services are provided by the Library System

- Current Content Service
- Current Book Review
- Select Bibliography
- CD Searches

Brief Statistics

1)	No. of Books added	:	280 (English)
			100 (Hindi)
2)	No. of Gray Information material added	:	164
3)	No. of Indian & Foreign Journals subscribed	:	120
4)	No. of Publication issued from the Library	:	15070
5)	No. of Publications consulted within the Library	:	18000
6)	No. of Publications borrowed or lent out on ILL	:	58
7)	No. of readers who visited the Library	:	16560
8)	No. of Issues of Current Contents brought out	:	12
9)	No. of pages of scientific & technical nature reprographed	:	28,666
10)	No. of reprints issued to users	:	31
11)	No. of Indian Newsletter received on complimentary basis	:	180

TECHNOLOGY ASSESSED AND TRANSFERRED

In the project on 'Estimation of flow and change in dynamic populations' an attempt has been made to develop the estimators for compositional changes in terms of number of units in dynamic population due to cross movements of units in two classes over the two occasions under general developmental phenomenon and various causal factors by adopting the successive sampling plan and by making use of projective geometry approach and transition probability matrix approach. The study is useful in the agricultural planning from the view point of knowing the socio-economic status of various classes of the farming community in the country.

The results obtained in the research project on 'An analysis of yield gap for buffaloe milk' are useful to the feed manufacturers who formulate their concentrate keeping in view the nutritional requirements of the animals. In order to obtain the optimum milk yield with the limited resources available with the farmers, they intend to follow a combination of the feeding schedules responsible for it. The overall direct effect of green fodder is 0.1276, that of concentrate is 0.6534 but the effect of dry fodder is -0.0222. An increase of 1.4 Kg. in milk yield may be achieved by feeding additional 1 kg of concentrate followed by an increase @ 0.029 kg in it for an unit increase in feeding of green fodder. The contribution of DCP towards milk yield for an unit increase is 5.20.

To study the functional relationship between the yield of important vegetable crops and various input components and the response of changing levels of different inputs on the yield of vegetable crops, a project entitled 'A study on the effect of various input components on the yield of important vegetable crops' was undertaken . This study will help the cultivators to understand the behaviour of various inputs towards the cultivation of vegetable crops and economise the use of inputs for maximum benefits.

A software for storage and retrieval of data from the database was developed using dBASE IV. The appropriate software for analysis of data was also developed.

EDUCATION AND TRAINING

Degree Courses

The Institute continued to conduct the following degree courses in collaboration with Post Graduate School of Indian Agricultural Research Institute (IARI) which has the status of a Deemed University:

(i) Ph.D. (Agricultural Statistics)
(ii) M.Sc. (Agricultural Statistics)
(iii) M.Sc. (Computer Application)

Both Ph.D. and M.Sc. students are required to do courses not only in Mathematics and Agricultural Statistics but also in Agricultural Sciences like Genetics, Agronomy, Agricultural Economics. All courses in Mathematics, Statistics and Computer Application, etc. are offered at this Institute while the courses in Agricultural Sciences are offered at the I.A.R.I.

The eligibility qualification for admission to Master's degree in Agricultural Statistics is a Bachelor's degree in Agriculture / Horticulture / Forestry / Agroforestry / Sericulture / Agricultural Marketing or B.Sc. (10+2+3 system). For admission to Master's degree in Computer Application, the eligibility qualification is a Bachelor's degree in Agriculture / Computer Science / Agricultural Engineering / or B.Sc. (10+2+3 system). Further, for admission to Doctor's degree in Agricultural Statistics, the eligibility qualification is a Master's degree in Agricultural Statistics or Statistics or Mathematical Statistics or Bio-Statistics of IVRI or Professional Statisticians' Certificate Course (PSCC) from IASRI

Number of students admitted completed various courses during 1998 - 99 is as follows:

i) Ph.D. (Agricultural Statistics)

Three students were admitted and three students have completed Ph.D. (Agricultural Statistics).

ii) M.Sc. (Agricultural Statistics)

Three students were admitted and two students have completed M.Sc. (Agricultural Statistics).

iii) M.Sc. (Computer Application)

Five students were admitted and three students have completed M.Sc.(Computer Application)

Other Training Programmes

A specialised training programme in Agricultural Statistics was organised for 16 participants of International Statistical Education Centre (ISEC) on November 3, 1998. Forty two trainees of XXI and XXII batch of Indian Statistical Service (ISS) probationers sponsored by Central Statistical Organisation, New Delhi visited this Institute on March 20, 1998 and January 8, 1999. The probationers were exposed to the latest research activities in the different Divisions of the Institute namely, Sample Survey Methodology, Design of Experiments, Forecasting Techniques, Biometrics, Computer Applications and Statistical Economics.

Training programmes for M.Sc. and Ph.D. students of various State Agricultural Universities like Punjab University, Chandigarh, University of Agricultural Sciences, Bangalore and Maharshi Dayanand University, Rohtak were also organised during the year.

Research Fellowships

During 1998-99, 16 M.Sc. and 9 Ph.D. students received research fellowship, 12 M.Sc. students received Junior Research Fellowship at the rate of Rs.3600/- p.m. each besides Rs.6000/- per annum as contingent grant. Four M.Sc. students received IARI Junior scholarship at the rate of Rs.3200/- p.m. each besides Rs.6000/- per annum as contingent grant. 9

Ph.D. students received IARI Senior Scholarship at the rate of Rs.4400/- p.m. in addition to Rs.10,000/- per annum as contingent grant.

Faculty members of P.G. School, IARI in Agricultural Statistics

1. Dr.Prajneshu,Professor (Ag.Stat.)
2. Dr.A.K.Srivastava,Principal Scientist
3. Dr.R.C.Jain, Principal Scientist
4. Dr.H.V.L.Bathla, Principal Scientist
5. Dr.Randhir Singh, Principal Scientist
6. Dr.B.S.Sharma, Principal Scientist
7. Dr.V.K.Sharma, Principal Scientist
8. Dr.(Mrs.) Ranjana Agarwal, Principal Scientist
9. Dr.V.T.Prabhakaran, Principal Scientist
10. Dr.V.K.Gupta, National Fellow
11. Dr.B.C.Saxena, Senior Scientist
12. Dr.D.P.Handa, Senior Scientist
13. Dr.V.K.Bhatia, Senior Scientist
14. Dr.G.C.Chawla, Senior Scientist
15. Mrs.Asha Saxena, Senior Scientist
16. Dr.D.L.Ahuja, Senior Scientist
17. Dr.U.C.Sud, Senior Scientist
18. Dr.Chandrahas, Senior Scientist
19. Sh.S.D.Wahi, Senior Scientist
20. Dr.K.K.Tyagi, Senior Scientist

21. Dr.P.K.Batra, Senior Scientist
22. Dr.P.S.Rana, Senior Scientist
23. Dr.R.Srivastava, Senior Scientist
24. Dr.Jagbir Singh, Senior Scientist
25. Dr.M.S.Narang, Senior Scientist
26. Dr.Aloke Lahiri, Scientist (Sr.Scale)
27. Dr.V.P.N.Singh, Scientist
28. Dr.Anil Rai, Scientist
29. Dr.(Mrs.) Seema Jaggi, Scientist
30. Dr.Rajender Parsad, Scientist
31. Dr.Lal Mohan Bhar, Scientist
32. Dr. Amrit Kumar Paul, Scientist
33. Dr. Tauqueer Ahmed, Scientist
34. Dr. A.R.Rao, Scientist

Faculty members of P.G. School, IARI in Computer Application

1. Dr.S.D.Sharma, Director
2. Sh.Mahesh Kumar, Professor (Computer Application)
3. Sh.S.N.Mathur, Principal Scientist
4. Dr.P.K.Malhotra, Principal Scientist
5. Dr.I.C.Sethi, Senior Scientist
6. Dr.D.K.Agarwal, Senior Scientist
7. Dr. R.C.Goyal, Senior Scientist
8. Dr. V.K.Mahajan, Senior Scientist
9. Sh.Harnam Singh Sikarwar, Scientist

Training Programmes in Computer Application

A. National Training Programmes

Sl. No.	Type of Training	Title	Period	No.of Participants
1	Training under the Centre of Advanced Studies	Design and analysis of field experiments	30.3.98 to 14.4.98	19
2	Training programme for officials of S.A.U.'s and ICAR**	Introduction to MS Office	13.4.98 to 18.4.98	19
3	Training programme for officials of S.A.U.'s and ICAR Institutes.**	Introduction to Statistical Packages	27.4.98 to 2.5.98	8
4	Training programme for officials of NCAP**	Introduction to SPSS	27.4.98 to 2.5.98	8
5	40th Ad-hoc Training programme**	Use of Computers in Agricultural Research	11.5.98 to 23.5.98	21
6	Training programme for officials of S.A.U.'s and ICAR Institutes**	Introduction to MS Office	1.6.98 to 6.6.98	18

Sl. No.	Type of Training	Title	Period	No.of Participants
7	Training under the Centre of Advanced Studies	Recent Advances in Survey Sampling relating to Agricultural Statistics	8.6.98 to 13.6.98	13
8	Training programme for officials of S.A.U.'s and ICAR Institutes**	Introduction to Statistical Packages	16.6.98 to 20.6.98	5
9	Summer School	Advances in Statistical Design for Agricultural Research	24.6.98 to 14.7.98	25
10	Summer School	Use of Computers in Information Processing	16.7.98 to 5.8.98	20
11	Training under the Centre of Advanced Studies	Advances in Statistical Genetics and Bio -Statistics	31.7.98 to 14.8.98	22
12	Training Course for officials of CSO**	Recent Advances in the Analysis of Survey Data	24.8.98 to 29.8.98	17
13	Training Course for Scientists of Indian Council of Forest Research Education, Dehradun**	Research Methodology with special emphasis on Statistics	1.9.98 to 30.9.98	20
14	Training Programme for Officials of SAUs and ICAR Institutes.	Introduction to MS Office	14.9.98 to 26.9.98	23
15	Training Course for Scientists of Indian Council of Forest Research Education, Dehradun**	Research Methodology with special emphasis on Statistics	6.10.98 to 5.11.98	20
16	Training Program for officials of SAUs and ICAR Institutes**	Introduction to MS Project	12.10.98 to 17.10.98	11
17	Training Programme for the Staff of Education Division,ICAR Head Quarters under the Centre of Advanced Studies	Introduction to Windows, MS-Office and E-mail	2.11.98 to 13.11.98	20
18	41st Ad-hoc Training Programme**	Use of Computers in Agril.Research	16.11.98 to 28.11.98	22
19	Training Programme for the Staff of ICAR Head Quarters**	Introduction to Windows, MS-Office and E-mail	1.12.98 to 7.12.98	21
20	Training Programme for officials of SAUs and ICAR Institutes under Revolving Fund Project	MS-Office-97 (I)	7.12.98 to 12.12.98	20
21	Training Programme for officials of SAUs and ICAR Institutes**	Introduction to Internet	14.12.98 to 19.12.98	22
22	Training Courses for Scientists of Indian Cuncil of Forest Research Education, Dehradun**	Research Methodology with special emphasis on Statistics	5.1.99 to 3.2.99	20
23	Training Programme for officials of SAUs and ICAR Institutes under Revolving Fund Project	MS-Office-97(I) and SPSS	11.1.99 to 16.1.99	20

Sl. No.	Type of Training	Title	Period	No.of Participants
24	Short term training course for SAUs and ICAR Institute personnel**	Introduction to MS-Office	11.1..99 to 23.1.99	24
25	Training Programme for officials of SAUs and ICAR Institutes under Revolving fund project	MS-Office-97 and SPSS	1.2.99 to 6.2.99	20
26	Training Programme for officials of SAUs and ICAR Institutes under Revolving fund project	MS-Office-97 and SPSS	8.2.99 to 13.2.99	18
27	Training Programme for officials of SAUs and ICAR Institutes under Revolving fund project	MS-Office-97 and SPSS	15.2.99 to 20.2.99	22
28	Training Programme Under the Centre of Advanced Studies	Efficient designing of experiments and analysis of experimental data	16.2.99 to 2.3.99	20
29	Training Programme Under the Centre of Advanced Studies	Computer and graphical assisted multivariate data analysis	8.3.99 to 20.3.99	21
30	Training Programme for the officials of CSO**	Methodological aspects in sample surveys	8.3.99 to 13.3.99	17
31	Training Programme for the officials of CSO**	Small area estimation theory and applications	22.3.99 to 27.3.99	15

** As a part of resource generation activity

B. *International Training Programmes*

Sl. No.	Type of Training	Title	Period	No.of Participants
1.	International Training Programme for Sri Lankan Officials	Recent developments in crop forecasting and related areas under FAO Project SRL/91/023-Market intelligence and food information system	2.11.98 to 13.11.98	3
2	International Training Course for officials of Nigerian Government	Remote Sensing and GIS Applications	11.1.99 to 23.1.99	3

Prof A Alam, DDG (Engg), ICAR presenting memento to Prof Prem Narain, Former Director of the Institute for delivering Nehru Memorial Lecture

A bouquet is being presented to Prof SL Mehta, DDG (Edn.) ICAR in a Valedictory function of the training programme on Advances in Statistical Genetics and Bio-Statistics

AWARDS AND RECOGNITIONS

- Dr. AK Srivastava, Principal Scientist & Head of Sample Survey Division was awarded PV Sukhatme Memorial Gold Medal for his contributions in the field of Agricultural Statistics by the Indian Society of Agricultural Statistics (ISAS) at its 52nd Annual Conference organised by Acharya N. G. Ranga Agricultural University, Hyderabad during Dec 17-19, 1998.

- Dr. Tauqueer Ahmed, Scientist received Jawaharlal Nehru Award for Outstanding Post-Graduate Agricultural Research for the year 1997 at the ICAR Award Ceremony held at Vigyan Bhavan, New Delhi on July 16, 1998.

- Indian Council of Agricultural Research awarded Certificates of Appreciation for organising programmes for Human Resource Development and developing excellent instructional material in commemoration of Golden Jubilee Year of Independence to:

(i) Dr. SD Sharma, Director of Centre of Advanced Studies in Agricultural Statistics and Computer Application.

(ii) Dr. PK Malhotra, Director of Summer School in Use of Computer in Information Processing.

(iii) Dr. VK Sharma, Director of Summer School in Advances in Statistical Designs for Agricultural Research.

