

वार्षिक रिपोर्ट
ANNUAL REPORT
1980



भारतीय कृषि सांख्यिकीय अनुसंधान संस्थान
(भा० क० अ० प०)
लाइब्रेरी एवेन्यू, नई दिल्ली-110012
INDIAN AGRICULTURAL STATISTICS RESEARCH INSTITUTE
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and

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प्रतिकथन

मैं भारतीय कृषि सांख्यिकीय अनुसंधान संस्थान, नई दिल्ली की वार्षिक रिपोर्ट को पाठकों के सभ्य सहर्ष परस्तुत करता हूँ जहां तक सम्भव हो सका है इस प्रतिवेदनाधीन वर्ष के अर्न्तगत संस्थान के सभी कार्य क्षेत्र और गतिविधियों के सभी पहलुओं पर प्रकाश डालने का प्रयास किया गया है। मुझे आशा है कि यह रिपोर्ट कृषि सांख्यिकीय क्षेत्र के अन्वेषकों व अन्य प्रयोजताओं के लिए बहुत लाभदायक सिद्ध होगी। इसके अगले अंकों में सुधार लाने के लिए मैं किसी भी प्रकार की टिप्पणी एवं सुझावों का आभार सहित स्वागत करूँगा।

मैं संस्थान के उन सभी अधिकारियों व सदस्यों का आभार सहित शार्दिक धन्यवाद करता हूँ जिन्होंने रिपोर्ट के इस अंक के लिए अपेक्षित सामग्री एकत्रित करने व प्रकाशित करने में सहयोग प्रदान किया है।

मैं सर्व श्री दलजीत सिंह अनेजा, महाराजस्वरूप, मदन मोहन, सोमदत्त, फणीन्द्रपाल सिंह और श्रीमती कुमुमलता का भी आभारी हूँ जिन्होंने रिपोर्ट के इस अंक के संकलन एवं मुद्रण में अपना भरपूर सहयोग दिया है।

दरोगा सिंह

निदेशक

भारतीय कृषि सांख्यिकीय अनुसंधान संस्थान

नई दिल्ली-११००१२

P R E F A C E

I take pleasure in presenting to the readers this Annual Report of the Indian Agricultural Statistics Research Institute, New Delhi for the year 1980. Efforts have been made to cover, as far as possible, all the aspects of the functions and the research activities of the Institute during the year under report.

I hope this report would prove useful to research workers in the field of agricultural statistics and other users. Comments and suggestions offered for improvement in the presentation of subsequent annual reports of the Institute would be welcome and appreciated.

I take this opportunity to place on record my sincere thanks to the officers and other staff of the Institute who extended willing co-operation in preparing and supplying the material required for this report.

I am also thankful to S/Shri D.S. Aneja, Maharaj Swaroop, Madan Mohan, Som Dutt, P.P. Singh and Mrs. Kusum Lata for the help rendered in compilation, preparation and printing of this issue of Annual Report.

DAROGA SINGH
DIRECTOR
INDIAN AGRICULTURAL STATISTICS
RESEARCH INSTITUTE
NEW DELHI-110012

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1. INTRODUCTION

The Indian Agricultural Statistics Research Institute is the premier Institute whose objective is to promote and conduct research and training in agricultural statistics in the country for improving the planning and evaluation of agricultural research and development. To achieve the above objective, the following functions are carried out.

- (i) To conduct research in experimental designs, sampling methods, statistical genetics, computer programming and data processing,
- (ii) To conduct post-graduate courses for training professional Statisticians and in-service training for agricultural scientists,
- (iii) To provide advisory service to agricultural scientists and agricultural organisations and
- (iv) To provide consultancy service for data processing.

The Institute has played a very important role in the progress in the application of statistical methods to agricultural research in India and has achieved international recognition for the high quality of its research work and training. A number of research workers from this Institute have served as consultants and advisers in Asian, African and Latin American countries. Also a number of statisticians and trainees of the Institute are at present occupying high positions in the universities and other research institutions of the U.S.A., Canada and other Countries.

It was in year 1930 that, in pursuance of the recommendations of the Royal Commission of Agriculture, the Institute made a modest beginning as a Statistical Section of the Indian Council of Agricultural Research (ICAR), the then Imperial Council of Agricultural Research. It was then manned by only one Statistician and a limited staff. Initially, the principal function of the statistician was to assist the agricultural officers in the various provinces of the country in planning experiments, analysing the data and interpreting the results. In 1933, he was also made responsible for scrutiny of the technical programmes and progress reports of the research schemes of the Council.

The activities of the Statistical Section entered a new phase towards the end of 1943 when at the instance of the Government of India, research was initiated to develop objective and reliable methods for collecting yield statistics

of principal food crops. This led to the development of the crop-cutting survey technique which was in the course of a few years, extended to almost the entire country for estimating agricultural produce. In the course of this work, the Statistical Section had to undertake research in sampling theory and train a large number of statisticians and field staff.

With its increasing activities, the 'Statistical Branch', as then it used to be called, was reorganised in 1945 into two separate units, each under the charge of a Statistician, dealing with Statistical applications to research in agriculture and in animal husbandry and was headed by Statistical Adviser to the Council. Also, the Council instituted regular post-graduate training courses for professional statisticians wishing to specialise in agricultural statistics and for research workers in the field of agriculture and animal husbandry who were desirous of acquiring knowledge of simple statistical methods required most often for use in their work. Although research and teaching was integrated, a small training unit consisting of whole time professor, assistant professors and demonstrators, was eventually constituted for organising the various courses of study. The 'Statistical Branch' soon acquired international recognition as a training and research institution in the field of agricultural statistics and was made responsible for training foreign students and organising internal seminars for the Food and Agriculture Organisation of the United Nations.

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

In September, 1952, the services of two F.A.O. experts, Dr. Frank Yates, Chief Statistician, Rothamsted Experimental Station, Harpenden (U.K.) and Dr. D.J. Finney of Oxford University (U.K.) were assigned to the Government of India to advise and assist the ICAR in reviewing its research and training activities. As a result of their recommendations, the activities of the 'Statistical Branch' were expanded in many directions and in August, 1955, it moved to its present campus at Pusa in the neighbourhood of the Indian Agricultural Research Institute for closer collaboration with that Institute and was called 'Statistical Wing' of the ICAR. The campus provided adequate space not

only for office accommodation for the technical and the ministerial staff but also for facilities of a library, reading room, class-rooms for the training classes, an auditorium and a hostel with the usual amenities including a play ground for the students admitted to the various courses of study. Also, in recognition of its important role as a training and research institution, the "Statistical Wing" was re-designated by the Government of India as the Institute of Agricultural Research Statistics (IARS) in June, 1959. A mechanical data processing unit was also then added to the Institute.

On the completion of construction of a new four-storey building in the campus of the Institute in 1964, the mechanical data processing unit was shifted to its ground floor and was expanded with the installation of an I.B.M. 1620 Model-II Electronic Computer and other related equipments, while the first and the second floors of the new building provided additional suitable office space for expanding technical and ministerial staff of the Institute and better accommodation for the Cooperative Canteen of the Institute on the first floor and spacious auditorium on the third floor which also provided a suitable venue of the cultural and other activities of Recreation and Welfare Club of the Institute. All these facilities enabled the Institute to discharge its functions more efficiently. In October, 1964, new courses leading to M. Sc. and Ph. D. degrees in Agricultural Statistics were started in collaboration with the Indian Agricultural Research Institute (IARI), New Delhi, which is a deemed University.

The Institute was declared a full-fledged Institute under the administrative control of ICAR with effect from 1st April, 1970 and is since then headed by a Director.

Since the activities of the Institute expanded manifold, a new three storied building was constructed in the Campus of the Institute in 1976. The Computer Centre with its additional equipments shifted to its ground floor. The Library was expanded and shifted to its spacious second floor. A new auditorium and a big exhibition room were also provided in this new building on ground floor and first floor respectively. The first floor also provided additional space for the expanding technical and scientific staff.

Looking into the growing demand of computer use, on recommendations of the Department of Electronics, Govt. of India, a third generation computer B-4700 system was installed in the new computer centre building. The New System was inaugurated by Shri B.D. Jatti, the then Acting President of India on 11th March, 1977.

Since 1st January, 1978 the name of the Institute of Agricultural Research Statistics (IARS) has been changed to Indian Agricultural Statistics Research Institute (IASRI) by the ICAR.

In order to cover the deficiencies in the existing documentation services that deal with agriculture, the Food and Agriculture Organisation (FAO) of the United Nations (UN) initiated a series of studies in 1971, to establish the Information System for Agricultural Sciences and Technology (AGRIS). After preliminary trials the system started functioning in 1975. As on 1st Nov., 1977 there are 82 input centres and 77 liaison offices all over the World, which contribute to the system. The Input Centre of India is the Agricultural Research Information Centre located at the Indian Agricultural Statistics Research Institute (IASRI), New Delhi. Our country is the third (next to USA and Japan) among the national input centres, from the point of number of inputs added to the system every month. The Indian Agricultural Statistics Research Institute (IASRI) New Delhi has started a Selective Dissemination of Information Service to help the Scientists in ICAR Institutes and Agricultural Universities to obtain references to documents relating to areas of their specific interest.

1.1. Organisational Structure of the Institute

The research and technical work of the Institute is organised in the following seven Divisions and one cell :—

Division of Statistical Research in Crop Sciences.

- „ „ Crop Forecasting Methodology.
- „ „ Statistical Research in Animal Sciences.
- „ „ Sample Survey Methodology.
- „ „ Econometric Analysis.
- „ „ Training and Basic Research.
- „ „ Computer Science and Numerical Analysis.

and Statistical Genetics Cell.