LINKAGES AND COLLABORATION IN INDIA AND ABROAD INCLUDING EXTERNALLY FUNDED PROJECTS

Sl. No.	Title	Collaborative Agency	Start	Completion
1.	Sample survey to evolve methodology for estimation of fish catch from rivers and streams especially of the hilly areas	Department of Fisheries, Himachal Pradesh	Nov., 1997	Dec., 1999
2.	Pilot sample survey for estimating the area and yield rates of ginger and potato in hilly areas	Directorate of Economics & Statistics, Meghalaya, Shillong.	Jan., 1997	Jun., 1999
3.	Use of remote sensing technology in crop yield estimation surveys	IIRS, Dehra Dun	Apr., 1995	Jun., 1998
4.	Use of Remote Sensing satellite data in crop surveys (A.P. Cess Fund)	-	Oct., 1996	Sep., 1999
5.	Study of land use statistics through integrated modelling using geographic information system. (A.P. Cess Fund)	All-India Soil & Land Use surveys, Min. of Agriculture	Approved	
6.	Estimation of wool production - emerging data needs and a methodological reappraisal. (A.P. Cess Fund)		Submitted	
7.	A study to investigate the causes of variation between official and trade estimates of cotton production. (to be funded by Directorate of Eco. and Statts., Min. of Ag. and Coop., Govt. of India)		Submitted	
8.	A pilot study on cost of production of Coconut in Kerala. (to be funded by Coconut Development Board, Kochi, Kerala)	CPCRI, Kasargod	Submitted	
9.	Planning, designing and statistical analysis of data relating to experiments conducted under AICRP on Long-Term Fertilizer Experiments	PC(LTFE) and State Agricultural Universities	Jul., 1985	Continuing
10.	Planning, designing and analysis of on farm research experiments planned under the PDCSR	Directorate of Cropping Systems Research, Modipuram, Meerut	Apr., 1986	Continuing
11.	Planning, designing and analysis of experiments planned on stations under the PDCSR	Directorate of Cropping Systems Research, Modipuram, Meerut	Apr., 1986	Continuing
12.	Study of designs for two or more sets of treatments applied at different periods of experimentation	AP Cess fund	Apr., 1996	Dec., 1998

Sl. No.	Title	Collaborative Agency	Start	Completion
13.	Designs for fitting response surfaces in agricultural experiment	AP Cess fund	Feb., 1999	Jan., 2001
14.	Development of Forewarning System for Aphids, Myzus persicae (Sulzer) on Potato.	N.C.I.P.M., New Delhi.	May, 1996	Apr., 1999
15.	Economic Study of Micro-irrigation System on Farmers' Fields	Collaboration with Water Technology Center, IARI.	Apr., 1996	Mar., 1999

RESEARCH COORDINATION AND MANAGEMENT UNIT

Research Coordination and Management Unit (RCMU) is responsible for documentation and dissemination of scientific output of the Institute through IASRI News and Annual Report etc. It also organises National Conferences of Agricultural Research Statisticians once in three years and conducts meetings of Heads of Divisions and Principal Scientists of the Institute from time to time. The Unit also assists the QRT and is responsible for correspondence with ICAR, ICAR Institutes, SAUs and other organisations in India and abroad. The other functions of the unit are: to examine the new Research Project proposals before these are considered by the SRC in respect of importance of problems, its design and final requirements; to monitor the progress of on-going research projects and to bring out half yearly monitoring progress reports; to prepare Annual Action Plan, Activity Milestone, EFC Memo, to maintain the Research Project Files and also their submission to ARIC (ICAR). The Unit also provides help in Art, Photography & Reprographic Services. The following activities were undertaken by the Unit during the year under report:

Publications:

- Golden Jubilee issue of Souvenir entitled 'Advances in Agricultural Statistics and Computer Application' (1998)
- Annual Report of the Institute for the year 1997-98
- IASRI News, Vol. 2, No. 3, Oct. - Dec., 1997
- IASRI News, Vol. 2, No.4, Jan. – Mar., 1998
- IASRI News, Vol. 3, No. 1, Apr. – Jun., 1998
- IASRI News, Vol. 3, No. 2, Jul. – Sep., 1998
- IASRI News, Vol, 3, No.3, Oct. – Dec., 1998
- Monitoring Progress Reports for ending Mar., 1998 and Sep., 1998

- Proceedings of Staff Research Council Meetings held on Aug 26-27, 1997

Communication of Research Material to:

ICAR

- Proposal for organisation of Summer Schools/Winter Schools and short courses during 1998
- Material for preparation of DARE/ICAR Annual Report for the year 1998-99
- Mandate of the Institute for the publication in the ICAR Handbook
- Profile of the Institute for publication in ICAR Newsletter
- List along with addresses of Ex-Directors of the Institute
- Information regarding action taken on the recommendations made by QRT of the Institute for the period 1987-95
- Reply of audit memo regarding QRT of the Institute
- Photographs and organograms depicting building of the Institute/research achievements for the publication of Brochure on the Institute
- DG's message for the memorial volume in the name of Late Prof. Sukhatme
- Information about various major accomplishments and problems faced by the Institute during 1998 for DG, ICAR
- Provisional starred Lok Sabha question by Dr Saroja V, regarding research centres of projects answered on March 3, 1999
- Action taken report on the recommendations of the Directors'meeting held on March 4-5, 1999 and agenda items proposed for the Directors' meeting held on Oct 7-8, 1998
- Follow-up action report on the proceedings of the review meeting of Directors'

Conference held at NBPGR, New Delhi on October 7-8, 1999

- Programme of Conferences, Seminars, symposia, workshops, meetings etc. in Agriculture proposed to be held during July-December, 1998 and Jan.-June, 1999 by the Institute
- Technical Programme for the year 1998
- EFC Memos for IX Plan
- RPFs for different years

Information supplied to ICAR Institutes

CCHAU, Hisar

- Message of Director for a Souvenir brought out by the Department of Mathematics and Statistics, CCHAU, Hisar on the occasion of first annual conference of Society of Statistics, Computer Applications

IVRI, Izatnagar

- Action taken report on the recommendations of the 14th meeting of the ICAR Regional Committee No. IV in respect of this Institute

Conference Organised

The **XII National Conference of Agricultural Research Statisticians** of the ICAR Institutes, Project Directorates and Agricultural Universities was organised at Rajasthan College of Agriculture, Udaipur (Rajasthan) during August 08-10, 1998. Sh MD Asthana, IAS, Secretary, Department of Statistics, Ministry of Planning, New Delhi inaugurated the Conference on August 8, 1998. The theme of the conference was "Advances in Agricultural Statistics and Computer Application since independence of India". Apart from plenary session, there were six technical sessions and one Hindi session as follows:

Session : I Action taken on the recommendations made during the last Conference

Session: II Advancement of the existing statistical methodologies and current research findings

Session: III Advancement of computer hardware, software, peripherals and other related equipments vis-a-vis agricultural research

Session: IV Monitoring and standardising teaching of agricultural statistics in Agricultural Universities

Session : V Identification of problems for future research

Session: VI Improvement of quality of agricultural statistics

Session : VII कृषि अर्थव्यवस्था के उदारीकरण के संदर्भ में सांख्यिकी के आयाम

Plenary Session: Presentation of reports by Rapporteurs of different sessions and summary of recommendations.

About 60 Scientists/Statisticians from various ICAR Institutes and State Agricultural Universities attended the Conference.

The recommendations of the XII National Conference of ARS are as under:

1. Applications of recently emerging techniques like Artificial Neural Network (ANN), Multivariate Adaptive Regression Splines (MARS) and Non-linear time series in modeling and forecasting biological phenomena may be attempted. Software packages dealing with these may be procured.

(Action: IASRI, BCKVV, NDUAT and NBSS&LUP)

2. The extensively collected catch-effort fisheries data species-wise/landing centrewise need to be re-examined using the techniques of non-linear estimation and/or non-equilibrium approaches for surplus production models.

(Action: IASRI and BCKVV)

3. Estimation and forecasting of intensity of pests and diseases in rice, cotton and tobacco and other crops may be taken up.

41

(Action: IASRI, ANGRAU, UAS, Dharwad, BCKVV, MPKV, Rahuri and PDKV, Akola)

4. Research work/Studies should be undertaken in:

(i) Resolving some of the outstanding issues involving Genotype-Environment interaction and yield stability of crops and animals.

(ii) Development of optimal, robust and cost effective statistical designs for inter-cropping experiments, mixed cropping, multiple cropping systems, diallel cross experiments, horticultural experiments, fisheries sciences and agro-forestry.

(iii) Small area estimation technique in various survey situations in the field of agriculture.

(iv) Development of sampling techniques for the social science components in agriculture.

(v) Methodological development for estimating area and production for minor and other high valued crops.

(Action: IASRI, UAS,. Dharwad, BCKVV, KAU, PDKV, Akola and ANGRAU)

5. Bayesian approach to the estimation of genetic parameters may be exploited for obtaining admissible estimates.

(Action: IASRI)

6. Efforts may be made to develop efficient designs for given varieties (v) and experimental units (n).

(Action: IASRI and BCKVV)

7. Re-appraisal of the analysis of the data generated by various All India Coordinated research projects and information systems on experimental data may be done.

(Action: IASRI)

8. Development of interactive softwares including aspects on cataloguing, layout and analysis of data of various experimental designs may be attempted.

(Action: IASRI and NBSS & LUP)

9. Remote sensing and GIS applications for crop production and other related statistics should be further intensified and integrated use of RS, GIS and GPS should be studied for improving Agricultural Statistics system.

(Action: IASRI, NDUAT and NBSS & LUP)

10. A workshop may be organised to look into various aspects of agricultural data collection process in order to improve the coverage, timeliness and quality of agricultural statistics.

(Action: IASRI, DES, State Deptts. of Agri.)

11. Like ICS in crop surveys, surveillance and check systems should be developed for forestry, livestock, fishery surveys, etc.

(Action: DES, State Deptts. of Agri and IASRI)

12. Uniformity trials may be conducted before start of the experiments for determining the size and shape of plots and blocks in order to improve the quality of experimental data.

(Action: IASRI, AICRP's, ICAR Institutes, NRC's, PD's and SAUs)

13. For better utilization of data collected in various large scale surveys, recent techniques for deeper analysis of complex survey data should be explored.

14. There is a need for reappraisal of already existing methodologies in the light of recent advances in Agricultural Statistics. This should take into account various methodological issues emerging out of changes taking place in the system and also the qualitative aspects of the data.

15. Rigorous efforts should be made for the adoption of efficient experimental designs by the experimenters. For this purpose closer interaction between research workers and the subject matter specialists should be further strengthened.

16. IASRI should possibly initiate RFLP studies in collaboration with IARI, for identifying crop genotype with production potential and a desirable level of physiological adaptivity.

17. Statistical evaluation of various projects should be done before approval and involvement of statisticians at every stage.

18. Separate Departments of Agricultural Statistics/Statistics should be created in those Agricultural Universities where these do not already exist.
(Action: SAUs)

19. The Agricultural Statistics courses at Under Graduate (UG) level should be taught only by the Statisticians. If necessary, an adequate exposure of the concerned application area like Veterinary /Fisheries/Horticulture, may be provided to them.

(Action: SAUs)

20. The credits for courses in Agricultural Statistics at Under Graduate (UG) level, as proposed recently by the Deans' Committee, needs to be increased and course contents need to be split in two courses. Three subjects cafetaria system of education may be implemented at the Under Graduate (UG) level.

(Action: ICAR & SAUs)

21. The Education Division of ICAR may be approached to form a high powered committee of eminent statisticians from IASRI and SAUs with a view to standardizing course curriculum for "Core Courses" at M.Sc. /Ph.D. (Agricultural Statistics) levels. The possibility of introducing newer courses in Agricultural Statistics at M.Sc./Ph.D. level like Ecological and environmental statistics, Techniques of spatial and temporal analyses, Statistical quality control may also be explored by this committee. To improve the quality, the course curriculum should introduce Computer Education applications to be taught by Agricultural statisticians. The syllabi of ASRB examination for Agricultural Research Service and Indian Statistical Service

should be taken into account while finalizing course curriculum. The same committee may also be asked to visit Agricultural Universities in order to suggest improvements in various aspects concerning faculty, computer facilities, adequate library facilities, etc. for efficient running of these courses.

(Action: IASRI)

22. Manuals/Lecture notes for theory and practicals on various topics may be prepared and distributed to the Departments of Statistics of SAUs for guidance of teachers. Special emphasis may be given for newer areas like Optimisation Techniques, Forecasting Techniques, Remote Sensing Techniques.

(Action: IASRI & SAUs)

23. Summer Institutes or visiting Professors' lectures, etc. for updating the academic level of teachers of SAUs may be organised.

(Action: IASRI & SAUs)

24. One educational tour of short duration for M.Sc. (Agricultural Statistics/Statistics) students may be made mandatory. They may also be required to submit tour reports.

(Action: IASRI & SAUs)

25. ARIS Cells have already been established at SAUs/ICAR Institutes/NRCs/PDs. Many of these locations do not have trained manpower to manage them and utilise the full potential of system provided and create useful services for the users. This training can be imparted by ICAR Institutes, NIC, CMC etc. It is recommended that trained manpower be made available to all the ARIS Cells.

(Action: ICAR)

26. With the availability of Statistical Software Packages, there is now demand from Agricultural Research Workers to use advanced statistical techniques for their data analysis. These software packages are expensive and a few of these carry annual license fee. It is recommended that apex

body, ICAR, may purchase statistical packages having Multisite and Unlimited User license for all the SAUs/ICAR Institutes/NRCs/PDs. This will result in substantial savings and will also help in enhancing the quality and uniformity for research data analysis. It is further recommended that latest version of SPSS be made available to all the location whereas SAS package which requires expertise in handling be restricted to SAUs/ICAR Institutes where M.Sc. & Ph.D. programmes in Agril. Statistics/Bio-statistics/Computer Application is offered.

(Action: ICAR)

27. It was felt that there is an urgent need to develop databases and information system and there integration that are required for agricultural research and management. Suitable programmes are initiated for undertaking this activity wherever trained manpower is available. Looking towards the importance given to IASRI under ARIS programme there is a need to have direct linkage of IASRI & ICAR through ARIS.

(Action: IASRI, SAUs, ARIS and other ICAR Institutes)

28. In order to make ARIS Cell more responsive to the information requirements of the users, there must be close relationship and linkage among ARIS Cell, Department of Agricultural Statistics/Statistics/Mathematics and Statistics and Head, Computer Cell.

(Action: SAUs; ICAR Institutes/PDs/NRCs; ARIS, ICAR)

29. (i) ICAR has provided Computer HW/SW to SAUs and ICAR Institute/NRCs/PDs under ARIS. In order to keep these equipment in good working condition, a manual containing instruction, guidelines and tips for maintaining the equipment may be prepared and sent to each location.

(ii) The equipment provided under ARIS at most of the location is not maintained by the suppliers because of expiry of warranty period and non-existence of AMC for these equipment. Action is, therefore, required for bringing the equipment under AMC.

(iii) In order to create websites, provide Internet/Internet Services as well as Internet connectivity at SAU/ICAR Institutes, HW/SW for setting webserver will be needed. The existing MS-office 4.3 supplied under ARIS also needs upgradation to MS-office 97. It is recommended that HW for setting Webserver along with necessary software is provided and MS-office upgraded at all the existing locations.

(iv) A comprehensive list of available software at SAUs/ICAR Institutes/NRCs/PDs be prepared and provided to all ARIS Cells so that the research workers in NARS can have access to these till ARISNET is fully functional and

(v) There is need of Separate Domain name for ICAR so that it can be searched by Search Engines.

(Action: ARIS, ICAR)

Meetings organised

- Twenty-two meetings of Heads of Divisions of the Institute were organised on Jan 01, Jan 13, Jan 21, Feb 11, Mar 23, Mar 31, Apr 06, Apr 15, Apr 17, May 05, May 14, Jun. 06, Jun 22, Jun 25, Jul 24, Sep 21, Oct. 09, Oct. 14, Oct., 20, Nov. 13, 1998 and Jan. 01 and Feb 05, 1999.

    One meeting of HDs and Principal Scientists of the Institute with DDG (Engg.) on Feb 07, 1998.

- Three meetings of Consultancy Processing Cell were organised on Sep. 16, Aug. 31 and Nov. 11, 1998 .

In addition to above the following items were undertaken by the Unit.

i. Preparation of the proceedings of the all the HDs/PS meetings

ii. Circulated information about training programmes/research activities received from various organisations from time to time among the HDs and Principal Scientists of the Institute

Felicitating Dr RS Paroda, DG, ICAR for Padma Bhushan Award

Prof. A. Alam, DDG (Engg.), ICAR distributing award – Annual Day Celeberation

Nigerian participants of the International training course on Remote Sensing and GIS Applications

हिन्दी दिवस समारोह के अवसर पर मुख्य अतिथि एवं पूर्व निदेशक प्रो. बाल बी.पी.एस. गोयल प्रतियोगी को पुरस्कृत करते हुए।

iii. Sent the following publications to various organisations in India and abroad:

a) IASRI Annual Report 1997-98

b) IASRI NEWS

c) Monitoring Progress Report ending Mar 31, 1998 and Sep 30, 1998 prepared and distributed to the Scientists of the Institute.

Art, Photography and Reprography

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

Photographic jobs including exposing, processing and printing of about 250 photographs taken on various important occasions of important research and extension activities of the Institute and some slides were prepared. In addition, enlargement of good number of photographs was also done.

The charts and graphs were up-dated 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. Photographs taken at the special occasions were also displayed. Latest publications were also added.

On Gestetner Copy Printer 5327 machine installed at the unit lab about three lakh pages for three thousand jobs were multicopied and supplied to 200 users of the Institute.

GENERAL/MISCELLANEOUS

LIST OF PUBLICATIONS

(a)   Papers Published

1. Agrawal, Ranjana and Jain R.C. (1998). Crop Weather Relationship and its Use in Yield Forecast. *IASRI Souvenir* ``Advances in Agricultural Statistics and Computer Applications" brought out on the occasion of 50th year of Independence: pp. 198-208

2. Arya, SN (1998). Sampling Studies on Livestock Development Parameters. *IASRI Souvenir* ``Advances in Agricultural Statistics and Computer Applications" brought out on the occasion of 50th year of Independence: pp. 81-88

3. Arya, SN (1998). Sampling studies on livestock development parameters. *IASRI Souvenir* entitled "Advances in Agricultural Statistics and Computer Applications" brought out on the occasion of 50th Year of Independence: 81-88.