Apart from the above, other cells known as Director Cell and Monitoring Cell have been functioning since 1973 and 1979 respectively.

The number of class I officers in position as on 31st December, 1980 was 124 (including one Scientist (S-3), one Scientist (S-2) and three Scientists (S-1) on deputation). List of these officers is given as Appendix-I. On the research and training side, the Director was assisted by two Joint Directors, 12 Senior

Scientists (S-3), 22 Scientists (S-2), 81 Scientists (S-1), one M.T.O. (T-6), one Field Officer (T-6) and one Librarian (T-6) and on the administration side, Field Officer (T-7), by a Chief Administrative Officer and one Sr. Administrative Officer.

The number of posts (including outstation posts) sanctioned as on 31st Dec., 1980 was 625 comprising of 92 Class-I, 66 Class-II, 386 Class-III and 81 Class-IV posts. A list of sanctioned and filled up posts is shown in Appendix-II.

1.2 Management Committee of the Institute

The main purpose of constituting Management Committees for the Research Institutes under the administrative control of the Indian Council of Agricultural Research (ICAR) is to ensure that greater administrative and financial powers delegated to the research Institutes in the re-organised set up of the Council are exercised to the fullest possible extent. The basic philosophy is that once a programme has been approved that necessary funds allocated by the Governing Body of the Council, the Institute should have the necessary authority to execute such programmes with as little reference to the Council as possible. The setting up of the Management Committee is also expected to broad-base the decision making process and ensure efficient implementation of the approved research programmes.

Besides, assisting the Director of the Institute in the discharge of his functions, the Management Committee particularly concentrates the attention on the research and other programmes of the Institute and ensure their implementation both in terms of physical targets and time schedules. For this purpose, the Committee will examine the progress of the programmes periodically, pinpoint bottlenecks, if any and suggest suitable remedial measures.

An eleven-member Management Committee of the Institute under the Chairmanship of the Director of the Institute was constituted by the ICAR in April, 1979 for a period of three years. A list of members of the Management Committee of the Institute is given below :

- | | | |
|----|---|----------|
| 1. | Dr. D. Singh
Director,
Indian Agricultural Statistics Research Institute,
New Delhi. | Chairman |
| 2. | Development Commissioner,
Delhi Administration,
Delhi. | Member |

- | | | |
|-----|--|------------------|
| 3. | Dr. C. Mishra,
Director,

Ex-Officio Additional Secretary to the Govt. of Orissa,
Plan Information Monitoring Evaluation,
Govt. of Orissa, Bhubaneswar. | Member |
| 4. | Dr. R.N. Singh.
Jt. Director (Research),
Indian Agricultural Research Institute, Pusa.
New Delhi-12. | Member |
| 5. | Dr. Prem Narain,
Joint Director,
Indian Agricultural Statistics research Institute,
New Delhi-12 | Member |
| 6. | Shri K.S. Krishnan,
Scientist, Indian Agricultural Statistics
Resarch Institute, New Delhi-12. | Member |
| 7. | Dr. H.P. Singh,
Scientist, Indian Agricultural Statistics
Research Institute, New Delhi-12. | Member |
| 8. | Shri L.K. Garg,
Scientist, Indian Agricultural Statistics
Research Institute, New Delhi-12. | Member |
| 9. | Assistant Director-General (Statistics)
Indian Council of Agricultural Research,
Krishi Bhavan, New Delhi. | Member |
| 10. | Chief Accounts Officer,
Indian Agricultural Research Institute, Pusa,
New Delhi-12. | Member |
| 11. | Shri R.N. Bakshi,
Chief Administrative Officer,
Indian Agricultural Statistics Research Institute.
New Delhi-12. | Member-Secretary |

The Council also nominated the following two village representatives as Non-Official Members to represent Agricultural/Rural interests in the Management Committee of IASRI.

1. Sh. Harbans Singh Jalal, Ex. M.L.A., Village-Jalal, Tehsil-Phul, Distt. Bhatinda (Punjab).
2. Sh. Brijender Bahadur Pal, Dhobaba Farm, Via Domariaganj Distt. Basti (U.P.).

The meeting of the Management Committee of the IASRI was held on 20.8.80.

1.3. Staff Research Council

The Staff Research Council of the Institute was constituted in 1970. The objectives of the Staff Research Council are to scrutinize the research programmes, decide the priorities and to watch the progress of the various research projects with a view to remove bottlenecks, if any, in their implementation. It discusses the progress of research problems in statistics involving inter-disciplinary collaboration. It also considers publication of results of statistical research which are worthy of being passed on for extension purpose.

The Staff Research Council continued to function during the year under report. The Staff Research Council met thrice during 1980 in the months of January, July and Aug., under the Chairmanship of the Director to discuss the progress of various research projects already in operation. In the meeting held in January, 1980 the progress of 77 projects was discussed whereas progress of 84 research projects of various Divisions of the Institute was reviewed in the Meetings held in July and August.

1.4 Divisional Research Committees

Divisional Research Committee meetings are held every month under the chairmanship of the respective Head of Division to discuss about the technical programmes, statistical methodology adopted, progress of work and bottlenecks, if any, in implementation of the various research projects, etc. and follow up action in the decisions taken therein.

During the year under report, several monthly meetings of the seven Divisions viz., (i) Division of Statistical Research in Crop Sciences, (ii) Division of Crop Forecasting Methodology, (iii) Division of Statistical Research in Animal Sciences, (iv) Division of Sample Survey Methodology, (v) Division of Econometric Analysis, (vi) Division of Training and Basic Research and (vii) Division of Computer Science and Numerical Analysis, were held under the chairmanship of the Heads of respective Divisions. In the meetings, the points mentioned above were discussed alongwith the

problems faced by the Scientists/Technical staff in execution of the projects, administrative problems and allocation of any other work of ad-hoc nature assigned by the Director. The Director of the Institute also participated in some of these meetings. He gave some valuable suggestions on the technical aspects of their various research projects for the improvement of their research work and also helped them in removing their difficulties.

1.5 Hostel

The Institute has within its campus two well-furnished and organised Hostels, commonly known as New and Old Hostels and flanked by good play grounds and lawns. Boarding and lodging in the Hostel is compulsory for all the students admitted to various courses. These hostels serve as a common place for sharing joys, sentiments and varying moods of the students coming from various parts of the country. The different festivals like Holi, Deepawali, Sarswati Puja, etc., are celebrated by students with full zeal and joy. Adequate arrangements for indoor and outdoor games have been provided by the authorities besides recreational facilities for the students. There is well furnished common room with provision of Radio and Television and in addition important Newspapers and Periodicals are made available. The students are provided free medical aid under the care and good supervision of a well qualified Doctor. Students organise sports, tournaments as well as cultural programmes and celebrate the annual day of the hostels on the eve of its convocation.

The general management of the Hostel is vested in the Warden who stays in the campus. Dr. Prem Narain, Joint Director is the Warden of the Hostel. He had gone to U.S.A in Nov., 1979 and returned on 14th April, 1980. In his absence Dr. K.C. Raut, Head, Division of Statistical Research in Animal Sciences who is residing in the campus looked-after the general management of the hostel. Every year at commencement of the session, a general body meeting of the students residing in the Hostels, is held to elect the Executive Committee consisting of Prefect and Secretaries for sports, health, cultural activities, common room and maintenance of Hostels etc. The class representatives are also elected and a mess committee is constituted to look-after the mess run by the students on co-operative basis. To inculcate sense of responsibility, the mess Chairman and the mess Managers are finalized in advance for the current academic year. As usual during the year 1980, the Executive Committee of the IASRI Hostels consisted of the following.

- | | |
|------------------------------|--------------------|
| 1. Prefect | Sh. D. Verma |
| 2. Common Room Secretary | Sh. A.K. Chaubey |
| 3. Common Room Jt. Secretary | Sh. Manoj Bhargava |

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|--------------------------------------|--|
| 4. Health Secretary | Sh. B.L. Kaistha |
| 5. Joint Health Secretary | Sh. C.S. Sharma |
| 6. Sports Secy. | Sh. B.N. Narasimhan |
| 7. Joint Sports Secy. | Sh. Mukhat Singh
Sh. R. Rahman |
| 8. Cultural Secy. | Sh. H. Sridharan |
| 9. Jt. Cultural Secy. | Sh. K.V.S. Rao
Sh. Vara Prasad
Sh. S.K. Panda |
| 10. Maintenance Secy. | Old Hostel : Sh. D.L. Ahuja
New Hostel : Sh. S.K. Panda |
| 11. Class Representatives | Ph. D : Sh. K.K. Singh
M. Sc. : IInd Year : Sh. Patwardhan
M. Sc. I Year : Sh. V.K. Pandey
Dip. : Sh. S.K. Tyagi
PSCC : Sh. S.K. Sharma
SCC : Sh. S.A. Wani |
| 12. Foreign Students representative | Sh. T. Mallik |
| 13. Warden's Nominee | Sh. R. Venkatesan |
| 14. Auditors for the Mess Committee. | Sh. Kamlesh Singh, Sh. K.K. Singh,
Sh. A.K. Chaubey, Sh. R.C. Kapur
and
Sh. Vara Prasad. |

During the year under report, the students organised the Annual Day Function on the 30th Sept., 1980. Dr. N.S. Randhawa, D.D.G., Indian Council of Agricultural Research was the Chief Guest. The function started with a few items of sports and light refreshment, where the staff and the students of the Institute took active part in a befitting manner. The Chief guest distributed prizes to those who distinguished themselves in sports and other extra-curricular activities. The prize distribution was followed by an excellent cultural programme in which a good number of students, artists from the Institute and other institutions took part.