4. Arya, SN; Mathur DC and Bhatia DK (1998). Disease profile of sheep and goats in Trichurapalli district of Tamil Nadu. *The Indian Journal of Animal Sciences,* 68(11): 1103-1105.

5. Bathla, HVL and Kher, KK (1998). Sampling methodology for estimation of fish catch. *IASRI Souvenir* entitled "Advances in Agricultural Statistics and Computer Applications" brought out on the occasion of 50th Year of Independence: 21-31.

6. Bhatia V.K. and Jayasankar, J.(1998), Precision of heritability estimation-A Computer intensive look. Proceedings of a Symposium on 'Computer Intensive Techniques in Agricultural Research' and 'Economic-Reforms in Agricultural Sector- A Statistical assessment'. *Journal of Indian Society of Agril. Statistics* on the occasion of Golden Jubilee Conference. pp 72-81

7. Bhatia, V.K.(1998), Computer Intensive Bootstrap Technique for Estimation of Variance and Confidence Intervals of Heritability. Proceedings of the Symposium on 'Recent Advances in Information Theory, Statistics and Computer Applications' published by CCS Haryana Agricultural University, Hissar, pp 12-26.

8. Bhatia,V. K. and Narain, P.(1998), A note on Sukhatme's influence on development of statistical methods in Animal Science Research, Journal of Indian Society of Agril. Statistics Vol.51, pp. 427-430.

9. Chand, L, Wahi, SD and Bhatia, VK (1998). Growth performance based on multiple traits in goats. *IASRI Souvenir* "Advances in agricultural statistics and computer applications", pp. 189-97.

10. Chandrahas, and Rai, T. (1998). Effect of errors of measurement oan estimates of parameters of forecast model. *Annals of Agril. Res.,* Vol. 19(2), 139-143.

11. Chawla, G.C. and Dey , A.(1998). A Series of Balanced Ternar Change Over Designs. *Journal of the Indian Society of Agric. Statistics vol.* LI(1) : 42-50.

12. Chawla, G.C.(1998). Analysis of change-over designs for s^2 experiments. *IASRI Souvenir* on the celebrations of fifty years of Independence.

13. Danke, MM, Bhattachargee, SK and Wahi, SD (1998). Correlation and regression studies in super star roses. *The Orissa Journal of Horticulture* Vol.26(1), 63-5.

14. Goel, Bal BPS and Bathla, HVL (1998). Agricultural statistics research in India. *JISAS*, 51(2&3): 407-426.

15. Gopalan, R and Kumar, Mahesh (1998). Teaching and Training Programs in Computer Application. *IASRI Souvenir* ``Advances in Agricultural Statistics and Computer Applications" brought out on the occasion of 50th year of Independence: pp. 242-246

16. Gupta, HC (1998) Fasal se dane nikalte samay anaj ke kshati. *Krishi Chayanika*, July - Sept., 1998: 4 -7 & 54.

17. Gupta, SS (1998). Surveys on estimation of area, yield, cost of cultivation of crops and assessment and evaluation- thereof. *IASRI Souvenir* entitled "Advances in Agricultural Statistics and Computer Applications" brought out on the occasion of 50th Year of Independence: 64-73.

18. Gupta, V.K.; Archana Pandey and Rajender Parsad (1998). A-optimal block designs under a mixed model for making test treatments-control comparisons. *Sankhya B,* 60 (3): 496-510.

19. Handa, DP; Kapoor, J.K. and Sreenath, P.R. (1998). Statistical Approach in Agroforestry. *IASRI Souvenir* ``Advances in Agricultural Statistics and Computer Applications" brought out on the occasion of 50th year of Independence: pp. 118-121

20. Jaggi, Seema and Gupta V.K. (1997). A-optimal block designs with unequal block sizes for comparing two disjoint sets of treatments. *Sankhya B,* 59(2): 164-180.

21. Jain, R.C. and Subramanian, V. (1998). 'Forecasting of crop yields using second order Markov chains', *JISAS*, Vol. L1 ; 67-72.

22. Jain, R.C.; Chandrahas and Agrawal, Ranjana (1998). Statistical models for Crop Yield Forecasting Using Biometrical Characters. *IASRI Souvenir* ``Advances in Agricultural Statistics and Computer Applications" brought out on the occasion of 50th year of Independence: pp. 217-226

23. Jain, Rajni and Kalra, Alka (1998), Y2K bug in Indian NARS, *ARIS News*, October-December, Vol.1,No.3.

24. Jain, Rajni and Kalra, Alka (1998), Y2K will affect Indian agriculture. *ICAR News*, Vol.4, No.4.

25. Jain, Rajni and Kalra, Alka (1998), Y2K:Impacts on Indian Agriculture, *CSI Communications,* Vol.22, Nov.1998.

26. Khatri, RS and Goyal, JP (1998). Estimation of live-stock numbers and products-A Review. *IASRI Souvenir* entitled "Advances in Agricultural Statistics and Computer Applications" brought out on the occasion of 50th Year of Independence: 89-99.

27. Kumar, Rajendra and Sreenath, P.R(1998). Study of heterogeneity of error variance in agricultural field experiments. *Annals of Agricultural Research* Vol.1 9 (3) : 321-323.

28. Lahiri Aloke, Mehta, D.K. , Sharma, N.K. and Saran, S.M.G. (1998). On use of soil test values for obtaining optimal fertilizer rates. *IASRI Souvenir* on the celebrations of fifty years of Independence.

29. Mahajan, V; Gupta, AS and Kher, AS (1997). Inheritance of grain filling period and yield gain per day in diverse seasons in maize. *Crop Research.* 14(2) : 257- 261.

30. Malhotra, P.K. (1998). Computer and Informatics – Experience at IASRI. *IASRI Souvenir* ``Advances in Agricultural Statistics and Computer Applications" brought out on the occasion of 50th year of Independence: pp. 247-253

31. Mathur, S.N. (1998). Electronic Data Processing Development (1957-1997).

IASRI Souvenir ``Advances in Agricultural Statistics and Computer Applications" brought out on the occasion of 50th year of Independence: pp. 227-230

32. Mishra, RK; Singh, B and Jain, VK (1998). Breed characteristics of changthangi pashmina goat. *Small Ruminant Research*. 27: 97- 102.

33. Pandey, R.K. (1998). Study of Technical Change in Agriculture. *IASRI Souvenir* ``Advances in Agricultural Statistics and Computer Applications" brought out on the occasion of 50th year of Independence: pp. 254-260

34. Pandey. R.K., Agrawal, Ranjana., Singh, Shivtar (1998). Estimation of labour employment potential in livestock production. *Indian Jour. of Animal Production.* Vol. 30(1-4), Jan.-Dec., 165-172.

35. Parsad, Rajender; Gupta, VK and Jaggi Seema (1998). Optimality Aspects of Experimental Designs. *IASRI Souvenir* ``Advances in Agricultural Statistics and Computer Applications" brought out on the occasion of 50th year of Independence: pp. 106-117

36. Rai T. , Swarup, Onkar and Chandrahas (1998). Yield forecast model for wheat (Triticum aestivum) crop. *Indian Joul. of Agril. Sciences* 68(4) : 206-8.

37. Rai, Anil and Srivastava, AK (1997). Role of agril. surveys in geographical information system. E.D. Mishra, B "Geographic Information system & economic development *'Mittal publication'.*

38. Rai, Anil and Srivastava, AK (1998). Estimation of regression coefficient from survey data based on test of significance. *Communications Statistics. Theory Methods* 27(3): 761-773.

39. Rana, PS and Prajneshu (1998). Five decades of research in biostatistics and statistical genetics: An overview. *IASRI Souvenir* "Advances in agricultural statistics and computer applications", pp. 172-79.

40. Rao, C.H., Jaggi, Seema and Khurana, G.L. Yardsticks of additional production of pulses from the combined application of fertilizers. *IASRI Souvenir* on the celebrations of fifty years of Independence.

41. Saksena, Asha (1998). Use of Agrometeorological Variables in Crop Planning, Monitoring and forecasting. *IASRI Souvenir* ``Advances in Agricultural Statistics and Computer Applications" brought out on the occasion of 50th year of Independence: pp. 209-216

42. Saxena, B.C. and Agarwal, S.C. (1998). Methodological developments in estimation of live-stock Statistics. *IASRI Souvenir* entitled "Advances in Agricultural Statistics and Computer Applications" brought out on the occasion of 50th Year of Independence : 100-105.

43. Saxena, BC; Tyagi, KK and Bindal, Vijay (1998). Area and yield estimation of minor fodder crops, *Agril. Science Digest,* 18(4): 240-242.

44. Saxena, BC; Bhagwan Das and Kumar, Davender (1998). Rabbit farming - A profitable enterprise. *Indian Farming*, 48(4):

45. Sethi, I.C. (1998). A Computer Package for Mixed Models. *IASRI Souvenir* ``Advances in Agricultural Statistics and Computer Applications" brought out on the occasion of 50th year of Independence: pp. 231-241

46. Sharma ,V.K, (1998). Analysis of change-over designs balanced for first and second residuals. *IASRI Souvenir* entitled "Advances in Agricultural Statistics and Computer Applications" brought out on the occasion of 50th Year of Independence: 163-171

47. Sharma SD and Bathla, HVL (1998). Agricultural statistics and computer application in agriculture : past, present and future orientation. *IASRI Souvenir* entitled "Advances in Agricultural Statistics and Computer Applications" brought out on the occasion of 50th Year of Independence, pp 01-20.

48. Sharma, SD and Singh AK (1998). An empirical study of ratio-regression type estimators. *JISAS*, 5(2&3), 349-360.

49. Sharma, V.K. (1995). Estimation of seemingly unreleated regression equations when explanatory variables are subject to error . *Indian J. Appl. Statistics*. Vol. 3 : 33-38.

50. Singh, Randhir (1998). Remote sensing applications in agricultural surveys. *IASRI Souvenir* entitled "Advances in Agricultural Statistics and Computer Applications" brought out on the occasion of 50th Year of Independence : 46-53.

51. Srinivasam V.R. (1998). Activities of Audit and Accounts Sections. *IASRI Souvenir* ``Advances in Agricultural Statistics and Computer Applications" brought out on the occasion of 50th year of Independence: pp. 268-270

52. Srivastava, AK; Ahuja, DL; Bhatia, DK and Mathur, DC (1998). Small area estimation techniques in agriculture. *IASRI Souvenir* entitled "Advances in Agricultural Statistics and Computer Applications" brought out on the occasion of 50th Year of Independence : 32-45.

53. Srivastava, R and Prajneshu (1998). Teaching and training activities at IASRI — An overview. IASRI *Souvenir* "Advances in agricultural statistics and computer applications", pp. 261-63.

54. Srivastava, R.; Parsad, Rajender and Gupta V.K. (1998). Robustness Aspects óf Experimental Designs. *IASRI Souvenir* ``Advances in Agricultural Statistics and Computer Applications" brought out on the occasion of 50th year of Independence: pp. 122-129

55. Srivastava, S.S. (1998). Library and Documentations Services at IASRI. *IASRI Souvenir* ``Advances in Agricultural Statistics and Computer Applications" brought out on the occasion of 50th year of Independence: pp. 266-267

56. Srivastava, S.S. (1998). Synopsis Journals : A New Communication Media. *IASRI Souvenir* ``Advances in Agricultural Statistics and Computer Applications" brought out on the occasion of 50th year of Independence: pp. 264-265

57. Sud, UC and Rai, Anil (1998). Recent trends in survey sampling. *IASRI Souvenir* entitled "Advances in Agricultural Statistics and Computer Applications" brought out on the occasion of 50th Year of Independence: 54-63.

58. Tyagi, KK (1998). Estimation of energy utilisation in agriculture. *IASRI Souvenir* entitled "Advances in Agricultural Statistics and Computer Applications" brought out on the occasion of 50th Year of Independence: 74-80.

59. Vats, M.R. , Mehta, D.K. and Sehgal, D. K. (1998). Some statistical aspects of multiple cropping in Long Term Experiments. *IASRI Souvenir* on the celebrations of fifty years of Independence: pp. 145-157.

60. Wahi, SD, Bhatia, VK and Chand, L (1998). Some investigations on precision of heritability, Souvenir "Advances in agricultural statistics and computer applications", pp. 180-88.

International Journal

1. Ramasubramanian, V. and Jain, R.C. (1999). Use of growth indices in Markov chain models for crop yield forecasting, *Biom. J.*, 41(1), 99-109.

(b) Research papers accepted for publication

1. Bathla, HVL (1998). Status of forestry statistics in environment management. Proceedings of the Symposium on "Agriculture, environment and forest: towards reconciliation" held at CARI.

2. Bhardwaj S.P. (1998) Role ofn Environmental Statistics in the growth and development of Agriculture. Proceedings of National Symposium by Agriculture, Environment and forest : Towards Reconcillation, held at Central Agricultural Research Institute, Port Blair on September 7-9, 1998.

3. Bhardwaj, S.P., Kaul Sushila , and Ved Prakash, (1998) "Marketing of fruits and vegetables in Delhi Market with reference to small and marginal farmers", Souvenir of National Seminar on Problems of small and marginal farmers in marketing fruits and vegetables organised by Farmers Education and Welfare Society,New Delhi, Aug.20, 1998:48-53.

4. Bhatia, A.K. and Kaur, Rajinder Statistical Assessment of rice based cropping sequences. Journal of farming Systems, Research and Development, Modipuram, Meerut.

5. David, Advaris and Pandey, R.K. (1998) "Construction of Composite Index of Technological Change : A Case Study in Sub-Montane Zone of Maharashtra" Agricultural Economics Research Review, Vol.11(1):72-77.

6. Gupta, V.K. , Ramana, DVV and Parsad, Rajender Weighted A-efficiency of block designs for making treatment - control and treatment-treatment comparisons. *Journal of Statistical Planning and Inference. vol. 79.*

7. Kaul Sushila and Bhardwaj, S. P. (1998) "Impact Assessment of Soil Conditions on Cropping pattern-A case study of Haryana State" proceedings of National Symposium by Agriculture, Environment, forest towards Reconcilation held at CARI, Port Blair during September 7-9, 1998.

8. Kaur, Rajinder and Bhatia, A.K. Crop Residue Management in Rice based cropping system, Journal of Farming Systems, Research and Development, Modipuram, Meerut.

9. Kumar Ashok ,(1998) "Role of Micro-Irrigation System in Food Production and Environment" proceedings of National Symposium by Agriculture, Environment, Forest towards Reconcilation held at CARI, Port Blair during September 7-9, 1998.

10. Kutaula S.S. (1998) "Simultaneous Determination of Output Supply and Derived Labour Demand function - An Economic Empirisism" , Agricultural Siatuation in India Agril., Vol.55 98(4), June: 141-147.

11. Kutaula S.S.(1998) " Simultaneous Determination of Output Supply and Derived Fertilizer Demand Function under constrained joint GLS" Fertilizer News, July, vol.13(7).15-24.

12. Lahiri, Aloke and Das, M.N. Method of exact PPS sampling without replacement. *Journal of statistics and application , vol. 1.*

13. Narain, P; Rai, S.C. and Bhati, V.K. (1999). 'Inter district variation of development in Southern Region' Vol.52(1), Jour. Ind. Soc. Ag. Stat.

14. Pandey R.K. and Kumar Ashok (1996) "Economic Reforms in Agricultural Sector"in Narain Prem and Pandey R.K.(eds.) Proceeding of Symposia on "Computer Intensive Techniques in Agricultural Research and Economic Reforms in Agriculture Sector-A Statistical Assessment" ISAS: 104-113.

15. Pandey R.K. , Agrawal Ranjana and Singh Shivtar (1998) "Estimation of Labour Employment Potential in Livestock Production" Indian Journal of Animal Production, Vol.30, (1-4): 173-177.

16. Prajneshu and Venugopalan, R (1999). Von Bertalanffy growth model in a random environment. To appear in *Can. J. Fish. Aqu. Sci.*

17. Rai, Anil ; Rai, T and Mohan, L (1997). Utilization of auxiliary character in stratified two stage sampling. Biometrical Journal, U.K.