1.6 Library

The library of the Institute has got a beautiful reading area with capacity of 72 readers at a time and had been furnished with new reading tables, chairs and periodicals' display racks. The floor area of the library is about 15.00 sq. ft.

During the year under report, the progress of the library was as under :

- (i) 1500 books and other literature were procured and added for select collection in the library. The Library continued to procure extra reprint of the articles by Scientists of the Institute for free distribution to the Scientists in the similar field in India and abroad. The library procured extra reprints of 200 articles during the year.
- (ii) Approximately 25000 persons visited the Library for consultation, references and borrowing the books etc.
- (iii) The Library was visited by a number of foreigners mainly from Bangla Desh, U.K. and Latin American countries.
- (iv) The Library continued Inter-Library Loan System with local libraries in general and with out-side libraries in particular.
- (v) The Library remained open from 9.00 A.M. to 4.30 P.M. on all working days.
- (vi) During the year, the following Library Committee was constituted for managing the smooth operation of the Library.

1. Dr. S. S. Pillai	Chairman
2. Dr. R. K. Pandey	Member
3. Shri K. S. Krishnan	Member
4. Dr. K. C. Raut	Member
5. Shri M. P. Jha	Member
6. Sh. S. D. Bokil	Member
7. Dr. A. K. Nigam	Member
8. Sh. S. S. Srivastava	(On leave from Sep., 80 to August 81).

The library committee met 5 times during the year under report for recommending and finalising proposals for purchase of books, journals, physical verification of books and important reprints published in Scientific Journals etc.

- (vii) The reprographic unit of this Library have attended 160 jobs consisting of more than 3500 pages received from the Scientific as well as Administrative staff from time to time.
- (viii) During the year Shri S. S. Srivastava, Librarian has proceeded for higher studies in Information Science at INSDOC, New Delhi.
- (ix) Shri Praveen Kumar Saxena, Tech, Asstt. attended and participated in the All India Seminar on Agricultural Libraries and Information Services at Hyderabad during 29th Dec., 1980 to 1st January, 1981.
- (x) Third Physical Verification of the Books in the library was conducted during this year by a team of verifiers specially appointed for the purpose.

1.7 Exhibition Room

There is an Exhibition room in the premises of the Institute where results of all the important projects undertaken by the Institute, are presented in the form of graphs and charts. Moreover, important publications by the officers and members of the staff of the Institute are displayed there. The Exhibition Room enables a visitor to the Institute to get at one place a comprehensive picture of the important research activities of the Institute.

During the period under report, the Exhibition room was up-dated with addition of many new charts and revision of some of the old charts. Besides, many new reports and publications of the Institute were also placed in the Exhibition room. The Minister of State for Agriculture, Shri R. V. Swaminathan visited the Institute in September, 1980 and was taken round the Exhibition room. The Minister took keen interest in the panels exhibiting various activities of the Institute.

1.8 Fellowship

The courses of study for which fellowships were awarded by the Institute during the year, the value of the fellowships and number of students are given below :-

Sl. No.	Name of Course	No. of Fellowships	Amount of Fellowship per month
1.	Ph.D. I Year	5	Rs. 400/-
2.	Ph.D. II Year	5	Rs. 400/-
3.	Ph.D. III Year	1	Rs. 500/-
4.	M.Sc. I Year	8	Rs. 300/-
5.	M.Sc. II Year	4	Rs. 300/-
6.	P.S.C. Course	8	Rs. 300/-
7.	Diploma	5	Rs. 400/-

1.9 Research Collaboration with other Research Institutes, Agricultural Universities and other Research Organisations at National level

1. The project "Pilot studies on pre-harvest forecasting of crop yields-sugarcane, tobacco, jowar" were undertaken in research collaboration with :

- (i) Department of Agriculture, U.P., Lucknow (Sugarcane).
- (ii) Department of Agriculture, Maharashtra, Poona (Jowar).
- (iii) Central Tobacco Research Institute, Rajahmundry (Tobacco).

2. The Institute continued the research collaboration with the Agronomy, Soil Science and Agricultural Chemistry Divisions of the IARI, New Delhi, Agricultural universities and State Departments of Agriculture in planning of experiments, collaboration of data statistical analysis, summarisation of data and reporting of results under the All India Coordinated Agronomic Research Project (AICARP) of ICAR.

3. The project "Studies for developing suitable methodology for estimation of Cost of poultry and egg production under small scale farming conditions" was undertaken in research collaboration with APAU, Hyderabad at Warangal District.

4. The project "National Index of Agricultural Field Experiments" was undertaken in research collaboration with the State Departments of Agriculture, Agricultural Universities, Institutes under ICAR and various Agricultural Research Organisations in the country.

5. The project "Pilot sample survey for estimation of catch of Inland Fish", in the region of W. Bengal and Orissa was undertaken in research collaboration with Central Inland Fisheries Research Institute (C.I.F.R.I.), Barrackpore (W.B.).

6. A number of research projects like Sample Surveys for methodological investigations into HYVP, etc., were undertaken/continued in collaboration and co-operation with the Department of Agriculture, Bureau of Economics and Statistics and Statistical Departments of different States.

1.10 Participation in Scientific Committees, Panels, etc.

(a) The names of the officers of the Institute and the Scientific Associations, Committees, Panel, etc. mentioned against their names of whom they were the members during the year under report are given below :

<i>Name of Officer</i>	<i>Name of Scientific, Association, Committee, etc.</i>
Dr. D. Singh	<ul style="list-style-type: none"> (a) The International Statistical Institute, Holland. (b) The Indian Science Congress Association, Calcutta, (c) The ICAR Scientific panel for Agricultural Economics, Statistics and Marketing. (d) Committee of Direction of the Scheme on Marketing Surplus and Post-harvest losses, Directorate of Marketing & Inspection (Ministry of Agriculture & Irrigation, Govt. of India). (e) Board of Studies, Meerut University, U.P. (f) Working Group for the Survey on livestock Enterprises, National Sample Survey Organisation. (g) Editorial Board of the Indian Journal of Agricultural Research Communication Centre, Soil Salinity Research Institute, Karnal. (h) Indian Society of Agricultural Statistics, New Delhi (Secretary). (i) P.G. Faculty of the P.G. School, IARI, New Delhi. (j) Statistical Sectional Committee of the Indian Standards Institution New Delhi. (k) Advisory Body of the Agro-Economic Research Centre, J.N.K.V.V. Jabalpur. (i) Advisory Committee of the Agro-Economic Research Centre, University of Allahabad, Allahabad. (m) Editorial Board of "Journal of Statistical Planning and Inference" of the Colorado State University, Colorado (U.S.A.).

- (n) Sub-Committee for organising the ICAR Golden Jubilee.
- (o) F.A.O. Statistics Advisory Committee of Experts, Rome.
- (p) International Association of Surveys Statisticians (IASS), Paris (FRANCE).
- (q) Governing Body of the Indian Council of Agricultural Research.
- (r) General Body of the Indian Council of Agricultural Research.
- (s) Collection of educational Statistics on Sample basis as on experimental Project in collaboration with UNESCO and NCERT.
- (t) Steering group to consider reports, sectoral papers of the working group for the formulation of New Sixth Five Year Plan (1980-85) of the ICAR on 16th June, 1980.
- (u) Task Force on Agricultural production Statistics-Formulation of the Sixth Five Year Plan 1980-85 Agriculture.
- (v) Executive council of the Society of Mathematical Sciences of University of Delhi, Delhi.
- (w) Experts to prepare plans for Intenifying research on priority items.
- (x) Reception committee of the 4th Annual Conference of the Indian Society of History of Mathematics held on 29th & 30th Nov., 1980.
- (y) Standing Finance Committee for a period of one year w.e.f. 30th Sept., 1980.
- (z) Indian Society of Agricultural Economics.

(i) Technical Committee of Direction for improvement of "Animal Husbandry & Dairying Statistics".

(ii) Working group on Agriculture Live-stock and Debt & Investment.

Dr. P. Narain

- (a) Indian Science Congress Association, Calcutta.
- (b) Indian Society of Agricultural Statistics (Also Member of Editorial Board of its Journal).
- (c) Indian Society of Genetics and Plant Breeding (Fellow).
- (d) Indian Journal of Animal Production (Also, Member of the Editorial Board of its Journal).
- (e) General Council of the University of Edinburgh, U.K.
- (f) Post-Graduate Faculty of P.G. School, IARI, New Delhi.
- (g) Fellow of the Royal Statistical Society, London.
- (h) Management Committee of the IASRI, New Delhi.
- (i) Fellow of Indian National Science Academy.
- (j) Editorial Board of Indian Journal of Animal Genetics and Breeding.
- (k) Committee on Improvement of Agricultural Statistics, Ministry of Agri. & Irrigation, Govt. of India, New Delhi.
- (l) International Statistical Institute, Netherlands.
- (m) Achievement and Audit Committee for General Marine Fisheries Research Institute (C.M.F.R.I.), Cochin.

- (n) Bernoulli Society for Mathematical Statistics and Probability, Netherlands.

Sh. S.K. Raheja

- (a) Indian Society of Agricultural Statistics, New Delhi.
- (b) Executive Council, Indian Society of Agricultural Statistics, New Delhi.
- (c) Advisory Committee, National Seed Demand Survey, under the National Seed Project N.S.C. Beej Bhawan, Pusa Campus, New Delhi.
- (d) Panel of Judges for the All India Crop-Competition Schemes of the Directorate of Extension, Ministry of Agriculture & Irrigation, Govt. of India.

Sh. K.S. Krishnan

- (a) Farm Accounts Sectional Committee, A.F.D.C. 49, of the Indian Standards Institution, New Delhi.
- (b) P.G. Faculty of the P.G. School, IARI, New Delhi.