18. Rai, Anil; Srivastava, AK and Gupta, HC (1999). Small sample comparisons of modified Chi-square tests for survey data. Biometrics Journal.

19. Rai, T. and Chandrahas (1999). Forecast of rice yield using linear discriminant score of weather parameters and input variables. *Indian Joul. of Agril. Sciences*

20. Sarup Shanti , Mahajan V.K. and Pandey R.K. (1997) "Trends, growth and Technological Change in Oilseeds in Karnataka" Agricultural Situation in India, Vol..54, August 1997: 251-255.

21. Saxena, BC and Das, Bhagwan (1998). Cost of rearing and maintenance of Angora rabbit in district Kullu. Ind. Jr. in Animal Research.

22. Sharma, S.D.,Sharma, V.K. and Rao, C.H. Crop response to fertilizers in different agro-climatic regions of the country. Fertilizer News, Agronomy Special issue.

23. Soni, P.N. , Vats, M.R., Sehgal, D.K. and Mehta, D.K. Sampling Technique for estimating plot yield, in Long Term Fertilizer Experiments. Indian Journal of Agricultural Research, Karnal.

Symposia Proceedings

24. Narain Prem and Pandey R.K. (1998) (ed.) Proceedings of Symposia on "Computer Intensive Techniques in Agricultural Research and Economic Reforms in Agricultural Sector - A Statistical Assessment" Indian Society of Agricultural Statistics, New Delhi: 1-186.

(c) Research Project Reports

Published

1. Sample survey for study of constraints in transfer of new agricultural technology under field conditions (1995).
   (PC Mehrotra, SK Raheja, , VS Rustogi, SS Gupta, NK Ohri, SS Shastri, GS Bassi, RC Gola and MS Narang)

2. Chi-square tests in survey data (1996).
   (Anil Rai, AK Srivastava and HC Gupta)

3. Pilot sample survey for estimating the area under wasteland (1997).
   (SS Gupta and PC Mehrotra)

4. Consolidated report on "Sample survey for study of constraints in transfer of new agricultural technology under field conditions, (1985-86 to 1988-89).
   (PC Mehrotra, SS Gupta et. al.)

5. Sampling methodology for estimation of fish catch from a lake.
   (HVL Bathla, OP Kathuria and KK Kher)

6. Survey methodology to study economics of keeping goats (1998).
   (R.L. Rustogi and SC Agarwal).

7. A methodological investigation in estimating the seasonal fluctuations in post-harvest food grains losses in wheat (1997).
   (Jagbir Singh, HC Gupta and OP Kathuria)

8. Estimation of post- production losses in milk in rural areas of District Rohtak, Haryana (1998).
   (RS Khatri, JP Goyal and KB Singh)

9. Sample survey to evolve suitable sampling methodology to study impact of command area irrigation project on agricultural production.
   (AS Gupta, PC Mehrotra and SK Raheja)

10. Sample survey for estimation of cashewnut and cashew apple yield and study of its cultivation practices.
(SS Shastri, VK Jain and PM Ramesan)

11. Development of estimation procedures for agricultural by-products.
(NK Ohri, PC Mehrotra and RC Gola)

12. Studies on feed intake by bovines through stall feeding and grazing.
(BC Saxena and KK Tyagi)

13. Pilot sample survey for evolving a sampling methodology for estimation of area and yield of cultivated fodder crops other than berseem and jowar crop, cost of production and cultivation practices thereof, Ghaziabad Distt.(U.P).
(Anand Prakash, BC Saxena and KK Tyagi)

14. Agricultural Research Data Book 1998 (1998).
(AK Srivastava, KK Tyagi, RS Khatri, Jagbir Singh, RM Sood, JP Goyal, MS Verma and B.N.Chakraborty)

15. A study of interactions of Agronomic factors with reference to resource constraints (1998)
(G.L Khurana K. C. Bhatnagar)

16. "Studies on Spatial Pattern and its role in analysis of agricultural field experiments".
V.K. Bhatia, J.S. Samra and P. Narain

17. "Investigations on the properties of projection matrices in population biology" (1998).
P.S.Rana and Indra Singh.

18. "Application of Bootstrap technique for studying the statistical properties of genetic parameters' (1998).
S.D. Wahi, V.K. Bhatia & Lal Chand.

19. Integrated yield forecast model using biometrical characters, agricultural inputs, weather and remotely sensed data.
(Ranjana Agrawal, G. Singh, B.C. Panda, R.C. Jain, R.N. Garg)

20. "Testing Relative Economic Efficiency and Determination of Factor Demand and Output Supply Functions for Wheat", 1998
(Kutaula S.S)

21. 'Studies on Spatial Patterns and its role in Analysis of Agricultural Field Experiments.' 1998.
(V.K.Bhatia, P.Narain and J.S. Samra)

22. 'Application of Bootstrap Techniques for Studying the Statistical Properties of Genetic Parameters'. 1998.
(S.D.Wahi, V.K.Bhatia and Lal Chand)

23. 'Statistical Modeling for Comparing Genetic Groups of Cross bred Goats for Growth Studies based on Multiple Traits'. 1998.
(Lal Chand, S.D.Wahi and V.K.Bhatia)

24. 'A Study to Compare the performance of different methods of estimating repeatability and to assess their stability by bootstrap techniques' 1998.
(S.P.Verma and R.K.Jain)

Finalised

1. Estimation of regression co-efficients from sample survey data.
(U.C. Sud, Anil Rai, I.C. Sethi and V.P.N. Singh)

2. Development of data base relating to basic and current agricultural and allied statistics over time and space.
(N.K. Ohri, Bal B.P.S. Goel and MS. Narang)

3. Sample survey for study of constraints in transfer of new agricultural technology under field conditions.
(S.K. Raheja, P.C. Mehrotra, V.S. Rustogi, S.S. Gupta, S.S. Shastri, N.K. Ohri, G.S. Bassi, R.C. Gola and M.S.Narang)

4. Pilot sample survey for estimation of yield of pepper and study of cultivation practices using successive sampling.
(S.S. Shastri, S.K. Raheja and V.K. Jain.)

5. Methodological investigation in predicting fertilizer response using soil test values and other site variables.
(Aloke Lahiri, D. K. Mahta, N.K. Sharma, S.M.G. Saran)

6. Yardsticks of additional production of pulses and oilseeds from the combined application of fertilizers (1998)
(C.H. Rao, Seema Jaggi)

7. Cataloguing and constructions of variance balanced block designs (1998).
(Rajender Parsad, V.K. Gupta , O.P. Khanduri)

8. Yield forecast based on weather variables and agricultural inputs on agroclimatic zone basis.
(Ranjana Agrawal, R.C. Jain, S.C. Mehta)

Dissertations Approved

Ph.D. (Agricultural Statistics)

1. RAMASUBRAMANIAN, V. - *Some Resampling Procedures Under Two - Phase Sampling*

The advances made in theory and practice of sample surveys resulted in large - scale sample surveys using factors such as stratification, post - stratification, two-phase sampling, adjustment for non-response, ratio or regression type estimators, etc. These factors induce non-IID structure to the data obtained from such surveys. Two-phase sampling has become a common alternative when there are expected to be gains from using auxiliary information. In the present study, the conventional variance estimation methods have been replaced by computer - intensive resampling techniques viz. the Bootstrap and Jackknife under two-phase sampling. Two new

Bootstrap methods namely Two-phase Post-stratified Bootstrap and Two-phase Proportionate Bootstrap and two new alternative Jackknife methods viz Two phase Post-stratified Jackknife and Two-phase Proportionate Jackknife have been proposed. The proposed methods are more reliable and simple to adopt in practice. The Two-phase Proportionate Bootstrap has been extended to the stratified set up as well. Moreover, the Bootstrap with replacement, the rescaling Bootstrap with replacement modifications have also been dealt with. All the variance estimators obtained from the proposed methods reduce to the standard ones in the special case of customary statistics, which have been shown by taking the particular cases of ratio estimators and combined ratio estimator under two-phase sampling. The common linearised form of the proposed Bootstrap methods resembles with the linearised version of the efficient Jackknife variance estimator under two-phase sampling given by Rao and Sitter. This result showed that the proposed Bootstrap methods became at par with Jackknife. The unconditional design-based approach showed that the proposed two-phase Bootstrap and Jacckknife methods stand to have smaller percent relative bias and become more stable if the correlation coefficient is high and become more so as the coefficient of variation of auxiliary character increases. Under the conditional framework, the proposed Bootstrap and Jackknife methods perform well in tracking the conditional mean squared error whereas the usual variance estimator performs miserably. Only for balanced samples, the usual variance estimator perform well in tracking the conditional mean squared error. The proposed methods perform at par with the Rao and Sitter's Jackknife variance estimator under two-phase sampling. The proposed Bootstrap methods may be used in situations where Jackknife has limitations. Under two-phase sampling for stratification, the simulation study provided strong support for using the Jackknife variance estimator with a reweighted expansion estimator for the population total and suggested that the Jackknife method may not perform well with a double expansion estimator of population total. The simulation study also showed that all the imputation methods induced

biasness and instability of all the variance estimators considered.

(Guide: Dr.Randhir Singh)

2. JHA, GIRISH KUMAR - *Investigations on Conditional Inference in Survey*

An attempt has been made to propose a conditional bias adjusted ratio type estimator in case of double sampling. A conditionally adjusted variance estimate has also been conjectured for the proposed conditional estimator, which has been supported through simulation results. Further, conditional properties of the above estimator have been studied in case of dynamic population, when sample is selected with the help of successive sampling. Here, sampling on two occasions has been examined under conditional framework, when double sampling ratio estimator in the matched portion has been replaced by a conditional bias adjusted ratio estimator. A conditional bias adjusted ratio estimator for the matched portion has been derived. These estimators based on asymptotic approximations have been derived by conditioning on sample auxiliary variable. In order to examine the performances of proposed conditional estimators relative to the existing estimators, a simulation study has also been carried out. For these simulation studies, the two populations have been generated. The first population is based on linear form of model which is best suitable for the usual ratio estimator while the second population is based on quadratic form of model which is not suitable for the ratio estimator. The conditional properties of proposed Hartley - Ross type estimator as well as proposed Mickey type estimator have been studied with respect to simple and harmonic mean of auxiliary variable for different sample sizes. In case of double sampling and successive sampling, the performances of proposed as well as existing estimators have been studied with respect to the ratio of sample mean of large sample to the small sample for auxiliary variable, which may be considered as ancilliary statistics. Apart from this, the conditional variance of usual regression estimator has been obtained through simulation and its conditional properties have been studied along with usual ratio and a conditional bias adjusted ratio estimator. Further, the performance of usual ratio estimator has also

been examined by conditioning on second moment. In case of successive sampling also, the existing double sampling regression estimator for the matched portion has been considered for the simulation study.

(Guide: Dr.A.K.Srivastava)

3. KRISHAN LAL - *Robustness of Designs Against Missing Data*

In a well-planned experiment, the following accidents may occur: one or more observation(s) could be lost accidentally; there may be one or more outlying observation(s); lack of independence of observations; there may be a systematic trend present in the experimental units; exchange or interchange of treatments during the experimentation, etc. The presence of the disturbances mentioned above may vitiate the ideal conditions on which statistical procedures are based. Among all these disturbances, the commonest factor responsible is the missing observation(s) because these may occur due to illness/death of an animal, due to saline patches in the plots or due to lethal treatment(s), etc. during experimentation. This is why the problem of missing data has received much more attention in the literature than the other disturbances. One of the solutions to such problem is that the experimenter may use such designs which are robust in the sense that the loss of information is small against missing observations. This thesis, therefore, investigates the robustness of designed experiments against the loss of any (t $\geq$ 1) missing observations.

The problem of missing observations is considered at the stage of building Gauss-Markoff general linear model. The C-matrix of the residual design (when any t observations are lost in the design) is obtained and its relationship with the C-matrix of the original design is established for estimating estimable parametric functions of a subset of parameters in Gauss-Markoff linear model. A necessary and sufficient condition of robustness as per connectedness criterion, under a homoscedastic model is derived. It is also established that a design that is robust under homoscedastic model is also robust under a general heteroscedastic model with correlated observations. The necessary and sufficient condition of robustness, against the loss of any

t ($\geq$ 1) observations, obtained in general linear model is simplified for the designs for one-way elimination of heterogeneity. A simple sufficient condition of robustness in terms of the smallest positive eigen - value of C-matrix of the original design, when the original design is binary block design, is derived.

The condition is used to identify robust designs among the well known binary block designs like BIB designs, PBIB designs with the associate classes and augmented BIB designs, variance balanced designs with unequal replication and unequal block sizes. The A-efficiency of the robust designs as per connectedness criterion has also bee studied. An explicit expression for working and the exact A-efficiency of residual design relative to original design when original design is variance balanced is derived. A lower bound to the efficiency of residual design is also obtained when the original design is not variance balanced. Only these binary block designs which are robust as per connectedness criterion are discussed. The robustness of designs for two-way elimination of heterogeneity as per both connectedness and A-efficiency criteria has also been studied. Simple sufficient conditions of robustness as per estimability criterion are also given. Latin square designs and Youden square designs are studied for their robustness, for the loss of any number of observations in a column or any two observations in the design.

(Guide: Dr.V.K.Gupta)

M.Sc. (Agricultural Statistics)

1.   SARKER, SUBHRA -   A
Comparative Study of Different Mathematical Models   Describing Lactation Yield of Cross-Bred Cattle

Lactation curves are very useful to study the pattern of milk yield in a lactation. Furthermore, lactation curve models could also be applied to forecast total lactation yield in early lactation. An algebraic description of lactation curve is important for day- to-day management to selection for breeding. In this study, an attempt has been made to critically examine the appropriateness of mathematical models for describing the milk yield of cross-bred by comparing three models namely Wood's model, Morant-Ganasakthy model,

Mitscherlich x Exponential model and also to find out the optimum number of observations required for prediction of total milk yield by an animal during its whole lactation. The selected model, i.e. Morant-Ganasakthy model has explained a larger variation. Though Morant-Ganasakthy and Mitscherlich x Exponential model performed almost equally when fitted to individual lactation data but the former model gave better estimated value of peak yield and total milk yield. Morant - Ganasakthy model fitted better for all the average data when averages were taken over seven first lactation data, seven second lactation data and all the 14 lactation data separately. In no case, Wood's model gave better fit in comparison with the other models. By fitting partial data to the Morant - Ganasakthy model, it has been found that 115 to 160 days data can be used to predict the total production during the whole lactation with 2% deviation in total yield. The important conclusion that emerges from this study is that the Wood's model does not perform well when there is greater variation in the data. Morant-Ganasakthy model is the best among the three models compared and can be used both by the dairy farm manager and animal breeders.

(Guide: Dr.P.S.Rana)

2.   VENU   MADHAV,   K.-*Statistical Modelling of the Dry Matter Accumulation of Wheat Crop*

The forecasting of crop yields is a topical and daunting problem. Different types of models used can be broadly classified into two types of models, viz. Between - year models and within - year models. The between - year models while performing well in normal years often falter in atypical years. So, the within-year models are being increasingly used for crop yield forecasting in preference to the between-year models. In the present dissertation, wheat crop has been selected as the crop under study, as it contributes to the country's economy to a greater extent. However, forecasting crop yields should be made available well before the harvest to enable the Government to take timely decisions and for proper planning of operations. In temperate countries, the wheat crop takes more time for maturity after earhead emergence, but in a tropical country like India, it takes less time. Thus, forecasting the earhead weight at maturity can not be done so accurately and well before

the harvest. So, forecasting the biological yield (IDMAW) will be worth attempting as it includes the weight of earheads along with the weight of the straw. In the present study, data was obtained from an experiment on the control of weeds through herbicides from IARI farm. Various sigmoidal models, viz. Logistic, Gompertz, Richards, Weibull and MMF were fitted as the scatter plots revealed that the data depicts an "S" shaped curve. The Empirical comparisons revealed that the Logistic model best represents the pattern of growth of dry matter accumulation of wheat crop (DMAW) because it has the highest R^2 and least values of RMSE and MAE. The Logistic model when developed using partial data gave forecast which were over-estimates of the observed value. Noting that problem, the already existing Modified Logistic model was also tried. This modified model gave a reliable forecast when developed for partial data for the various periods above the point of inflexion, but incase below the point of inflexion, it either under-estimates or fails to converge to give the parameter estimates of the model. In order to overcome these problems in the present study, two modified models were proposed, which were found to have some theoretical basis for their validity. The first model fitted well to the study data, but the already existing models performed inconsistently in different situations. All the models resemble the results obtained from those of the Logistic model when all the data points are considered. The proposed modified model provides an estimate well before the harvest, which was not possible by the earlier modifications. Thus, this study reveals that reliable forecast can be made by using the Proposed Modified Logistic model, in preference to the already existing models. Further studies could be carried out to know the efficacy of the proposed model by calculating different measures of nonlinearity in comparison with the existing models.