Dr. S.S. Pillai

- (a) EC-III Committee of the Indian Standards Institution, New Delhi.
- (b) Computer Society of India.

Dr. K.C. Raut

- (a) Indian Society of Agricultural Statistics, New Delhi (Hony. Joint Secretary).
- (b) Indian Dairy Association, New Delhi.
- (c) Indian Society of Agricultural Economics.
- (d) Technical Committee of Direction for improvement of Animal Husbandry Statistics constituted by Ministry of Agriculture & Irrigation, Department of Agriculture.

- Dr. R.K. Pandey
- (a) Indian Society of Agricultural Economics, Bombay.
 - (b) Indian Society of Agriculture Sciences New Delhi (Secretary).
 - (c) Member of ICAR Task Force.
- Sh. M.P. Jha
- (a) Indian Society of Agricultural Statistics, New Delhi.
 - (b) Indian Science Congress Association, Calcutta.
 - (c) International Association of Survey Statisticians Paris (France).
- Sh. S.D. Bokil
- (a) Indian Society of Agricultural Statistics, New Delhi (Hony. joint Secretary).
 - (b) Indian Society of Agricultural Economics, Bombay.
 - (c) P.G. Faculty of the P.G. School, IARI, New Delhi.
- Sh. P.N. Bhargava
- Indian Society of Agricultural Statistics, New Delhi.
- Dr. Aloke Dey
- (a) Indian Society of Agricultural Statistics, New Delhi.
 - (b) Indian Science Congress Association, Calcutta.
 - (c) International Statistical Institute, Netherlands.
 - (d) Academic Council, IARI, New Delhi.
 - (e) Editorial Board, Journal of Indian Society of Agricultural Statistics.
- Dr. B.B.P.S. Goel
- (a) Indian Society of Agricultural Statistics, New Delhi (Hony. Joint Secretary and Hindi Editor).

- (b) P.G. Faculty of the P.G. School, IARI, New Delhi.
- (c) Sub-Committee on Industrial Statistics of Indian Standard Institution.
- (d) Technical Committee for Integrated Sample Survey on Estimation of Livestock Products, Animal Husbandry Division, Ministry of Agriculture & Irrigation, New Delhi.
- Dr. O.P. Kathuria
- (a) International Association of Survey Statisticians, Paris (France).
- (b) Indian Society of Agricultural Statistics, New Delhi.
- (c) Board of Studies, IARI, New Delhi.
- Dr. H.P. Singh
- (a) Scientific Panel of animal health and breed.
- (b) Indian Society of Agricultural Statistics, New Delhi.
- Sh. S.N. Mathur
- Computer Society of India (Institutional Member).
- Sh. A.C. Kaistha
- (a) Indian Society of Agricultural Statistics, New Delhi.
- (b) Computer Society of India (Institutional Member).
- Sh. K.V. Sathe
- (a) Computer Society of India (Institutional Member).
- (b) Indian Society of Agricultural Statistics, New Delhi.
- Sh. U.G. Nadkarni
- P.G. Faculty of the P.G. School, IARI, New Delhi.
- Sh. R. Gopalan
- Indian Society of Agricultural Statistics, New Delhi.
- Dr. K.G. Aneja
- (a) P.G. Faculty of the P.G. School, IARI, New Delhi.

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| | (b) Indian Society of Agricultural Statistics, New Delhi. |
| Dr. A.K. Banerjee | (a) Indian Society of the Agricultural Statistics, New Delhi. |
| | (b) P.G. Faculty of the P.G. School, IARI, New Delhi. |
| Sh. J.S. Maini | Indian Society of Agricultural Statistics, New Delhi. |
| Sh. P.C. Mehrotra | Indian Society of Agricultural Statistics, New Delhi. |
| Sh. R.K. Khosla | (a) Indian Society of Agricultural Statistics, New Delhi. |
| | (b) Association of Rice Research Workers, Cuttack. |
| | (c) International Association of Survey Statisticians, Paris (France). |
| Sh. L.K. Garg | (a) Indian Society of Agricultural Statistics, New Delhi. |
| | (b) Management Committee of the I.A.S.R.I., New Delhi. |
| Sh. V.S. Rustogi | (a) Indian Society of Agricultural Statistics, New Delhi, |
| | (b) P.G. Faculty of Agricultural Statistics, New Delhi. |
| Sh. P.N. Soni | (a) Indian Society of Agricultural Statistics, New Delhi. |
| | (b) P.G. Faculty of the P.G. School, IARI, New Delhi. |
| Dr. A.K. Srivastava | (a) Indian Society of Agricultural Statistics, New Delhi. |
| | (b) Indian Science Congress. |
| | (c) P.G. Faculty of P.G. School, IARI, New Delhi. |

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| Sh. S.C. Rai | Indian Society of Agricultural Statistics,
New Delhi. |
| Sh. H.C. Jain | P.G. Faculty of the P.G. School, IARI,
New Delhi. |
| Sh. B.C. Saxena | (a) Indian Society of Agricultural Statistics,
New Delhi.

(b) P.G. Faculty of the P.G. School, IARI New
Delhi.

(c) I.C.A.R. Scientific panel for Fisheries. |
| Sh. H.B. Chaudhary | (a) Indian Society of Agricultural Statistics,
New Delhi.

(b) P.G. Faculty of the P.G. School IARI, New
Delhi. |
| Sh. S.N. Arya | (a) Indian Society of Agricultural Statistics,
New Delhi.

(b) P.G. Faculty of the P.G. School, IARI, New
Delhi |
| Sh. R.C. Jain | (a) Indian Science Congress Association,
Calcutta.

(b) P.G. Faculty of the P.G. School, IARI, New
Delhi,

(c) Indian Society of Agricultural Statistics New
Delhi. |

The following officers were members of Indian society of Agricultural Statistics, New Delhi.

Dr. Shivtar Singh, Sh. P.K. Malhotra, Sh. Randhir Singh, Sh. P.P. Rao, Dr. H.V.L. Bathla, Dr. D.V. Subba Rao, Mrs. Ranjana Agrawal, Sh. R.P. Singh, Dr. Bhagat Singh, Sh. Satyendra Kumar, Sh. M.L. Sahni, Sh. G.N. Bahuguna, Sh. T.B. Jain, Sh. S.S. Shastri, Sh. Pranesh Kumar, Sh. R.L. Rastogi, Sh. Mahesh Kumar, Sh. V.T. Prabhakaran, Sh. G.C. Chawla, Sh. M.S. Batra, Dr. Basant Lal, Sh. D.L. Ahuja, Sh. K.B. Singh, Sh. J.P. Goyal, Sh. Jagmohan Singh, Sh. A.S. Gupta, Sh. D.P. Malhotra, Sh. S.N. Bajpai and Shri R.S. Khatri.

(b) The Director was the ex-officio member of the following Scientific Committees, Panels, Working Groups, etc., during the year.

1. Direction Committee (Computer Science and Numerical Analysis), IASRI, New Delhi.
2. Advisory Board on Training Courses, IASRI, New Delhi.
3. Academic Council, IARI, New Delhi.
4. Standing Committee for Agricultural Economics, Statistics and Marketing Research, ICAR New Delhi.
5. Committee on Improvement of Agricultural Statistics National Sample Survey Organisation, New Delhi.
6. Expert Team for Assessment of Fertilizer Requirements for Achieving the Agricultural Production Targets, Department of Agriculture Govt. of India, New Delhi.
7. Standing Committee of Experts on Manures and Fertilizers, Department of Agriculture, Govt. of India, New Delhi.
8. Meteorological Programme Advisory Committee of the Indian Meteorological Deptt. Review Committee to represent the Departments of General Agricultural Statistical Research Institute.
9. Technical Advisory Committee for Agro-climatic Studies of Drought Indian Meteorological Department, Pune.
10. Quality Control & Industrial Statistics Sectional Committee, Indian Standards Institution, New Delhi and its Process Control Sub-Committee, Industrial Statistics Sub-Committee for ISO/TC 69 Work.
11. The methods of Sampling Sectional Committee (SMDC 4) of the Indian Standards Institution, New Delhi and its Sub-Committee on Sampling of Ores.
12. High Level-Co-ordination Committee on Crop Estimation Surveys of the Department of Agriculture, Haryana Government, Chandigarh.
13. Expert, Working group on Statistical Design Data Management and Data analysis, Central Road Research Institute, New Delhi.
14. Working group on Agricultural Statistics and Demand Supply Projections for the Sixth Five Year Plan, Dte. of Eco. and Statistics, New Delhi.

15. Committee on Improvement of Agriculture Statistics, Dte. of Eco. & Statistics, New Delhi.
16. Steering Committee on Monitoring and Evaluation of Rice Cultivation in India, National Council of Applied Economics Research (NCAER), New Delhi.
17. Steering Committee for the study of Fertilizer Demand Projections National Council of Applied Economic Research (NCAER), New Delhi.
18. Faculty of Mathematics, University of Delhi, Delhi.
19. U.G.C. Panel in Mathematics, University Grants Commission, New Delhi.
20. Co-ordinating Committee for organisation of Micro-Economic Studies in the field of Agricultural Economics.
21. Sub-Committee on Livestock Statistics, Ministry of Agriculture & Irrigation, Govt. of India, New Delhi.
22. Identification of Specific Priority Topics for application of Satellite Remote Sensing Techniques for Ministry of Agriculture & Irrigation, Govt. of India, New Delhi.