(Guide: Dr.R.C.Jain)

M.Sc. (Computer Application)

1. PARKASH, SAURABH - *Inventory Management Software for Agricultural Institutes*

Agricultural research institutes in the country have grown rapidly in size as well as in scope in the recent years. In the light of increased institutional activities coupled with the growing scarcity of resources as well as the complexities of *National Agricultural Research System (NARS)*, the research managers are faced with the problem of efficient and effective management of their research in the absence of a efficient store and inventory management it has been observed that defective planning in respect of procurement and installation of machinery and equipment, idle investment in equipment / capacity etc. are the major resource consumption areas and need to put thoughts for efficient management.

The present investigation was carried out with the idea of developing software that incorporates basic structure of inventory keeping that suites not only NARS but also agricultural farms and small business organizations. *Inventory Resource Information System (IRIS)* is developed for windows platform. It has been developed in COM module, the latest technology of Microsoft^{TM} and assumed to stay for long, now known by the name ActiveX. It is the technology that produces readymade pre-compiled and linked component or module. IRIS can be implemented as a network - based system with or without a server. It is a network - based system with a difference in approach. It maintains information regarding consumable as well as non-consumable items and allows user organization to maintain items according to their requirement, by providing facility of defining new category of items under the groups consumable and non-consumable and new item under each defined category. There is provision to calculate economic parameters for consumable for providing better management of inventory resources. It also provides detailed information regarding each non-consumable item maintained in an organization. Buzzes panic alarm when a consumable item goes below reorder level and prompts store manager for placement of order for the item. Because of its modular approach it can be included as inventory management module of an Enterprise Resource Planning (ERP) package.

(Guide: Dr.P.K.Malhotra)

2. AHUJA, SANGEETA - *Software Package for Factorial Experiments*

There are a large number of Statistical Software Packages available; to name a few like

SPBD, SPAR1, SPSS, SAS, MSTAT-C, SYSTAT, GENSTAT etc. These packages are capable of carrying out the statistical analysis of data as well as analysing the data generated from the designed experiments, particularly the General Linear Models. Some of these packages are either completely devoted to generation, randomization and analysis of designs or are useful for generation of designs as well as analysis of data. For instance, SPBD is a package useful for viewing catalogue of designs, generation of designs, generation of randomized layout of the designs and analysis of data. The designs generated are the Balanced Incomplete Block Designs with $k \leq 30$ for symmetrical designs and $k \leq 20$ for asymmetrical designs. Similarly SPAR1 is completely devoted to the analysis of designs specially suited for genetical experiments. SPSS, GENSTAT, MSTAT-C, SYSTAT, SAS etc. deal with the generation of designs and analysis of data, but the generation of design have a restriction on number of factors and levels. Moreover, there is no provision of generating a randomized layout of the design. Further, these packages are cost prohibitive.

Keeping the interests of experimenters in mind, this work has been devoted to the development of a Statistical Software Package (**Software Package for Factorial Experiments**). This package is essentially for symmetrical factorial experiments. There is a provision of generation of the design as well as the randomized layout of the design (including totally and partially confounded designs) and fractional factorials. Provisions has also been made in this package for analysing the data generated from the experiments using these designs. Separate modules have been developed for generating the probabilities using χ^2 distribution, F distribution, t distribution for testing the level of significance. This package is user friendly, interactive and password protected.

Despite many interesting features of the package, there are some limitations. Firstly it requires a minimum of 16 MB RAM for generation of the designs. Further, there is a restriction on the number of factors as well as levels. The package can generate designs upto 20 factors only. When the number of levels is a prime number, there is no restriction on the number of levels. However, when the number of levels is such that it is expressible as p^n,

power of a prime number p, the upper bound to the number of levels is 20. For the analysis of data, the upper bound to the number of treatment combinations is 500, i.e. the choice of (levels) s and (factors) n should be such that $s^n \leq 500$.

(Guide : Shri Mahesh Kumar)

3. SUDEEP - *Internet Solutions for Research Organization*

The ways of managing information are of utmost importance in the scientific world. This importance is recognized in today's research area, where internets are rapidly being heralded as one of the most effective ways of organizing and distributing scientific information. This dissertation entitled Internet Solutions for Research Organization is an attempt in this direction. As a result of the requirement analysis various feasible Internet solutions are marked out while taking care of information needs for various scientific research activities as well as the routine organizing works. A set of databases for the different Internet Solutions are designed e.g. seminar, project, course / training and other information. Suitable logic and algorithms for program were developed, coded and tested. Integration of algorithms in the form of a user friendly, interactive, Graphical User Interface software for Internet Solutions named **Interactive Internet Solutions for Research Organization (IISRO)** is developed using the three layer modular approach viz. Client Slide Interface Layer (CSIL), Server Side Application Layer (SSAL), and Database Layer (DBL).

IISRO is a network based GUI software with very high user interaction. It is very easy to learn and operate. It is based on same technology as the Internet. Basically, it creates an internet (INTRANET) within an organization without putting any limit on physical boundaries of the organization.

IISRO is designed specifically for ICAR like Organizations. Following are its main features:

- It is GUI software and is very user friendly. One can learn it in few hours.
- It omits the need of remembering complex database commands.

- It has highly enhanced search capabilities for searching a particular information.
- It creates a database that is highly consistent with minimum redundancy.

- It is based upon the latest technology from the Microsoft i.e. Active Server Pages (ASP).

(Guide: Sh.S.N.Mathur)

LIST OF APPROVED ON-GOING PROJECTS

No.	Project title	Project leader and associates
1.	Pilot sample survey to develop a sampling methodology for estimation of poultry meat production.	Mahender Singh
2.	Sample survey to evolve methodology for estimation of fish catch from rivers or streams specially of the hilly areas	HVL Bathla KK Kher AK Gupta
3.	Study for estimation of area and production of important vegetable crops on the basis of partial harvest	AK Srivastava DL Ahuja DC Mathur K Chug
4.	Pilot sample survey for estimating the area and yield rates of ginger and potato in hilly areas.	SS Gupta MS Narang RC Gola
5.	Studies on feed intake by bovines through stall feeding and grazing	BC Saxena KK Tyagi
6.	Estimation of flow and changes in dynamic population	Jagbir Singh
7.	To study the effect of various input components on the yield of important vegetable crops	AK Gupta
8.	Small area estimation of milk production	DK Bhatia SN Arya HC Gupta
9.	Estimation of regression coefficients from sample survey data.	UC Sud Anil Rai IC Sethi VPN Singh
10.	An analysis of yield gap for buffaloes milk	Satya Pal RM Sood T Rai
11.	A study of variance estimation in complex surveys	VPN Singh Anil Rai VK Jain
12.	Use of remote sensing technology in crop yield estimation surveys	Randhir Singh RC Goyal
13.	Use of remote sensing satellite data in crop surveys (AP Cess funded project)	Randhir Singh RC Goyal

No.	Project title	Project leader and associates
14.	Development of data base relating to basic and current agricultural and allied statistics over time and space.	NK Ohri Bal BPS Goel MS Narang
15.	Planning, designing and analysis of experiments planned on stations under the Project Directorate for Cropping Systems Research	Rajinder Kaur Ajit Kaur Bhatia
16.	Planning, Designing and Analysis of 'On Farm Research Experiments' planned under P.D.C.S.R	P.K. Batra N.K. Sharma Mahesh Kumar
17.	Planning, designing and analysis of data relating to experiments conducted under AICRP on Long-Term Fertilizer Experiments	M.R. Vats D.K. Sehgal D.K. Mehta
18.	Agricultural Field Experiments Information System	P.K. Batra O.P. Khanduri D.C. Pant
19.	Agricultural Experiments Information System for Animal Sciences	G.C. Chawla
20.	Cataloguing and construction of variance balanced block designs : Computer algorithms for construction	Rajender Parsad V.K. Gupta O.P. Khanduri
21.	A statistical investigation on the long term effect of fertilizers on productivity of cereal crop sequences.	V. K. Sharma Rajinder Kaur
22.	Construction of efficient designs for asymmetrical factorial experiments	D.P. Handa P.R. Sreenath
23.	Study of designs for two or more sets of treatments applied at different periods of experimentation (AP-Cess fund ICAR)	Seema Jaggi R. Srivastava V.K. Gupta
24.	Designs for fitting response surfaces in agricultural experiments. (AP-Cess fund ICAR)	Rajender Parsad R. Srivastava P.K. Batra
25.	Application of bootstrap techniques for studying statistical properties of genetic parameters	S.D. Wahi, V.K. Bhatia Lal Chand
26.	A study to compare the performance of different methods of estimating repeatability and to assess their stability by bootstrap technique	S.P. Verma R.K. Jain
27.	Study of contagious distributions and dynamical models for aphid population growth	Prajneshu
28.	Investigations on the properties of projection matrices in population biology	P.S. Rana Indra Singh
29.	Yield forecast based on weather variables and aricultural inputs on agro-climatic zone basis	Ranjana Agrawal R.C. Jain S.C. Mehta
30.	Study to develop models for assessing the effects of floods on yield of crops	Jagmohan Singh B.H.Singh Ranjana Agrawal

No.	Project title	Project leader and associates
31.	Use of discriminant function of weather parameter for developing forecast model on rice crop	T. Rai Chandrahas
32.	Pilot study for developing Bayesian probability forecast model based on farmers' appraisal data on wheat crop	Chandrahas T. Rai
33.	Development of Forewarning System for Aphids, Myzus persicae (Sulzer) on Potato	T.P. Trivedi (NCIPM) R.C. Jain S.C. Mehta L.M. Bhar
34.	Development of early warning and yield assessment models for rainfed crops based on agroclimatic indices	Asha Saksena R.C. Jain R.L. Yadav (Modipuram)
35	Estimation of farm level technical efficiency and its related parameters under error decomposition methodology of stochastic frontier model in the production of wheat	S.S. Kutaula R.K. Pandey
36.	Economic study of micro irrigation systems on farmers' fields	Ashok Kumar S.P. Bhardwaj
37.	A Study on Production Efficiency and Resource Use in Poultry Production	S.P. Bhardwaj V.K. Mahajan R.K. Pandey
38.	Study of Demand for Agricultural Products and its Implication for Food Security in India.	Dr. R.K. Pandey
39.	Short Term Training Programmes in InformationTechnology – Revolving Fund Scheme Project	Dr. SD Sharma Dr. VK Mahajan

CONSULTANCY, PATENTS, COMMERCIALISATION OF TECHNOLOGY

ADVISORY/CONSULTANCY SERVICES PROVIDED

Three copies of the software SPBD Release 1.0 (A statistical Package for Block Design) have been sold.

RAC, MANAGEMENT COMMITTEE, SRC ETC. MEETINGS WITH SIGNIFICANT DECISION

Research Advisory Committee

The third meeting of the RAC of IASRI was held on 17th August, 1998 under the Chairmanship of Prof. Y.K. Alagh.

Some of the important decisions taken on which the Institute has to take action are as follows:

1. The field visits of IASRI scientists should be followed up with reports and follow up. Given this effort, IASRI should be involved in the annual meeting of High Level Coordination Committees (HLCC) of different states which also include the State Agricultural Statistics Authorities (SASA) of the respective state.

2. Methodology for using remote sensing data and GIS for estimation purposes need to be developed. IASRI must get the details of the FASAL Project and help in it.

3. IASRI scientists may obtain scientific recommendations for farmers and compile the information into a database management system. It was noted that the existing data sets needed updating. Update data sets may be made with a few characteristics, so that a record of all field exzperiments at one place is available. More complete information sets will take time. There is a need to develop and expand Agricultural Field Experiments information system database. Users should have access to such information on the Internet as well.

4. IASRI may immediately create a web - site of its own where its programmes and activities can be highlighted.

5. (i) In view of the targets for doubling the milk production of the country in the next ten years, the IASRI may be involved in the development of the methodology for estimation and projections of fodder for future.

(ii) For estimation of fodder production, studies need to be undertaken in every agro-climatic zone. IASRI should compare the feed ratios of unirrigated areas with those obtained in their project on fodder undertaken in Dharamapuri..

(iii) For estimation of fodder production, studies need to be undertaken in every climatic zone. IASRI should compare the feed ratios of un-irrigated areas with those obtained in their project on fodder undertaken in Dharmapuri.

6. There is a need to prepare a data base of the methodologies developed by the Institute so far. Methodologies may be developed for advance estimation of crop production for all forecast crops. IASRI may provide appropriate estimation methodology for crops having multiple pickings. IASRI may provide methodologies to develop state / District level estimates for areas like Meghalaya. These studies may be developed in consultation with Directorate of Economics and Statistics, Ministry of Agriculture.

7. For new project proposal no.7 entitled 'Forecasting fish production from ponds' the proposed methodology need to be discussed in a separate meeting. Particularly the sampling issues raised by the Committee members need to be discussed:

8. Projects for which experts are not available in RAC, comments may be obtained from experts outside RAC, from India or abroad.

9. For completed projects, date of start and date of completion may also be reported in the RAC agenda in future for information of the members.

Staff Research Council Meeting of the Institute in progress

Dr SD Sharma., Director addressing the participants of a training course on Recent Advances in the Analysis of Survey Data

Research Advisory Committee Meeting of the Institute in progress

Management Committee of the Institute in progress

10. Basic research is extremely important as a sound base for development of applied research Some resources should be allocated to basic research also.

The Research Advisory Committee of the Institute was reconstituted w.e.f. October 12, 1998 for a period of three years are as follows:

Shri VR Rao	Chairman
Dr. MN Das	Member
Prof. Prem Narain	Member
Dr. MM Pant	Member
Dr. S. Mohanty	Member
Dr. VJ Shrikhande	Member
Dr. SD Sharma	Member (Ex-officio)
Dr. Mruthyunjaya	Member (Ex-officio)
Sh. HT Mohan Kumar	Member (IMC Member)
Sh. Sayed Mohd. Altaf Bukhari	Member(IMC Member)
Dr. HVL Bathla	Member-Secretary

Management Committee

The Director of the Institute, who is in-charge of the overall management of the Institute, is assisted in the discharge of his functions by the Management Committee of the Institute (constituted by the Council) by providing a broad-based platform for decision making process by periodically examining the progress of the Institute activities and by recommending suitable remedial measures for bottlenecks, if any.

The Management Committee of the Institute was consists as follows:

1.	Dr SD Sharma, Director	Chairman
2.	Director of Agriculture, Delhi Administration	Member
3.	Director of Agriculture, Govt. of Punjab	Member
4.	The Professor and Head, Deptt. Of Mathematics & Statistics, CCSHAU, Hisar	Member
5.	Sh HT Mohan Kumar	Member
6.	Shri Sayed Mohd. Altaf	Member
7.	Dr RK Pandey	Member
8.	Dr Pranheshu	Member
9.	Dr Randhir Singh	Member
10.	Dr PK Malhotra	Member

11.	Dr Mruthyunjaya, ADG (ESM), ICAR	Member
12.	Finance & Accounts Officers, NBPGR	Member
13.	Sh SN Jha, Chief Administrative Officer	Member-Secretary

The 39th & 40th meetings of the Management Committee were held on August 18, 1998 & Feb. 26, 1999 respectively under the Chairmanship of Dr. SD Sharma, Director and Dr. Prajneshu, Director (A) respectively.

In the 40th meeting, following important decisions have been taken by the Management Committee.

i) All the 80 old Audit Paras (as per directions of the ICAR) and outstanding advances with CPWD, DGS&D, other Departments and with departmental officers have been settled and these achievements were appreciated by the Management Committee.

ii) The Management Committee recommended for stepping up Training Fee in stages i.e. Rs.2000/- from Rs. 1500/- for one week and Rs. 3750/- from Rs. 3000/- for two weeks durations courses relating to Computer Application in Agricultrure.

iii) The Committee also approved the purchase of 30 Nos. of UPS of 05 KVA and replacement / upgradation of Computer furniture to the extend of 10 Units.

Staff Research Council

The Staff Research Council (SRC) of the Institute is an important forum to guide the scientists in the formulation of new research projects and to review the progress of on-going research projects periodically. It also, monitors the follow up action on the recommendations of the Quinquennial Review Team (QRT) in respect of technical programmes of the Institute. Dr. SD Sharma, Director is the Chairman and Dr HVL Bathla, Principal Scientist & Head (RCM) is the Member-Secretary of the SRC.

Two Meetings of the SRC were held during June 15-16 and Dec. 09-10, 1998. In the first meeting 4 new research project proposals were considered and to review of progress of 37 on-going research projects were discussed.

In the second meeting 1 new research project proposal were considered and to review of progress of 31 on-going research projects were discussed.

PARTICIPATION OF SCIENTISTS IN CONFERENCES, MEETINGS, WORKSHOPS, SYMPOSIA, ETC. IN INDIA AND ABROAD

Sl. No.	Name of the Scientist	Programme	Venue	Period
1	2	3	4	5
1.	Ms. Alka Kalra	Novell 6.2 Administration	IASRI, New Delhi	Jan 4-7, 1998
2.	Dr. SD Sharma	Seminar on 'Application of statistics methods in the study of aphid ecology'	NCEIPM, Pusa, New Delhi	Jan 30, 1998
3.	Ms. Alka Kalra	FOCARS, Hyderabad	Hyderabad	Jan 7 - May 5, 1998
4.	Dr. VK Bhatia Dr. A.K. Paul	Frontiers on Biomedical Research	Delhi University	Mar 31 – Apr 02, 1998
5.	Dr AK Srivastava	Estimation of marketing surplus and post harvest losses of food grains	NIC Office, New Delhi	Apr 01, 1998
6.	Dr SD Sharma	Brainstorming Session on ICAR-Private Sector: An interface in Agricultural Research	IASRI, New Delhi	Apr 02, 1998
7.	Sh. M.R. Vats	National workshop on Long-Term-Fertility Management through integrated Plant Nutrient Supply System	IISS, Bhopal	Apr 02-04 1998.
8.	Dr. VK Mahajan	SAS Training	Bandra, Mumbai	Apr 13-14, 1998
9.	Dr. SD Sharma	NCERT National Seminar on Food Processing Education, Employment and networking	New Delhi	Apr 21-22, 1998
10.	Dr. SD Sharma	Data Users Conference-2001 Census organised by the Office of the Registrar General & Census Commissioner, India	Vigyan Bhavan, New Delhi	Apr 24-25, 1998
11.	Sh RS Khatri	Golden Jubilee Seminar organised by CSWRI and Ind. Soc. of Sheep, Goat and Rabbit Production and Utilization	Jaipur	Apr 24-26, 1998
12.	Sh. S.C. Mehta Dr. L.M. Bhar	National Seminar on Entomology in 21st Century: Bio-diversity, Sustainability, Environmental Safety and Human Health.	Rajasthan College of Agriculture, Udaipur.	Apr 30-2 May 19, 1998

Sl. No.	Name of the Scientist	Programme	Venue	Period
1	2	3	4	5
13.	Dr. SD Sharma	Presentation of 'Project Based Budgeting' by Director, NAARM, Hyderabad	NBPGR, New Delhi	May 19, 1998
14.	Dr. P.K. Batra Smt.Rajinder Kaur	22nd workshop of AICRP on CSR	GAU, Junagadh	May 26-30, 1998
15.	Dr. PK Malhotra Dr. Rajender Parsad	International workshop on Pedagogy	IASRI, New Delhi	May 28-30, 1998
16.	Dr. K.K.Tyagi	"International Workshop on Science of Teaching" organised by Division of agricultural Education, ICAR	IASRI, New Delhi	May 28-29, 1998
17.	Sh. RK Jain	Workshop on 'Essential Software Project Management'	IIC, New Delhi	Jun 6-9, 1998
18.	Dr HVL Bathla	A training course on 'Essential Software Project Management'	QAI (India) Ltd., New Delhi	Jun 8-9, 1998
19.	Sh VK Jain Sh AK Gupta Ms. Sonali Das	Training Course on "Recent Advances in Survey Sampling in Relation to Agriculture"	IASRI , New Delhi	Jun 08-22, 1998
20.	Dr. SD Sharma Dr. AK Srivastava	Brain Storming Session on "Post harvest technology" organised by the Engg. Division of ICAR, New Delhi	IASRI , New Delhi	Jun 23-24, 1998
21.	Dr AK Srivastava Dr. RK Pandey	National Seminar on Importance of buffalows for milk, meat, draught and future strategies for processing and marketing of buffalow products organised by World Buffalow Trust	IARI , New Delhi	Jun 24-25, 1998
22.	Dr.V.K.Bhatia	Training Programme on 'Pedagogy'	IARI, New Delhi	Jun 24-25, 1998
23.	Dr SD Sharma Dr AK Srivastva Dr HVL Bathla Dr. RK Pandey Dr. R.C. Jain Dr Randhir Singh Dr BC Saxena Dr UC Sud Dr KK Tyagi Dr MS Narang	National Seminar on "Improvement of Agricultural Statistics" organised by Directorate of Economics & Statistics, Krishi Bhawan, New Delhi	NBPGR , New Delhi	Jun 26-27, 1998
24.	Dr. Rajender Parsad	Annual workshop of All India Co-ordinated Research Project on "Applications of Plastics in agriculture"	VPKAS, Almora	Jun 26-27, 1998

Sl. No.	Name of the Scientist	Programme	Venue	Period
1	2	3	4	5
25.	Dr. SD Sharma	NATP Demonstration by Dr. Ronald Ng of World Bank	Krishi Bhavan, New Delhi	Jul 15, 1998
26.	Dr. SD Sharma Dr. RK Pandey	National Seminar on Food Production and Environment: Strategies for Sustainable Indian Agricultural organised by NCAP, New Delhi	New Delhi	Aug 01, 1998
27.	Dr. SD Sharma	One-day Policy Dialogue on 'A National Emergency: the Crisis of Agriculture and Food Security' organised by Research Fopundation for Science, Technology & Ecology, New Delhi	India International Centre	Aug 03, 1998
28.	Dr. G.C. Chawla	Seminar-cum- Fifth Annual Workshop of Repeseed-Mustard Research workers	KVC, Kanke Ranchi	Aug 05-08, 1998
29.	Dr SD Sharma Dr AK Srivastava Dr HVL Bathla Dr. RK Pandey Dr. PK Malhotra Dr. R.C. Jain Dr. V.K. Sharma Dr. (Smt.) Ranjana Agrawal Dr UC Sud Sh RS Khatri Dr. Rajender Parsad Dr Anil Rai Dr SP Bhardwaj Dr. RC Goyal	XII National Conference of Agricultural Research Statisticians	Rajasthan College of Agriculture, Udaipur	Aug 08-10, 1998
30.	Dr SD Sharma Dr. P.K. Malhotra	All India Workshop on Agricultural Research Information System	NBPGR, New Delhi	Aug 17-18, 1998
31.	Dr. SD Sharma Sh RS Khatri Dr SP Bhardwaj Ms Sushila Kaul	National Seminar on problems of small and marginal farmers in marketing of fruit and vegetables organised by the Farmers' Education and Welfare Society, New Delhi	Ph. D Home, New Delhi	Aug 20-21, 1998
32.	Dr. SD Sharma	Sensitization Workshop on 'Priority Setting, Monitoring and Evaluation in Agricultural Research under NATP'	IASRI, New Delhi	Aug 26-27, 1998

Sl. No.	Name of the Scientist	Programme	Venue	Period
1	2	3	4	5
33.	Dr SD Sharma Dr. V.K. Sharma Dr. RK Pandey Dr. R.C. Jain Dr. V.K. Gupta Dr. P.K. Batra Smt. Rajinder Kaur Sh. M.R. Vats Smt. Ajit Kaur Bhatia Sh. N.K. Sharma	Brain Storming Session on Organic Farming organised by PDCSR, Modipuram	IASRI, New Delhi.	Sep 7-8, 1998
34.	Dr HVL Bathla	Symposium on Agriculture Environment and Forest towards reconcilliation	CARI	Sep 7-9, 1998
35.	Dr. SD Sharma	Workshop on 'Modernisation of the Statistical System in India' organised by the Department of Statistics, Ministry Planning & Programme Implementation, Government of India, New Delhi	Vigvan Bhavan, New Delhi	Sep 14-16
36.	Dr. SD Sharma	Vice Chancellors' Conference of State Agricultural Universities	NBPGR, New Delhi	Sep 16-17, 1998
37.	Dr SD Sharma Dr. RK Pandey	Workshop on Risk Analysis and Management in Rainfed Rice Systems organised by IRRI Manila and NCAP, New Delhi.	IASRI, New Delhi	Sep 21-23, 1998
38.	Dr. SD Sharma	Kisan Diwas	Research Centre of NBPGR, Issapur	Sep 26, 1998
39.	Dr. SD Sharma	NATP Launch Workshop	PHD House, New Delhi	Oct 6, 1998
40.	Dr. A.R. Rao Dr T Ahmed Dr GK Jha Dr. A.K. Paul Dr. Ramasubramanian, V.	Training on "65th Foundation Course for Agricultural Research Services"	NAARM, Hyderabad	Oct 07, 1998 - Feb 06, 1999
41.	Smt. Rajinder Kaur Smt. Ajit Kaur Bhatia Dr. (Mrs) Seema Jaggi	Constltative meet of National Commission for Women and Women Farm Scientitsts of IARI on gender issue of Agriculture	IARI, New Delhi	Oct 9, 1998

Sl. No.	Name of the Scientist	Programme	Venue	Period
1	2	3	4	5
42.	Dr HVL Bathla	A training course on 'Agricultural Scientists Development Programme' for personal and organisational effectiveness	NAARM, Hyderabad	Oct 19-Nov 03, 1998
43.	Dr KK Tyagi	Interaction Meet on "Business Opportunities in Agricultural Consultancy"	Consultancy Development Centre, New Delhi	Oct 21, 1998
44.	Dr SD Sharma Dr. R.C. Jain Sh. SN Mathur Dr. Aloke Lahiri Sh. M.R. Vats	1st conference of Soc. Of Statistics, Computer and application	CCS Haryana Agricultural University, Hisar.	Oct 23- 25, 1998
45.	Sh. R.K.Jain	Training programme on 'Agricultural Research Prioritization Techniques'.	NAARM, Hyderabad	Nov 14-21, 1998
46.	Dr. SD Sharma	Annual Seminar of the Fertiliser Association of India	Hotel Ashok, Delhi	Nov. 19, 1998
47.	Sh RS Khatri	29th Dairy Industry Conference	NDRI , Karnal	Nov 28-29, 1998
48.	Dr. L.M.Bhar	International Conference on Pest and Pesticide Management for Sustainable Agriculture	C.S.A. University of Agriculture And Technology	Dec 11-13, 1998
49.	Dr SD Sharma Dr. P.K. Malhotra	Global Symposium on Connecting Strategic Intent with Project Management	New Delhi	Dec 14-16, 1998
50.	Dr SD Sharma Dr AK Srivastava Dr. V.K. Sharma Dr KK Tyagi Dr UC Sud Sh RS Khatri Dr Jagbir Singh Sh RM Sood Sh.K Chugh Dr Anil Rai Dr. V.K. Gupta Dr. R. Srivastava Dr. VK Bhatia Smt. Rajinder Kaur Smt. Ajit Kaur Bhatia Dr. Aloke Lahiri Dr. Rajender Parsad Sh. T. Rai	52nd Annual Conference of Indian Society of Agril. Stat.	Acharya NG Ranga Ag. Univ., Hyderabad	Dec 17-19, 1998

Sl. No.	Name of the Scientist	Programme	Venue	Period
1	2	3	4	5
51.	Dr. R.C. Jain Dr. (Smt.) Ranjana Agrawal	National Workshop on Dynamic crop simulation modeling for agro-meteorological advisory service	NCMRWF, India Meteorology Department New Delhi	4-6 Jan, 1999
52.	Dr Randhir Singh	National Seminar Improvements of Agricultural Statistics organised by DES, Ministry of Agriculture	New Delhi	Jan, 1999
53.	Dr. Somy Kuriakose	66th Foundation Course for Agricultural Research Service (FOCARS)	NAARM, Hyderabad	Jan 6 - May 5, 1999
54.	Dr. P.K. Batra	Ninth Annual meeting (Delhi Zone) of Indian Phytopathological Society	NRL , IARI, New Delhi	Jan 16, 1999
55.	Dr Jagbir Singh	Workshop meeting of AICRP (Micronutrients) and AICRP(STCR)	Gujrat Agriculture University, Anand	Jan 16-18, 1999
56.	Dr. Aloke Lahiri	21st workshop meeting of Soil test crop response co-ordinated project (ICAR)	Gujarat Agricultural University, Anand Gujarat	Jan 16-18, 1999
57.	Dr. Ashok Kumar	14th Economic Development Conference, organised by Institute of Trade and Industrial Development, Delhi.	New Delhi	Jan 27, 1999
58.	Dr. P.S. Rana	National Conference on applied statistics and Computing methods	Utkal University, Bhubaneshwar	Jan 30-31, 1999
59.	Dr. Prajneshu	Seventeenth meeting of the SAARC Technical Committee on Agriculture	Ashoka Hotel, New Delhi	Feb. 15-17, 1999
60.	Dr. P.K. Malhotra	Seminar on Intel Enabling the Internet Computing	New Delhi	Feb 26, 1999
61.	Dr. P.K. Malhotra	2nd ARIS Cells Incharge Workshop and Seminar on Linux	NBPGR, New Delhi	Mar 5-7, 1999
62.	Dr Randhir Singh	International conference on Geomformatics for Natural Resources Assessment Monitoring and Management	IIRS , Dehradun	Mar 9-11, 1999
63.	Sh. Mahesh Kumar	Meeting of Directors of Centre of Advanced Studies	Conference Hall, IARI, New Delhi	Mar 26-27, 1999

Visit Abroad

Dr. SD Sharma, Director, and Dr. RC Goyal, Sr. Scientist of the Institute were on deputation to University of California, Davis, California, USA for participation in AHRD training course on 'Web Based, Distance Education Course Development and Databases on the Internet' from January 02 to April 03, 1999.

INSTITUTE'S PARTICIPATION IN MEETINGS

- The meeting of task Force on PM & E System for NATP project of ICAR at NCAP, New Delhi on Jan 02, 1998.

- The meeting of the High Level Technical Coordination Committee regarding fruits and vegetables at Jaipur in the office of the Divisional Horticulture Commissioner on Jan 06.

- The meeting of Manpower Planning and Database Development in Agriculture at the Institute of Applied Manpower Research, New Delhi on Jan 09, 1998.

- The Brainstorming meeting of Project Based Budgeting under the chairmanship of Director General, ICAR at NCAP, New Delhi on Jan 10, 1998.

- Fourth meeting of the Task Force to examine and workout the modalities of implementing the proposal of Forecasting Agricultural Output using Space, Agrometeorology and Land based Observations" (FASAL) project of the Dte. of Economics & Statistics, Ministry of Agriculture, Govt. of India at New Delhi on Jan 12, 1998.

- The 4th meeting of the Technical Committee of Marketable Surplus and post-harvest losses at Nirman Bhavan on Feb 06.

- Meeting of Board of Studies in the Deptt.of Economics Extension & Statistics, Institute of Agriculture, Sriniketan, Shantiniketan (Bolpur), West Bengal on Feb 15, 1998.

- The XVII meeting of the SAARC Technical Committee on Agriculture at New Delhi from Feb. 15-17, 1999.

- Meeting on Methodological Issues of Oilseeds Production Estimation of the Dte. of Economics & Statistics, Ministry of Agriculture, New Delhi on Feb 17, 1998.

- The meeting of the Sub Committee for identification of methodology for estimation and requirement of fodder and fodder seeds of the Department of Animal Husbandry & Dairying, Government of India at Krishi Bhavan, New Delhi on Feb. 19, 1999.

- Meeting of the Intellectual Property Right at NBPGR, New Delhi on Feb 21, 1998.

- Meeting of the ICAR Directors at NBPGR, New Delhi on Mar 4-5, 1998.

- Meeting of the National Advisory Board on Statistics held at Central Statistical Organisation, New Delhi on Mar 30, 1998.