1.11 Visitors

- (i) Prof. D.S. Traey, Professor of Statistics, University of Windsor, Ontario, Canada visited the Institute and delivered two lectures to the scientists and students of the Institute.
- (ii) Dr. Dao The Tuan, Deputy Director, Head, Department of Plant Physiology, the Vietnam Agricultural Science Institute, Vandiet, Hanoi, S.R. Vietnam, visited the Institute on 10th April, 1980 and had discussion with Dr. P. Narain, Jt. Director on the use of Statistics and Crop Sciences.
- (iii) Dr. Elmonson from University of Kent at Canterbury (U.K.) visited the Institute and had discussion with Dr. P. Narain, Jt. Director in regard to designing of experiments and bi-variate analysis involved in inter-cropping experiments.

- (iv) Mrs. Hilony Ianger, Department of Botany, University of Canterbury, Christchurch, New Zealand, visited the Institute on 10th Oct., 1980 and had discussion with Dr. Prem Narain, Jt. Director regarding "Interpretation of multi-variate data".
- (v) Mr. R.P. Sharma, Computer Department, Rothamsted Experimental Station, Harpenden, Herts, U.K. visited the Institute on 14th November, 1980 and had discussion with Dr. Prem Narain, Jt. Director regarding systems programming.
- (vi) Mr. Nanda Tilakaratne, Veterinary Research Institute, Peradeniya, Sri Lanka and other participants to the International Workshop on "Methodology for improvement of data base on Livestock Resources" visited the Institute and had discussion with Dr. Prem Narain, Jt. Director.

1.12 (a) **Appointments, Promotions, Transfers, etc.**

(i) **Appointments/Assessments**

Shri S. K. Sublania has been appointed as Mechanical Tabulation Officer (M.T.O.) in the grade of (T-6 w.e.f. 16.5.80).

(ii) **Promotions**

The following Technical Personnel have been given the merit promotion to T-5 (Category-II) in the pay scale of Rs. (650-1200) with effect from the dates mentioned against each.

<i>Sl. No.</i>	<i>Name of officers</i>	<i>Date from which promoted.</i>
1.	Shri S.D. Bal, Sr. Tech. Asstt.	1.7.77
2.	Shri M.P. Saxena, Sr. Tech. Asstt.	1.7.78

(iii) **Inductions**

S/Shri B. Harvinder Singh, Satya Pal, Tech. Asstt. (Stat.) have been inducted to Scientist (S) grade of ARS w.e.f. 1.10.75.

(iv) **Transfers**

Nil.

Changes Heads of Divisions (H.D.)

The following changes were effected from 1st January, 1980.

<i>Sl. No.</i>	<i>Name of the Division</i>	<i>Out going Head</i>	<i>In coming Head.</i>
1.	Sample Survey Methodology (SSM)	Sh. S. K. Raheja	Sh. S. D. Bokil
2.	Stat. Res. in Crop Sciences (CS)	Sh. K S. Krishnan	Sh. P.N. Bhargava
3.	Computer Science & Numerical Analysis (CS & NA).	Dr. S.S. Pillai	Sh. S.N. Mathur

1.13 Representation of Scheduled Castes/Scheduled Tribes in Service at the Institute

The position of posts held by the S.C./S.T. Candidates during the year under report, is indicated in Appendix-II.

1.14 Joint Council

The Joint Council of the Institute was re-constituted for a period of three years w.e.f. 13.8.1979. The full constitution of the Joint Council of the Institute was same as given in the last year's report. During the year five meetings were held.

1.15 Grievance Cell

In order to provide a forum for employees of the Institute to ventilate their personal grievances relating to the official matter, such as salary, overtime, leave, training opportunities, transfer, etc., a Grievance Cell of the Institute was constituted on the 27th Feb., 1975 under the Grievance Cell Scheme of the I.C.A.R. The following were the office bearers of the Cell :

1. Dr. B.B.P.S. Goel	Chairman
2. Dr. M.G. Mittal	Non-member Secretary
3. Sh. A.P. Mehta	A.A.O. (I)
4. Sh. P.N. Vali	Accounts Offices
5. Sh. Onkar Swaroop	Member
6. Sh. S,C. Sethi	„
7. Sh. Krit Ram	„
8. Sh. Ram Niwas	„

The Grievance Cell had five meetings during the year under the chairmanship of Dr. B.B.P.S. Goel.

1.16 Staff Amenities

(a) Staff Quarters

Four type V Quarters within the campus of the Instt. have been completed and taken over from the C.P.W.D. Necessary action to allot them to the eligible officers is in hand and the same will be allotted shortly.

In so far as the construction of 107 Quarters at Paschim Vihar is concerned, although the progress appears to be very slow still the C.P.W.D. authorities are very confident to hand over these Quarters to us some time in 1981. However, the matter relating with the speedy construction of these quarters is very vigorously being pursued with the concerned Construction Division of C.P.W.D.

(b) Recreation & Welfare Club

The Club was formed in 1965 and provides means of recreation and welfare to the officers and staff of the Institute. The main objectives of the Club are :

- (i) to provide facilities for indoor and outdoor games,
- (ii) to provide facilities of library and reading room.
- (iii) to promote social and friendly relations among the members, and
- (iv) to undertake such other activities as may be decided by the Managing Committee from time to time for general welfare of Members.

The club continued to provide facilities to its members for indoor and outdoor games like table-tennis, chess, badminton, carrom etc. during the year under report. However, the scope of activities was limited on account of lack of adequate space. Fortunately, steps to provide adequate space have been initiated. For members with literary taste, a number of magazines, novels and other books were procured and made available for general reading purpose.

Facilities for indoor and outdoor games like table-tennis, badminton, volleyball, kabaddi, chess, etc and athletics were provided during the year. A number of Exhibition/Friendly Matches in T.T., Badminton, volleyball, kabaddi & chess were organised by inviting teams from other organisations as well as some of the outstanding players of Delhi State. Apart from providing a rich fare of competitive and high level of the game, these matches also served to improve the technique and standard of the game of our players. Further, to promote and encourage interest in general agricultural aspects and in sports and games as well as to provide a sense of involvement to the members not participating in sports and games, Quiz Contests were organised bearing mainly upon General Knowledge and sports and games events in the country. The Chief Guests in the quiz programme were the Hon'ble Minister of State for agriculture Shri R.V. Swaminathan and the Secretary of the ICAR Shri S.S. Dhanoa and these programmes were highly appreciated by them and other dignitaries. In addition, a large number of books, magazines and journals were purchased and made available to the members to encourage and satisfy the reading habits of the members.

A notable achievement of the Club which also brought great name to the Institute was the highly commendable performance of our teams in the ICAR Final Sports Meet held at Hyderabad during Feb., 1980. We retained supremacy in table-tennis Singles & Doubles. The performance of other teams was also quite good.

(c) Co-operative Canteen/Store

The ICAR (Statistical Wing) Co-operative Stores Limited continued its activities by running a canteen during the year under report. Tea, Coffee, snacks, etc. and other items were available for the officers & staff of the Institute. The Annual Accounts for the year 1979-80 (July, 1979 to June, 1980) were got audited by the office of the Registrar, Co-operative Stores and requisite fee was paid for the audit of the accounts.

The number of members of the Co-operative Stores as on 30th June, 1980 was 166. A general body meeting of the Co-operative Stores was held on 18th March, 1980 and it was unanimously decided that the existing Management Committee will continue for the next term.

The audited accounts of the Co-operative Stores showed that it was running in profit. Accordingly, dividend as permissible under the rules and Diwali gift were given to the members during the year.

(d) Benevolent Fund

In order to provide relief in time to the families of employees of this Institute who die in harness and are left in an indigent condition, a Benevolent Fund was constituted. The Fund is fed by the contribution from the members of the Fund and donations received from the Institutes' employees and students. During the year, the meeting of the Benevolent Fund Committee was held on 26.2.80. As on 31.12.80, the number of the members enrolled in the Fund was 147 and the amount at the credit of the Fund was Rs. 4043.38. The Benevolent Fund day was observed on 7.8.80 and a sum of Rs. 400/- was collected on that day.

(e) Co-operative Thrift & Credit Society

The Society was registered with the Registrar, Co-operative Societies, Delhi Admn. Delhi in June, 1977. The total number of members in the society as on 31.12.1980 was 344. The last general body meeting of the society was

held on 22nd September, 1980 in which the accounts for the year 1979-80 were presented and passed. The election of the Managing Committee was also conducted and the following were elected :

1.	Shri S.K. Raheja	President
2.	„ R.C. Goel	Vice President
3.	„ D.C. Pant	Hon. Secretary
4.	„ J.P. Goyal	Hon. Treasurer
5.	„ Ram Kumar	Member
6.	„ R.P. Jain	„
7.	„ S.L. Dua	„
8.	„ D.K. Aggarwal	„
9.	„ K.C. Kukkar	„
10.	„ Smt. Usha Jain	„
11.	„ Shri Chandu Lal	„

Certain amendments in the bye-laws of the society were passed at the General Body Meeting held in Sept. 1980 which were subsequently approved by the Registrar, Co-operative societies, Delhi Admn. Following are the amendments made :—

- (i) The new name of the society will be I.A.S.R.I. Employees Co-operative Thrift & Credit Society.
- (ii) The regular loan limit will be Rs. 5000/- or 8 months basic pay or 10 times the share money whichever is less. In case of emergent loan the limit will be Rs. 300/-.
- (iii) The number of instalments in which the loan is to be repaid will be 30 & 6 for regular loan and emergent loan respectively.

The total amount of loan advanced to the members during the year (1.7.79 to 30.6.80) was of the order of Rs. 2,92,555/-. The loan amount was met from the share money and compulsory and fixed deposits of the members in the society.

1.17 Receipt and Expenditure of the Institute during the year 1979-80**RECEIPTS**

1. Rent	Rs. 21,810.65
2. Application fee from candidates	Rs. 516.00
3. Application fee, Tution fee and Diploma charges	Rs. 4,886 50
4. Service rendered	Rs. 83,581.00
5. Sales	Rs. 22,175.77
6. Interest on Loan & Advances	Rs. 7,148.20
7. Leave Salary contribution	Rs. 1,317.00
8. Pension contribution	Rs. 10,189.95
9. Miscellaneous	Rs. 23,965.60

Total	Rs. 1,75,590.73

EXPENDITURE

1. Non-Plan	Rs. 83,52,812.58
2. Plan	Rs. 16,95,549.50
3. Pension and other retirement benefits	Rs. 60,061.94

1.18 Honours/Awards Won Etc.

(a) Dr. D. Singh was elected member of the Reception Committee of the 4th Annual Conference of the Indian Society of History of Mathematics held on 29th and 30th Nov., 1980.

He was elected by the Governing Body of the ICAR a member of the Standing Finance Committee for a period of one year w.e.f. 30th Sept., 1980.

Dr. Singh was also elected President of technical sessions of the 40th Annual Conference of the Indian Society of Agricultural Economics held during 30th Dec., 1980 to 1st Jan., 1981 at Pune.

(b) Jawaharlal Nehru Award for IASRI Scholar

Jawaharlal Nehru Award for. Ph. D. Research was awarded to the Scholar of this Institute Dr. B.V.S. Sisodia on his Thesis 'On preliminary test estimation procedures & bias in repeated surveys' guided by Dr. D. Singh, Director, IASRI.

1.19 Foreign Assignments

- (i) Dr. D. Singh left for abroad on 17th April, 1980 for about two months to help His Majesty's Govt. of Nepal as F.A.O. Consultant to prepare "1980's Pilot Census of Agriculture" in Nepal.
- (ii) Dr. Prem Narain, Jt. Director (Trg. & Res.) who went abroad during Novemer, 1979 returned on 14th April, 1980 after a five months assignment as Visiting Professor in the Centre for Demographic and Population Genetics, Health Science Centre, University of Texas, Houston, Texas U.S.A.
- (iii) Shri J. N. Garg, Scientist (S-2), continued to serve as Expert in the Secretariat of Agriculture, Deptt. of Planning, Sidi-El-Masari, Tripoli Libiya.

1.20 Miscellaneous

(i) Dr. D. Singh, Director was elected a member of the Committee to attempt collection of Educational Statistics on Sample basis as an experimental Project in Collaboration with UNESCO & NCERT in Feb., 1980.

He delivered a lecture at Delhi University on Statistical Appraisal of water use in Feb., 1980 and lecture on Experimental design and layout of field trials at Central Arid Zone Research Institute, (C.A.Z.R I.) Jodhpur (Rajasthan) in March, 1980.

He attended the meeting of Working Group to work out the modelities of the scheme "Collection of Educational Statistics on Sample basis" as a pilot project in collaboration with UNESCO & NCERT, New Delhi on 30th June, 1980.

He was elected a member of Steering Group to consider reports sectoral papers of the Working Group for the formulation of New Sixth Five Year Plan (1980-85) of the ICAR on 16th June, 1980.

He attended the meeting of the "Task Force on Agricultural Production Statistics-Formulation of the Sixth Five Year Plan 1980-85-Agriculture" held at New Delhi on 19th May, 1980.

He was elected a member of the Executive Council of the Society of Mathematical Sciences of University of Delhi, Delhi.

He attended the meeting of the Task Force on Agricultural Production Statistics Formulation of the Sixth Five Year Plan 1980-85, held at New Delhi on 14th July, 1980.

He attended the meeting of the Governing Body of the ICAR on 28th Sept., 1980.

He chaired the Technical Committee of Direction for improvement of "Animal Husbandry & Diaring Statistics" held on 21st Aug., 1980 at Gandhi Nagar (Ahmedabad).

As Member, he attended the meeting of the Committee of Experts to prepare plans for intensifying research on priority items on 8th Aug., 1980. The Committee was constituted by D.G., ICAR at G.B. meeting held in Dec., 1979.

He attended the Third meeting of the working group on Agriculture Livestock and Debt. & Investment, held on 27th Sept., 1980 at Sardar Patel Bhawan, New Delhi.

He delivered a lecture to the trainees of Sr. Statistical Officers on "Research in Agriculture & Animal Husbandry Statistics" and two lectures to the ISS Officers on (i) Variance and cost functions and (ii) Determination of the Sample Size, at C.S.O., New Delhi in Aug., 1980.

He attended the meeting regarding recruitment to Grade IV of Indian Economics Service/Indian Statistical Service on 24th Nov., 1980.

Dr. Singh also delivered a speech on 'Constraints of Cold Storage' at the "International Training-cum-Orientation Course on Cold Storage of Potatoes" jointly organised by the National Agricultural Co-operative Marketing Federation of India (NAFED) and International Potato Centre (CIP) at New Delhi from 10th to 11th Nov., 1980.

(ii) Dr. Prem Narain, Joint Director (T & R) joined the Institute after remaining in a foreign assignment (for about 5 months from 5th Nov., 1979 to 14th April, 1980) as a visiting professor to the University of Texas U.S.A.

He was appointed a member of the ICAR Accreditation Team for examining the possibility of upgrading of existing Department of Statistics to the level of P.G. Departments of Orissa University of Agriculture & Technology, Bhubaneswar.

He acted as Director, IASRI, New Delhi from 17th April, 1980 to 16th June, 1980 in the absence of the regular Director Dr. D. Singh who went abroad for a short F.A.O. assignment.

He attended a meeting of the Working Group on Agricultural Statistics, Economics and Marketing for finalising the VI Five Year Plan on 18th June, 1980.

He attended a Review Committee Meeting of the All India Co-ordinated Agronomic Research Project, at ICAR, Krishi Bhavan, New Delhi on 4th June, 1980.

He chaired a meeting of the Joint Council of IASRI on 12th May, 1980.

He chaired a meeting of the Advisory Board of the IAS I on Training Courses on 26th April, 1980.

He attended a Sectional Committee Meeting of the INSA, New Delhi on 21st & 22nd May, 1980.

He chaired a meeting of the Hindi Committee of the IASRI on 19th April, 1980.

He was elected a Member of the Bernoulli Society for Mathematical Statistics and Probability by International Statistical Institute, Netherlands.

He organised the XVIII Convocation of the IASRI Training Courses and Hostel's Annual Day Function.

He attended the Executive Council Meeting of the Indian Society of Animal Genetics and Breeding.

He also attended a Sectional Committee Meeting of the Indian National Science Academy, New Delhi on 3rd October, 1980.

(iii) Dr. S.S. Pijlai, Joint Director (C.S. & N.A.) was nominated by Computer Society of India as a Member of the Programme Committee for organising its Sixteenth Annual Convention to be held in March. 81 in Vigyan Bhavan, New Delhi.

He was entrusted with the work of organising two days Workshop-cum-Tutorial on Data Base Management to be held at Vigyan Bhavan from 25th to 26th Feb., 1981.

He delivered a lecture to the participants of Summer Institute on "Techniques for collection, maintenance and conservation of germ plasma and collection of Agri-horticultural plants" conducted at NBPGR, New Delhi on the topic, "Data Processing and Information Retrieval".

He delivered a lecture to the participants of Summer Institute on 'Dairy Economics' conducted at NDRI, Karnal on the topic "Programmes for analysis of Data on B-4700 System".

He gave four lectures on "Computers in Agricultural Research" to the ARS Probationers who were on training at National Academy of Agricultural Research Management on 23rd & 24th Sept., at Hyderabad.

He delivered one lecture on "Documentation of Plant Genetic Resources" to the participants of second IBPGR/NSPGR International Training Course on Plant Exploration and Collection Techniques, at Delhi on 25th Sept., 1980.

He was nominated by the Computer Society of India as Chairman of the Tutorial Committee for organising a Tutorial on "Data Base Management Systems" to be held at India International Centre, New Delhi.

He also delivered a series of 4 lectures to the A.R.S. Probationers at National Academy of Agricultural Research and Management on 16th and 17th Dec., 1980.

(iv) Sh. S.K. Raheja, Scientist S-4 led the Institute contingent to ICAR Inter-Zonal Golden Jubilee Sports tournament at Hyderabad (A.P.) as the President of the Sports Committee of the I.A.S.R.I.

He delivered a Seminar on "Determinates of Fertilizer use decisions by farmers in Semi-Arid Tropics" at ICRISAT at Hyderabad (A.P.) jointly with Dr. D. Jha of ICRISAT, Hyderabad.

He delivered a lecture on "Sample Survey Methodology and Functions & Activities of IASRI" to the trainees of Jr. Certificate Course of C.S.O. at Central Statistical Organisation (C.S.O.), New Delhi.

He attended the meeting of working group on Agril. Stats. NSSO/CSO held at New Delhi on 21st March, 1980.

He attended the meeting of the 'Zonal Advisory Committee' under Lab to Land Programme of ICAR at H A.U., Hissar (Haryana).

He delivered a lecture to ISS Officers (Gr. II & III) on Sampling Investigations with high yielding varieties programme, at C.S.O., New Delhi on 18th Aug, 1980.

He attended the 3rd meeting of Zonal Advisory Committee of Lab to Land programme at Karnal on 30th July, 1980.

He acted as referee of papers for Indian Journal of Agricultural Sciences, ICAR.

He attended the meeting of Zonal Advisory Committee under the ICAR Lab to Land Programme at Palampur and Chandigarh on 4th Oct., 1980 and 12th Nov., 1980 respectively.

Shri Raheja attended the meeting of the management committee under ICAR Inter Institute Sports Tournaments Zone at Karnal on 8th Dec., 1980.