- Meetings of the Cadre Review Committee for Group "A" Administrative posts under the chairmanship of Dr. Kirti Singh, Member, ASRB at New Delhi on Jan 14, Feb 11and Mar 26, 1998.

- The Brainstorming Session on ICAR-Private Sector: An Interface in Agricultural Research held under the Chairmanship of Director General, ICAR at the Institute on Apr 02, 1998.

- The meeting of the Cadre Review Committee for Group "A" posts of ICAR under the chairmanship of Dr. Kirti Singh, Member, ASRB at Krishi Anusandhan Bhavan, New Delhi on Apr 30, 1998.

- The meeting with DDG(Engg.) regarding the upgradation of Agricultural Research

. Data Book at ICAR, Krishi Bhawan on May 08, 1998.

- The meeting of National Advisory Board on Statistics at Vigyan Bhavan, New Delhi on May 12, 1998.

- The presentation of "Project Based Budgeting" by Dr. J.C. Katyal, Director, NAARM, Hyderabad at NBPGR, New Delhi on May 19, 1998.

- The lecture on "The Competitive Challenge Facing India's Agriculture: The Role of Research" delivered by Dr. V. Kurien, Chairman, NDDB at New Delhi on the occasion of Foundation Day of National Academy of Agricultural Sciences on June 05, 1998.

- The meeting regarding the development of Databases under NATP, at Krishi Bhavan, New Delhi on Jul. 14, 1998.

- A demonstration on NATP by Dr. Ronald Ng, World Bank on Jul. 15, 1998 at Krishi Bhavan, New Delhi.

- The One Day Policy Dialogue on "A National Emergency: The Crisis of Agriculture and Food Security" organised by Research Foundation for Science, Technology & Ecology, New Delhi at India International Centre on Aug. 3, 1998.

- Discussion with Dr. A. Vaidyanathan, Professor Emeritus, Madras Institute of Development Studies on collaborative project on "Raising Livestock Productivity in Mixed Crop-Livestock Systems in South Asia" at IASRI on Aug. 4, 1998.

- The First meeting of the CSO Advisory Committee on Awards on Aug. 13, 1998 at New Delhi.

- Discussion with Professor YK Alagh, Chairman, Research Advisory Committee of the Institute on Aug. 14, 1998.

- The meeting of the Departmental Sanctioning Committee/EFC of

Agricultural Census Scheme (1995-96) of the Ministry of Agriculture, Government of India at Krishi Bhawan, New Delhi on Oct. 12, 1998.

- The meeting of the Empowered Committee on Oilseeds Policy (ECOP) regarding oilseeds production estimates of the Directorate of Economics & Statistics, Ministry of Agriculture, Govt. of India at Krishi Bhawan, New Delhi on Oct. 13, 1998.

- The meetings of the PIC of the Engineering Division of ICAR in connection with the IX Plan EFC Memos under the Chairmanship of DDG (Engg.) during Nov. 9-10, 1998.

- The meeting of the National Advisory Board on Statistics at Vigyan Bhavan, New Delhi on Nov. 12, 1998.

- The meeting of the State High Level Committee on Agricultural Statistics of the Directorate of Economics and Statistics, Karnataka at Bangalore on Nov. 24, 1998.

- The meeting at Coconut Development Board, Kochi in connection with the collaborative research project on Estimation of cost of cultivation of Coconut Production in the State of Kerala, prepared by IASRI to be taken up jointly by IASRI, Coconut Development Board and CPCRI, Kasargod on Nov. 25, 1998.

- The meeting and Brainstorming Session of O&M Task Force of NATP at NCIPM, New Delhi under the chairmanship of Director General, ICAR on Nov. 27, 1998.

- The meeting of the Advisory Committee on Awards of the Department of Statistics, Govt. of India, New Delhi at Vigyan Bhavan, New Delhi on Jan. 18, 1999.

- The meeting of Project Coordinator (R.M.) and Scientists from NRC on Rapeseed Mustard, Bharatpur was organised by the Director, National Research Centre on Rapeseed Mustard, Bharatpur to discuss Coefficient of Variation Norms for rejecting experiments having high

unreliability, was held at the Institute on May 26, 1998.

- ICAR Society at Vigyan Bhavan, New Delhi on Jul. 16, 1998.

- Elocution Contest of the IARI Students on 'Agricultural Education in next millennium - Students Perspective' and Prize Distribution ceremony by Director General at IARI, New Delhi on Aug. 14, 1998.

- The meeting of the Cadre Review Committee for Group "A" posts under the

chairmanship of Dr. Kirti Singh at New Delhi on Aug. 24, 1998.

- The Inaugural Function of the Vice Chancellors' Conference of Agricultural Universities at NBPGR, New Delhi on Sep. 16-17, 1998, where Computer Software Program for National Informatics System of Agricultural Education (NISAGE) was presented at the above Vice Chancellors' Conference on Sep. 17, 1998.

- The Workshop on "Risk Analysis and Management in Rainfed Rice System" jointly organised by NCAP-IRRI on Sep. 21- 23, 1998..

WORKSHOPS, SEMINARS, SUMMER INSTITUTES, FARMERS' DAY ETC. ORGANISED AT THE INSTITUTE

A Summer school on "Advances in Statistical Designs for Agricultural Research"

A summer school aimed to acquaint the participants with the latest developments in the field of design of experiments and also to expose them with different latest statistical packages that are being used for analysis of experimental data was organized from 24th June to 14th June, 1998 with Dr. VK Sharma as the Director of the school. 30 participants from all over the country attended summer school. The participants were working as Assistant Professors / Associate Professors / Scientists in different SAUs and ICAR Institutes. The summer school was planned in such a way that there was a blend of theory and application. Besides, the latest developments in design of experiments, the participants were exposed to different software packages.

Summer School on Use of Computers in Information Processing

The Institute organised a summer school on **Use of Computers in Information Processing** during July 16 to August 05, 1998. The course was divided into three broad areas viz. (i) **Information Processing Tools** - Windows OS, MS-Office, MS-Project and Statistical Packages; (ii) **Application Development Tools** - Internet and Intranet Application Development, Web Page Development and HTML (iii) **Information Systems/Services** - Geographic Information Systems, National Information System for Agriculture Education and Library Information Services. Twenty participants attended the Summer School from SAUs and ICAR Institutes. Besides the course work, the participants were taken to National Informatics Centre, New Delhi and National Agricultural Library, IARI to expose them to the recent trends in information technology and dissemination of information. The valedictory function was organised on August 05, 1998. Dr. SL Mehta, Deputy Director General (Education), ICAR was the Chief Guest. He also distributed the certificates to the participants and delivered the valedictory address.

The Annual Day

The annual day of the Institute was celebrated on Jul 02, 1998. As a part of these celebrations, a contests on "Economic Liberalisation is essential for improving the work culture" for technical and administrative staff was held on July 01, 1998. A declamation contest on "Fifty years of Research and Development in Agricultural Statistics and Computer Application in India" for scientists and students was held on July 02, 1998. Dr. DN Jha, Director, National Centre for Agricultural Economic Policy, New Delhi chaired both the sessions and distributed prizes to the winners of the contests.

The main Annual Day Function was celebrated in the afternoon on Jul 02, 1998. Professor A. Alam, Deputy Director General (Engg.), ICAR was the Chief Guest. Professor Prem Narain, Former Director of the Institute delivered the VIII Nehru Memorial Lecture on "Philosophy of Reductionism Versus Dialectics in Agricultural Sciences". The late Shri M.K. Bose Memorial Award was awarded to Shri D.P. Sharma, Technical Officer, a departmental candidate for securing the highest rank in the Senior Certificate Course in Agricultural Statistics and Computing Examination of the Institute during the year 1997-98. The Nehru Memorial Medal was also awarded to Shri Sanjeev Kumar, M.Sc. (C.A.) student, for the session 1995-97. The Chief Guest released the 'Annual Report 1997-98' of the Institute on this occasion.

Seminars

The result of 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 48 seminars were organised. Out of which 32 seminars were delivered by the students of PG School, IARI, 13 by the Scientists of the Institute and 3 were delivered by eminent guest speakers. Name(s) and topics of the research seminars delivered by eminent scientists are as follows:

Seminars By Guest Speakers

Sl.No.	Speaker	Topic
1.	Dr. Aloke Dey, Prof. of Statistics, I.S.I., Delhi Centre	Optimality of Factorial Designs.
2.	Dr. Raj S. Chhikara Prof. of Statistics, University of Houston, Texas.	Sampling from list frame, only for USDA labour survey.
3.	Prof. R. Sambasiva Rao, School of Chemistry, Andhra University, Vishakhapatnam	Artificial neural net works- A new information technique.

DISTINGUISHED VISITORS

INDIAN

Dr. R.S. Paroda,
Director General, ICAR & Secretary, DARE,
Government of India,
Krishi Bhavan,
New Delhi – 110 001.

Prof. A. Alam,
Deputy Director General (Engg.),
I.C.A.R., Krishi Bhavan,
New Delhi – 110 001

Prof. S.L. Mehta,
Deputy Director General (Edu.),
I.C.A.R., Krishi Bhavan,
New Delhi – 110 001

Dr. Mruthyunjaya,
Asstt. Director General (ES&M),
I.C.A.R., Krishi Bhavan,
New Delhi – 110 001

Dr. M.N. Das,
Former Director IASRI,
New Delhi – 110 012.

Prof. Prem Narain,
Former Director IASRI,
New Delhi – 110 012.

Dr Aloke Dey
Head, Stat.-Math. Unit,
Indian Statistical Institute,
7-S.J.S. Sansanwal Marg,
Kathwaria Sarai,
New Delhi – 110 016

Sh T Bhaskaran
NSSO,
Faridabad
Prof Arijit Choudhary
Indian Statistical Institute,
Calcutta

Dr Ravinder Singh
Punjab Agriculture University,
Ludhiana

Dr I Natrajan
National Council Of Applied Economic
Research, New Delhi
Sh SK Sinha
Registrar General Office,
New Delhi

Prof. R. Sambasiva Rao,
School of Chemistry,
Andhra University, Vishakhapatnam

Dr Rajeev Mehta
Ministry of Agriculture,
Govt. of India

Dr PR Sreenath
Emeritus Scientist
IASRI,
New Delhi

Dr Padam Singh
ICMR,
New Delhi

Dr MC Agarwal
Delhi University,
Delhi

Dr Shivtar Singh
Retired Principal Scientist,
IASRI,
New Delhi

Dr GS Ram
Economics & Statistical Advisor,
Ministry of Agriculture,
Krishi Bhavan,
New Delhi

Dr. R.P. Katyal,
Former Joint Director,
Central Statistical Organisation,
New Delhi

Shri B.A. Khan,
Former Assistant Director General,
Indian Council of Forestry Research &
Education
Dehradun

Dr A.K. Roy,
Sr. Scientist,
CIFA,
Bhubaneshwar

Foreign

Dr. Raj S. Chhikara
Prof. of Statistics,
University of Houston, Texas.

PERSONNEL (MANAGERIAL POSITION ONLY)

Sl. No.	Name	Designation	Telephone Off.	Resi.	E-mail
1.	Dr SD Sharma	Director	5741479	7261478 7871772	sdsharma@rocketmail.com sdsharma@iasri.delhi.nic.in
2.	Dr AK Srivastava	Principal Scientist & HD(SS)	5781475	2299496	aks@iasri.delhi.nic.in
3.	Dr HVL Bathla	Principal Scientist & Head (RCM)	5755508	7044393	bathla@iasri.delhi.nic.in
4.	Dr. V.K. Sharma	Principal Scientist & HD(DE)	5721952	667734	vksharma@iasri.delhi.nic.in
5.	Dr Prajneshu	Principal Scientist & HD (BM) and Prof (Ag. Stat.)	5788721	7273793	prajneshu@iasri.delhi.nic.in
6.	Dr RC Jain	Principal Scientist & HD (FTCD & P)	5783398	5403349	rcjain@iasri.delhi.nic.in
7.	Dr RK Pandey	Principal Scientist & HD (SE)	5721952	5588079	rkpandey@iasri.delhi.nic.in
8.	Dr. P.K. Malhotra	Principal Scientist & HD(CA)	5781074	2272225	pkm@iasri.delhi.nic.in
9.	Sh. Mahesh Kumar	Sr. Scientist & Prof. (CA)	5721952	5431395	mahesh@iasri.delhi.nic.in
10.	Sh SN Jha	Chief Administrative Officer	5720574	5588079	snj@iasri.delhi.nic.in
11.	Sh VR Srinivasan	F&AO	5739157	9152525 (PP)	vrs@iasri.delhi.nic.in
12.	Sh RS Khatri	Sr.Scientist, Warden & I/c, Guest House	5783398	5572955	rskhatri@iasri.delhi.nic.in
13.	Dr SS Srivastava	Head, Library	5719135	2296364 2118989	sss@iasri.delhi.nic.in

ANY OTHER RELEVANT INFORMATION SUCH AS SPECIAL INFRASTRUCTURAL\DEVELOPMENT

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 ensuring a high degree of efficiency in the service.

Two meetings of Institute Joint Staff Council were held on May 20 and Nov. 30, 1998 under the Chairmanship of Dr. SD Sharma, Director of the Institute. In this meeting various issues were discussed.

Grievance Committee

The Grievance Committee of the Institute (constituted as per ICAR rules) provides the employees a forum to ventilate their grievances relating to official matters and for taking remedial measures. The Grievance Committee of the Institute was reconstituted with the approval of the Management Committee of the Institute for a period of two years w.e.f. July 07, 1997. Two meetings of the Grievance Committee of the Institute were held on August 28, 1998 and March 11, 1999 under the chairmanship of the Director.

Cooperative Thrift and Credit Society

The society is registered with the Registrar Cooperative Societies, Delhi Administration, Delhi and continued its activities as in the past years by advancing loans to its members and looking after their welfare. The source of funds of the society and share money, compulsory deposits and fixed deposits from the members of the society. At present the number of members on the roll of the society is 516.

The society is managed by an Executive having one President, one Vice President and nine members, the Secretary and Treasurer of the society are elected by the executive from its nine members.

The executive of the society is

1.	President	Sh. VK Mishra
2.	Vice President	Dr. VK Mahajan .
3.	Secretary	Sh. VK Jain
4.	Treasurer	Sh. UC Bandhooni
5.	Member	Sh. GM Pathak
6.	Member	Sh. Arbind Kumar
7.	Member	Sh. Naresh Kumar
8.	Member	Sh. Mukesh Kumar
9.	Member	Sh. Ashok Kumar
10.	Member	Smt. Usha Jain
11.	Member	Smt. Pushpa Marwah
12.	Member	Sh. NP Singh
13.	Member	Sh. Pal Singh
14.	Auditor	Sh Mahesh Kumar

Main achievements of the Society

1. The society advanced Rs.46,13,500/- to the members as loan

2. The society has refunded Rs.1,70,800/- to the members as their 50% CD

3. An amount of Rs.251/- was given as gift to the each members on their retirement from the Institute

4. The financial half of Rs.4,000/- was extended from the members welfare fund to the bereaved family of one member

5. The net profit for the financial year 1997-98 was Rs. 1,24,163/-.

Hostel Activities

There are two well furnished hostels viz. Panse Hostel and Sukhatme Hostel to cater to the residential requirements of the trainees and students of M.Sc. and Ph.D. courses at the Institute within its premises. Officers and other trainees to the various other refresher, short-term and adhoc courses organised at the Institute are also provided residential accommodation at the Panse Hostel. Ample facilities exist for the cultural activities and sports for the hostel in-mates. Hostel mess is run by the students on cooperative basis. The general management of the hostels is vested with the Warden, who is assisted by the Prefect and the other students. The main activities included are as follows:

A General Body meeting of IASRI hostel inmates was held under the Chairmanship of Shri RS Khatri, Warden. For smooth functioning of the hostel activities Prefect alongwith other Executive Body members were elected.

Boarding and lodging arrangements were made in Panse Hostel (Guest House) for the participants of various training programmes organised in the Institute during the period under report. Similar arrangements were made for the guests who stayed in guest house from different departments/organisations.

Benevolent Fund

The employees of the Institute have constituted a Benevolent Fund from their own contributions to provide relief to the families of the employees who die in harness and are left in an indigent condition. The meetings of the Benevolent funds were held on Sep 15 and Dec. 02, 1998.