(v) Shri K.S. Krishnan, Senior Scientist delivered a lecture to the participants of the Fertilizer Association of India-Marketing Management Development Programme held at New Delhi.

(vi) Dr. K.C. Raut, Senior Scientist delivered a special lecture entitled "Application of Statistics in Animal Husbandry Research" to the trainees of the Junior Certificate Course in Statistics, Central Statistical Organisation (C.S.O.), New Delhi.

He had discussions with prof. P.V. Rao from Andhra Pradesh Agricultural University (APAU) about the cost of production of Poultry and Egg under small scale poultry farming conditions.

He delivered a lecture on "Cost of production surveys on livestock products" at CSO, New Delhi on 14th Aug., 1980.

He also delivered a lecture on 'Statistical Research in Animal Sciences' to C.S.O. Trainees on 3rd Nov., 1980.

(vii) Shri S.D. Bokil, Senior Scientist discussed the work being undertaken in the division (SSM) with Dr. J.S. Rustogi of Ohio University, U.S.A.

(viii) Dr. B.B.P.S. Goel, Senior Scientist was invited to contribute an article on Estimation of livestock products jointly with Sh. C.L. Malik, Dy. Director, AH Statistics, Ministry of Agriculture, Krishi Bhavan, New Delhi for the Manual to be brought out in connection with the FAO Regional Animal Production and Health Commission for Asia, the Far East and the South-West Pacific.

(ix) Dr. A.K. Banerjee, Sr. Scientist, delivered two lectures to ISS Officers (Grade II and III) on 'Stratified Sampling' at CSO, New Delhi on 23rd July, 1980.

(x) Dr. A.K. Srivastava, Sr. Scientist delivered lectures on the topics 'Multi-stage sampling', 'Multi-phase Sampling' on 'Fruit and Vegetable Survey' at CSO, New Delhi on 28th July, 29th July and 18th Aug., 1980. respectively.

(xi) Shri K.V. Sathe, Scientist (S-2) underwent a training course in use of TEMPO-A linear programming package on B-4700, system by Tata Burroughs Ltd., at Bombay for five days.

Sh. K.V. Sathe and Sh. S.N. Mathur, Scientists (S-2) presented the paper on 'Computer Applications for Development' at Annual Convention on Computer Applications for Development (Pune Chapter) organised by Computer Society of India during 7-8 June, 1980 at Pune.

(xii) Sh. J.C. Malhotra Scientist (S-2) delivered lectures to the participants of Refresher course-cum-training programme in A.H. Statistics on 'Statistical genetics and analysis of breeding data etc.' at Chandigarh from 6th to 9th Oct., 1980.

(xiii) Sh. R.K. Khosla, Scientist (S 2) attended the "International Training-cum-Orientation Course on cold storage of Potatoes", jointly organised by the National Agricultural Co-operative Marketing Federation of India (NAFED) and International Potato Centre (CIP) at New Delhi from 10th to 18th November, 1980.

(xiv) Statistical evaluation of the programme of aerial spray of an insecticide on mustard crop in Rewari Tehsil, Haryana was taken up by Dr. M.G. Mittal, Scientist (S-2) and report was sent to the Plant Protection Adviser, Dte. of Plant Protection, Quarantine & Storage, Ministry of Agriculture and field training was imparted to the field staff engaged for the survey.

(xv) Shri J.P. Goyal, Scientist S-1 discussed with the Dy. Director (Stat.) Animal Husbandry Department, Chandigarh about the Methodology for estimation of Livestock Products.

(xvi) Dr. Bhagat Singh, Scientist S-1 attended the colloquy on communication for Development at India International Centre, New Delhi on 28.4.80 organised by Planning Commission under the Chairmanship of Dr. M.S. Swaminathan Dy. Chairman, Planning Commission.

Dr. Singh also attended the colloquy on 'Role of Communication in Education' and 'New Communication and information order' organised by Jt. Adviser, Planning Commission at India International Centre, New Delhi on 29th Sept., 80 and 20th Dec., 80 respectively.

2. STATISTICAL RESEARCH IN CROP SCIENCES

The work on statistical research in crop sciences was continued during the year under report as per the programme laid down. The progress of work in respect of various items of research included in the programme is summarised below in brief and the names of the concerned principal investigator and his associate (s) are given in brackets at the end of the description.

2.1 Planning of experiments and co-ordination of their statistical analysis under the All India Co-ordination Agronomic Research Project (AICARP)

The objectives of the project were :

- (i) To plan and organise the experimental programme of All India Co-ordinated Agronomic Research Project,
- (ii) To participate in the state level training programme and to give statistical guidance in the effective implementation of the technical programme,
- (iii) To guide the State Statistical Officers and the Field Staff working under AICARP in the collection, coding and reporting of experimental data,
- (iv) To supervise the field work, to improve the quality of experiments and to ensure accuracy in reporting of data,
- (v) To develop suitable methodology for statistical analysis of the data and
- (vi) To statistically analyse the data of the experiments conducted and to supply the results to participating scientists and to prepare summary tables, suitably interpret them and prepare project reports.

For better organisation of the work under AICARP, the country is divided into four regions. The regional break-up and further details are indicated in the following projects (item 2.1.1., 2.1.2, 2.1.3 and 2.1.4) respectively of this report. For experiments at Agronomic Research Centres, the analysis of variance technique as applied to various designs viz. R.B.D., Split-plot, Split-split plot, Confounded factorial, etc., was adopted with appropriate modifications

wherever required. The experiments on cultivators' field were conducted by adopting a stratified multi-stage random sampling design. The data were analysed following the appropriate methods for a multi-stage random sampling design both at zonal level and pooled over the zones at the district level. The results for different regions which are covered in the subsequent projects are also indicated therein.

(P.N. BHARGAVA)

2.1.1 Statistical analysis and interpretation of data relating to experiments conducted under the All India Co-ordinated Agronomic Research Project (AICARP) in Northern and North-western region of the Country

During the year under report, data of 1950 experiments conducted on cultivators' fields and 120 complex experiments at Agronomic Research Centres during 1978-79 were statistically analysed and the results communicated to the concerned authorities. The salient results achieved have already been published in the IASRI Annual Report, 1979. Some more results for 1978-79 are as follows:—

(a) Experiments at Agronomic Research Centres (ARC)

For gram crop, fertiliser application could be scaled down to the extent of 25% of the recommendations at Purafarm and Hanumangarh while at Bichpuri such a possibility existed only upto 75% of the recommended fertiliser level. For mustard crop, 25% reduction in fertiliser level over the recommended dose was indicated at Bichpuri. At Banswara lower levels of irrigation caused a reduction in the yield by about 3.0 q/ha. At Purafarm, fertiliser dose could be reduced to 75% of the recommended dose for rai crop.

At Pantnagar, delayed sowing of RR-21 and HD-2204 by one month from normal resulted in increase in yields by 7-9 q/ha. At Ludhiana delaying the sowing by a fortnight significantly increased the yields of HD-2204 by 5.0 q/ha.

At Hamumangarh, WL-711 variety was found to be the best with the application of 150 Kg. N/ha. At Tulab Tilloo KSML-3 and at Ludhiana WL-711 gave the highest yield at 120 kg. N/ha.

During kharif, rhizobium culture was found to be more effective to cowpea than to moong in Hissar providing an additional response of about 1.6 q/ha. During rabi residual effect of rhizobium applied during kharif on cowpea was observed to be more pronounced than moong on the succeeding wheat crop.

Following during kharif season resulted in significantly higher grain yield of wheat as compared to all the treatments.

To obtain higher yields of bajra, economy in the use of fertiliser through FYM substitutions was indicated at 75% level ($N_{90} P_{45} K_{45}$) at Hanumangarh. To wheat crop no such possibility existed at any fertiliser level.

To Bajra crop, no chemical weed control was found to be as effective as weed free check both at Bichpuri and Hanumangarh. No residual effect of the weed control treatments applied during kharif was exhibited in wheat during rabi at either of the centres.

(b) Experiments on cultivator's fields (ECF)

For irrigated rice, application at $N_{120} P_{60} K_{60}$ gave the highest response in Kurukshetra, Gurdaspur and Kangra which ranged from 22-29 q/ha. Application at N_{120} alone gave response of about 10 q/ha. in Hamirpur. A significant response to Zine Sulphate was also observed in Kurukshetra, Gurdaspur and Kangra. In case of wheat, application of $N_{120} P_{60} K_{60}$ was found to be adequate in all the districts. At this level the response was the highest in Agra (29.2 q/ha) followed by Bundi, Farukhabad and Hissar (around 25.5 q/ha) and in the range of 17-22 q/ha in other districts.

The newly released varieties of bajra BK-560 in Delhi, BJ-104 in Sawai Madhopur, CHS-5 variety of jowar in Bundi and Ganga-2 variety of maize in Chittorgarh performed better than the locally popular varieties at these locations. These varieties gave consistently high response at all levels of nitrogen application. The pre-release variety K-468 of Gram established its superiority over T-3 the standard variety in Lalitpur, Hamirpur and Agra. There was significant improvement in yield with increase in the level of phosphorus application in these districts.

For cereal crops wheat, barley and jowar grown under dry land conditions, the nitrogen response continuously increased upto 90 kg. N/ha, the highest dose tried. Application of phosphorous at moderate level of 30 kg. P_2O_5 /ha. in conjunction with nitrogen was useful in accelerating the yield rates. Responses to potassium as also to zinc sulphate were generally negligible.

For bengalgram, and blackgram results indicated that application of phosphorus alone is not adequate but it needs to be applied in conjunction with nitrogen at moderate level. A dose of $N_{20} P_{40}$ was indicated suitable at which responses of the order of 6 to 7 q/ha of blackgram were obtained.