Cooperative Store

The cooperative store, registered with the Registrar, Cooperative Societies, Delhi Administration, Delhi continued to be run for the benefit of the staff members of the Institute, Cold drinks, Coffee, Snacks-provisions and general merchandise etc. were made available at reasonable rates to the staff members of the Institute.

Member's Children Education Welfare Scheme was also introduced by the Managing Committee during the year 1997-98 for the promotion of educational improvement for the children of the members of the cooperative store. Under the scheme 16 children of the members of the Cooperative Store were benefited.

The Total membership of the cooperative store as on 31st December, 1998 was 469.

Recreation and Welfare Club

The Institute has a Recreation and Welfare Club which provides facilities for indoor and outdoor games, promotes social and friendly relations among the members and general recreation and welfare of its members. The club organised sport tournaments annually at Institute level for different games/events fe.g. Table Tennis, Carrom, Volleyball, Card games etc. The sport tournaments for the year 1997 were organised during 1997-98 and prizes/trophies were distributed to the Winners/Runners at the Annual Day Function organized on 1.12.1998. The election for the new Executive Committee of the club were held during January 1999. Shri Santosh Kumar, Technical Officer was elected as the Honorary Secretary, Dr.,, SD Sharma, Director was unanimously requested to be the President of the club and Dr. KK Tyagi, Sr. Scientist as its Vice-President. The newly constituted

Executive Committee of R&W club is as follows:

1. Dr. SD Sharma, Director	President
2. Dr. KK Tyagi	Vice-President
3. Sh. Santosh Kumar	Secretary
4. Sh. Ram Bhool	Sports Secretary
5. Sh. KK Hans	Hony. Secretary
6. Sh. Mohan Lal	Member
7. Sh. Naresh Kumar	Member
8. Sh. Pradeep Kumar	Member
9. Sh. Diwan Singh	Member

संस्थान में हिन्दी का प्रगामी प्रयोग

संस्थान में हिन्दी पखवाड़ा दिनांक ३१.८.६८ से १८.८.६८ तक बड़ी धूमधाम से मनाया गया। हिन्दी पखवाड़े का उद्घाटन संस्थान के निदेशक महोदय द्वारा किया गया। निदेशक महोदय ने अपने उद्घाटन भाषण में संस्थान के समस्त अधिकारियों और कर्मचारियों को राजभाषा हिन्दी में कार्य करने के लिए प्रेरित किया और कहा कि हिन्दी में कार्य करना कठिन नहीं बल्कि आसान है। जरूरत केवल पहल करने की है। पखवाड़े के दौरान काव्य पाठ, वाद–विवाद प्रतियोगिता, प्रश्न मंच तथा डा. दरोगा सिंह स्मारक व्याख्यान का आयोजन किया गया। काव्य पाठ में संस्थान के ही कवियों ने स्वरचित कविताओं का पाठ किया। यह कार्यक्रम अत्यन्त ही लोकप्रिय रहा। दिनांक १४ सितम्बर, ९६८ को संस्थान में हिन्दी दिवस/वार्षिकोत्सव का आयोजन किया गया और हिन्दी पखवाड़े के दौरान आयोजित प्रतियोगिताओं के विजयी प्रतियोगियों को पुरस्कृत भी किया गया। इसी अवसर पर डा. दरोगा सिंह स्मारक व्याख्यान का आयोजन किया गया। इस व्याख्यान के वक्ता संस्थान के पूर्व निदेशक डा. बाल बी.पी.एस. गोयल थे। व्याख्यान वैज्ञानिक प्रकृति का था जिसका विषय था— "कृषि सांख्यिकी का विकास"। यह व्याख्यान वैज्ञानिकों के लिए अत्यन्त ही लाभदायक था जिसकी वैज्ञानिकों द्वारा सराहना की गई।

संस्थान द्वारा दिनांक ८–१० अगस्त, ९६८ के दौरान राजस्थान कृषि विश्वविद्यालय, उदयपुर में आयोजित "कृषि अनुसंधान सांख्यिकीविदों के १२वें राष्ट्रीय सम्मेलन" में वैज्ञानिकों की हिन्दी में एक "राष्ट्रीय संगोष्ठी" का आयोजन किया गया। जिसका विषय था "कृषि अर्थव्यवस्था के उदाशिकरण के संदर्भ में सांख्यिकी के आयाम" जिसके तीन उपशीर्षक थे : (क) कृषि अर्थव्यवस्था का भूमण्डलीकरण और आंकड़ों की आवश्यकता, (ख) स्थायी कृषि के संदर्भ में कृषि सांख्यिकी अनुसंधान, (ग) कृषि सांख्यिकी अनुसंधान एवं शिक्षा की नई दिशाएं। संगोष्ठी में अनेक वैज्ञानिकों द्वारा लेख प्रस्तुत किए गए जिसका संकलन कर एक स्मारिका के प्रकाशन किया गया।

संस्थान में राजभाषा के प्रगामी प्रयोग में हो रही अभिवृद्धि का जायजा लेने के लिए एक राजभाषा निरीक्षण समिति का गठन किया गया है जो तीन महीने में एक बार अनुभागों/प्रभागों का निरीक्षण कर अपनी रिपोर्ट सुझावों सहित निदेशक महोदय को प्रस्तुत करेगी जिससे संस्थान में धारा ३(३) तथा वार्षिक कार्यक्रम का अनुपालन समुचित ढंग से हो सकेगा।

संस्थान द्वारा एक संपादक मंडल का गठन किया गया है जो संस्थान के वैज्ञानिकों द्वारा किये जा रहे शोध कार्यों की रिपोर्ट तथा उनके बृहत सारांशों में अनुवाद से संबंधित कार्य देखेगा। वर्ष ९६८ के दौरान हिन्दी प्रशिक्षण योजना के अंतर्गत संस्थान के तीन अंग्रेजी के आशुलिपिकों को तथा सात कनिष्ठ लिपिकों को हिन्दी आशुलिपि/टंकण का प्रशिक्षण दिलवाया गया।

विशिष्ट सारांश

भारतीय कृषि सांख्यिकी अनुसंधान संस्थान (भा.कृ.सां.अ.सं.) की स्थापना सन् १९५६ में हुई थी तभी से यह संस्थान कृषि सांख्यिकी में अनुसंधान को बढ़ावा दे रहा है और शिक्षा/प्रशिक्षण प्रदान करने का महति दायित्व निभा रहा है। सूचना प्रौद्योगिकी में हो रही उन्नति के साथ–साथ इस संस्थान ने स्वयं को कृषि अनुसंधान की वर्तमान जरूरतों के अनुकूल बनाया है। बदलते हुए परिवेश में संस्थान को सोंपे गए कार्य हैं– कृषि सांख्यिकी में मौलिक, व्यावहारिक और अनुकूल अनुसंधान करना, राष्ट्रीय कृषि सांख्यिकी प्रणाली को विकसित करने एवं सुदृढ़ बनाने में सहायता करना, कृषि सांख्यिकी एवं कंप्यूटर उपयोग में स्नातकोत्तर और सेवाकालीन पाठ्यक्रम चलाना, परामर्श सेवाएं प्रदान करना, कृषि सांख्यिकी में सूचना भण्डार के रूप में कार्य करना, कृषि सांख्यिकी और कंप्यूटर उपयोग में एक उन्नत श्रेष्ठ शिक्षा एवं प्रशिक्षण केन्द्र के रूप में संस्थान को विकसित करना और इन विषयों में राष्ट्रीय एवं अन्तर्राष्ट्रीय संगठनों के प्रायोजित अनुसंधान कार्य करना।

संस्थान के विभिन्न प्रभागों जैसे प्रतिदर्श सर्वेक्षण, परिक्षण डिजाइन, जीवसांख्यिकी, सांख्यिकीय अर्थशास्त्र और कंप्यूटर उपयोग में अनेक अनुसंधान परियोजनाएं चलाई जाती है। प्रतिवेदनाधीन वर्ष के दौरान ३८ अनुसंधान परियोजनाएं और एक रिवाल्विंग फंड परियोजना चलाई गई। संस्थान में चलाई गई परियोजनाएं श्री– मुर्गियों के मांस का उत्पादन, अन्तर्देशी मत्स्यजोल आकलन, उत्पादन एवं क्षेत्र आकलन, मूल्यांकन एवं मूल्य निर्धारण अध्ययन, लघु क्षेत्र आकलन, जटिल सर्वेक्षणों में पद्धतिबद्ध सर्वेक्षणा, जटिल सर्वेक्षणों में पद्धतिबद्ध अध्ययन, सुदूर संवेदी प्रौद्योगिकी का उपयोग, आंकड़ों के आधारों का विकास, फसल प्रणाली अनुसंधान कृषि एवं पशु परिक्षणों के लिए सूचना प्रणाली, पशु कृषि वानिकी और मत्स्य अनुसंधान के लिए परीक्षण डिजाइन, पशु और पादप आनुवंशिकी में सांख्यिकीय अध्ययन, जीव विज्ञान प्रक्रिया के लिए माडलिंग, समष्टि जीवविज्ञान में अध्ययन, कृषि प्रणाली में पूर्वानुमान तकनीक, कृषि में प्रौद्योगिकी संबंधी बदलाव और उसका विसरण, कृषि में संसाधन उपयोग की कुशलता इनमें से कुछ अध्ययनों में मान एवं सूचना प्रौद्योगिकी में प्रशिक्षण कार्यक्रम, संस्थान, विभिन्न संस्थानों, प्रयोक्ता संगठनों से सहयोग कर रहा है। अनुसंधान समन्वय एवं प्रबंध एकक समन्वय एवं प्रबंध कार्य के अलावा संस्थान की वार्षिक रिपोर्ट, तिमाही भा.कृ.सां.अ.सं. समाचार निकालती है, प्रगति रिपोर्टों की निगरानी करती है और "कृषि सांख्यिकी एवं कंप्यूटर उपयोग में उन्नति" नामक सोविनियर का स्वर्ण जयन्ति अंक निकाला है।

प्रतिदर्श सर्वेक्षण प्रभाग, फसल, पशुधन, मात्स्यिकी और दूसरे क्षेत्रों से संबंधित विकास के कार्य में लगा हुआ है। गतिक समष्टि एवं परिवर्तन के आकलन पर एक परियोजना में उत्तरोत्तर प्रतिचयन योजना और संरक्षण आव्यूह विधि की सहायता से सामान्य विकासशील प्रक्रिया और विभिन्न आकस्मिक कारकों के अधीन दो अवसरों पर दो वर्गों में इकाइयों के संकरण संचालन के फलस्वरूप गतिक समष्टि में इकाइयों की संख्या के परिवेश में संयुक्त परिवर्तनों के लिए आकलक विकसित किए गए हैं।" भैंसों के दूध के उत्पादन में अंतरों का एक विश्लेषण" नामक परियोजना से उपयोगी परिणाम प्राप्त हुए हैं जो चारा निर्माताओं के लिए सांड तैयार करने में अत्यधिक लाभप्रद है। "महत्वपूर्ण सब्जियों की फसलों की उपज पर विभिन्न निवेश संबंधी घटकों के प्रभाव" नामक अध्ययन से प्राप्त परिणामों से किसानों की सब्जी

85

की फसलों की खेती में विभिन्न निवेशों का व्यवहार समझने में मदद मिलेगी और वे निवेशों का किफायती उपयोग कर अधिक से अधिक लाभ प्राप्त कर सकेंगे।

ऐसी डिजाइनें प्राप्त की है जब उपचारों का एक समुच्चय अनुक्रमण में लागू किया जाता है तो परस्पर अनुक्रिया होती है। जब परस्पर अनुक्रिया की संभावना होती है तो कारकों और एक समुच्चय में उपचारों का प्रतिनिधित्व करने वाले कारकों के भिन्न-भिन्न उपचारों के समुच्चय सहित एक क्रमगुणित समुच्चय इन उपचारों के समुच्चय कारकों के स्तर के होते हैं। प्राप्त डिजाइनों की संरचना लंबिक क्रमगुणित है। कुशल असमित्रता डिजाइनों की दो श्रृंखलाए अर्थात $q = ५, ६$ और ७ स्तरों सहित $q = २$ और $q = ५,६,७$ और ८ स्तरों के लिए $q \times ३ⁿ$ विकसित की गई है। असममित कारकों के भिन्न-भिन्न अनेक स्तरों की सर्वाधिक उपयुक्त सहयोगी योजनाएं आकलित विपर्यासों के सहसंबंध पर आधारित मानदण्डों सहित भिन्न-भिन्न A,D और E अनुकूलता मानदण्डों की सहायता से प्राप्त किए गए। ये डिजाइनें ऐसी दशाओं के लिए उपयोगी है जहां परीक्षण में दूसरे कारक के स्तरों से एक कारक के स्तर भिन्न होते हैं। वर्ष के दौरान अधिक भारतीय समन्वित अनुसंधान परियोजनाओं के तहत भिन्न-भिन्न सहयोगी परियोजनाओं से प्राप्त आंकड़ों का विश्लेषण उपयुक्त सांख्यिकीय तकनीकों की सहायता से किया गया। एफिस (ए.एफ.ई.आई. एस.) में उपलब्ध परीक्षणों के आंकड़ों के ढांचे को इस प्रकार संशोधित किया गया कि उन्हें रोगों के अध्ययन के लिए किए जाने वाले परीक्षणों में शामिल किया जा सके।

करने के लिए बूटस्ट्रैप तकनीक का उपयोग और बूटस्ट्रैप तकनीक द्वारा पुनरावृत्ति एवं उनके स्थायित्व के मूल्यांकन का आकलन करने के भिन्न-भिन्न विधियों के कार्यनिष्पादन की तुलना करने के लिए अध्ययन।

फसल उपज पूर्वानुमान के क्षेत्र में सांख्यिकीय तकनीकों का विकास करने और फसल, नाशीकीटों और रोगों के आसन्न प्रकोप के लिए पूर्वानुमान तकनीक पर अध्ययन किए गए। आलू पर चेंपा के प्रकोप की पूर्वचेतावनी प्रणाली के विकास पर अध्ययन से पता चलता है कि दो प्रकार के अर्थात (i) अरैखिक माडल जिनमें भिन्न-भिन्न कोटिज्य फलनों (कोसाइन फंक्शंस) का उपयोग किया गया (ii) जी.एम.डी.एच. तकनीक की सहायता से उच्च श्रेणी के समिश्र बहुपद, माडल विकसित किए गए। इन माडलों के पूर्वानुमानित मान, प्रेक्षित माडल के काफी करीब थे। मौसम संबंधी चरों के आधार पर दो सप्ताह पूर्व चेंपा की पूर्वचेतावनी संभव है। एक अध्ययन में मौसम संबंधी प्राचलों की सहायता से चावल की फसल के पूर्वानुमान माडल विकसित करने के लिए विविक्तकर फलनों का उपयोग किया गया। जलवायवीय समंक (विदर स्कोर) विकसित करने के लिए रैखिक एवं द्विघात फलनों का उपयोग किया गया। फसल के सक्रीय वनस्पतिक चरण में रैखिक जलवायवीय समंक की वर्गीकरण शुद्धता ७६.२ प्रतिशत थी जबकि द्विघात समंक ६५.२८ प्रतिशत था इससे ज्ञात होता है कि द्विघात समंक रैखिक समंक की अपेक्षा बेहतर है। इस चरण में जलवायवीय समंक और निवेश चरों की सहायता से पूर्वानुमान माडल उपज में ८७ प्रतिशत विचलन दर्शाते हैं। यदि माडल में उपयोग किया गया जलवायवीय समंक द्विघात किस्म का है तो पूर्वानुमान माडल उपज में ६२ प्रतिशत विचलन देखने में आता है।

जैव सांख्यिकीय के क्षेत्र में किए गए अनुसंधानों में शामिल हैं— चेंपा समष्टि की बढ़वार के लिए सांसर्गिक वितरण एवं गतिकीय माडल, समष्टि जीवविज्ञान में प्रक्षेपण आव्यूहों के गुणों पर अन्वेषण, आनुवंशिक प्राचलों के सांख्यिकीय गुणों का अध्ययन

पंजाब और हरियाणा में गेहूं के उत्पादन में तकनीकी दक्षता के आकलन, राष्ट्रीय प्रतिदर्श सर्वेक्षण आंकड़ों की सहायता से मुर्गी उत्पादन

86