For oil seed crops grown under rainfed conditions high response at 60 kg. N/ha were obtained with increased level of phosphorous application in districts of Farrukhabad, Bundi, Lalitpur and Hamirpur (for Sesamum) Farrukhabad, Delhi, Sawai Madhopur, Kangra and Hissar (for Mustard) and Hamirpur and Lalitpur (for linseed). A dose of $N_{60} P_{40}$ gave a response of 3-4q/ha for sesamum and 4-5q/ha for mustard and linseed.

(P.N. SONI AND A K. MUKHERJEE).

2.1.2 Statistical analysis and interpretation of data under the AICARP in Arid Western Plains, Humid Bengal-Assam and Eastern Himalayan regions

The Statistical analysis of 94 successfully conducted experiments at 10 Agronomic Research Centres and of 1650 experiments conducted on cultivators fields in 11 ECF districts during Kharif and Rabi 1979-80 were carried out and the results were communicated to concerned Scientists and the Project Co-ordinator. Summary tables are under preparation. Layout plans for 80 seasonal and annual experiments for kharif and rabi 1980-81 were prepared and supplied to various agronomic research centres.

The project report for 1978-79 had been published. The salient results have been presented in I.A.S.R.I. Annual Report, 1979.

(H.C. JAIN AND M.R. VATS)

2.1.3 Statistical analysis and interpretation of data under the All India Co-ordinated Agronomic Research Project in Southern Region

During the year under report, data of 75 experiments conducted during 1979-80 at 6 Agronomic Research Centres and of 3142 experiments conducted on cultivators' fields in 18 ECF districts were statistically analysed and the results communicated to the Project Co-ordinator and other concerned Scientists. Preparation of summary tables and Annual Project Report were in progress.

The soil analysis data of experiments conducted in cultivators' fields were got transferred on punch cards for carrying out statistical analysis to study crop response in relation to initial soil fertility. The data on biometric characters of 19 experiments conducted at 4 Agronomic Research Centres were statistically analysed and of 12 experiments from 2 centres transferred to punch cards. Plant analysis data of 15 experiments from 2 centres were analysed and another 18 experiments from 3 centres transferred to punch cards.

The project report relating to the data for 1978-79 was published. The salient results achieved were given in IASRI Annual Report, 1979. Some more results for 1978-79 are as follows :—

(a) Experiments at Agronomic Research Centres

At Karaiyiruppu Maize-Rice-Bajra rotation gave the maximum grain production (130.8 q/ha.) but Ragi-Rice-Cotton rotation was found to be more profitable (90.5 q/ha. of grain + 15.8 q/ha. of Kapas). At Siruguppa reducing the level of irrigation from 5 to 3 for crops like wheat, Bengalgram and Safflower did not appreciably affect the yield and plots receiving reduced level of irrigation showed greater residual effect on the succeeding Jower crop (17% increase). At Siruguppa Onion was found to be the most suitable intercrop with Sugarcane. At Karaiyiruppu and Bhawanisagar green-gram was found to be a suitable intercrop with Cotton. At Mangalore combined application of FYM at 12 tonnes/ha. + $N_{30} P_{15} K_{15}$ was found to be beneficial while at Bhawanisagar FYM at 12 tonnes/ha. was found to give more or less equal response as $N_{30} P_{15} K_{15}$ and their combined application was not found to be useful. At Bhawanisagar sulphur coated urea gave higher response in direct and cumulative phases. At Karaiyiruppu 5 tonnes/ha. of azolla + 30 kg N/ha. gave higher yield than 60 kg N/ha. as fertilizer. At Maruteru medium duration rice variety in kharif followed by medium duration variety of rice in rabi gave highest annual production (12.8 tonnes/ha.).

(b) Experiments on cultivators' fields

(i) Fertilizer requirements of different crops

Rice :

At lower levels balanced application of fertilizer at $N_{40} P_{20} K_{20}$ was found to be beneficial in Madurai, Tiruchirappalli, North Arcot, Khammam, Krishna, Tumkur, Belgaum, and Medak. At moderate levels $N_{80} P_{40} K_{40}$ was found to be beneficial in Madurai, Tiruchirappalli, North Arcot, Prakasam and Tumpur. Consistently higher response to $N_{120} P_{60} K_{60} + Zn_{25}$ was observed in Madurai district.

Wheat :

Balanced application of $N_{40} P_{20} K_{20}$ was found to be beneficial in Bidar, Belgaum and Khammam. Increasing the fertilizer levels beyond this was not economical in any of the districts.

Maize :

$N_{40} P_{20} K_{20}$ was found to be economical dose in Belgaum.

Jowar :

$N_{40} P_{20} K_{20}$ was found to be economical in Belgaum and Prakasam.

Bajra :

Economic response was obtained upto $N_{80} P_{40} K_{40}$ in Prakasam.

Ragi :

Beyond $N_{40} P_{20} K_{20}$ it was not economical in Prakasam district.

Cotton :

Varalaxmi gave almost double the response (13.5 q/ha.) at $N_{120} P_{60} K_{60} + Zn 25$ as compared to Mysore Vijaya (6.7 q/ha.) in Belgaum.

(ii) Relative performance of pre-release and standard varieties of cereals**Rice :**

During Kharif TKM-9 (Madurai), Masuri (Medak), NLR 9672, NLR 9674 (Prakasam), MTU 8002, MTU 8089 (Krishna), Phalguna, Culture 3234 (Khammam), MTU 4569, MTU 9416 (East Godavari), Intan (Chikmagalur), IR 36 (Kozi-Kode and Kottayam) were found to be suitable varieties for the districts indicated in paranthesis. During rabi ADT 31 (North Arcot) and BPT 125 (East Godavari) performed well.

(iii) Fertilizer requirements of different crops under dryland

$N_{30} P_{30}$ was found adequate for kharif Jowar in Bidar and Medak, for wheat in Chikmagalur and for Variga (Common millet) in Prakasam. Application of phosphate alone was not found to be beneficial to groundnut and pulses. $N_{20} P_{20}$ was found to be adequate for green gram in Bidar and Khammam and for Blackgram in Bidar and for Bengal gram in Bidar and Medak. Sesamum responded to $N_{60} P_{40}$ in East Godavari and Sunflower to $N_{60} P_{40} K_{60}$ in Medak.

(iv) Fertilizer requirements under resource constraints

In East Godavari 25% reduction in recommended level of $N_{120} P_{60} K_{60}$ of fertilizer in Kharif and full application of fertilizer $N_{120} P_{60} K_{60}$ during rabi resulted only 1% fall in annual production. In Kottayam application of 50% recommended fertilizer of $N_{120} P_{60} K_{60}$ both during kharif and rabi resulted 3% fall in total production.

(V.N. IYER AND D.K. SEHGAL)

2.1.4 Statistical analysis and interpretation of data under AICARP in Sub-humid to Humid-Eastern and South-Eastern uplands and Semi-arid Lava Plateaus and Central High Lands

During the year under report, the data of about 1920 experiments conducted in 9 selected districts on cultivator's fields both under irrigated/adequate rainfall, as well as under dryland conditions and 170 complex experiments conducted at 16 Model Agronomic Centres which cover different Agronomic aspects viz. production potential under optimum resource conditions, effects of inter and mixed cropping, varietal evaluation etc. pertaining to 1979-80, had been scrutinised, coded, analysed, summary tables prepared and the results sent to the respective Assistant Agronomists, the Officers-in-charge and the Project co-ordinators. The preparation of the report was under progress. The Layout plans of the agronomic research experiments to be conducted during 1980-81 have been sent to the respective centres. The salient results have already been published in IASRI Annual Report, 1979. Some more results for 1978-79 are as follows :

(a) Experiments at Agronomic Research Centres

In the production potential experiment the high intensity crop sequence including cereal and pulse was identified at Navsari Rice-Wheat-Greengram giving a yield of 10.9 tonnes/ha. Crop sequence including fodder crop Bajra-Wheat-Maize (Fodder) tried at Junagadh gave a maize fodder (Gs-2) yield of 18.1 q/ha. besides a grain yield of 3.2 q/ha. of cereals in a year.

In potential experiment under resource constraints for wheat crop, the fertilizer level could be reduced by 25% at Akola and 50% at Raipur. For gram crop reduction to the extent of 75% at Jabalpur and Indore and 50% at Akola was found possible.

Studies on inter-cropping indicated that inter-cropping did not affect the yield of main crop. Rather at Rahuri, in normal row planting pattern inter-cropping of groundnut increased the yield of main crop of jowar, which ranged from 4.6 to 5.5 q/ha. as against 4.4 q/ha. as pure stand. In this pattern the yield of groundnut was between 9.1 to 12.4 q/ha.

At Navsari when mixed cropping practice with wheat and mustard was adopted, the yield rate of mustard improved but the wheat yield was affected substantially. At none of the other Centres, mixed cropping was found to be superior to single crop.

(b) Experiments on cultivator's Fields

In Baroach, application of $N_{90} P_{60} K_{60}$ increased the yield rate of wheat from about 7 q/ha. (for unfertilised plots) to about 21 q/ha. In Satna, the corresponding increase in the yield of wheat was from 9 q/ha. (for control) to 22 q/ha.

Bengalgram gave a good response of about 5 q/ha. to 40 kg. P_2O_5 /ha in Satna and Ujjain. The gram varieties JG-62-404 in Ujjain and J-62 in Satna gave good response of over 6 q/ha. to 20 kg. N/ha. The treatment $N_{20} P_{20}$ was found to be superior in most of the districts.

Application of a small dose of nitrogen at 20 kg. N/ha. was beneficial to greengram in Baroach and Kutch. The same level of nitrogen application was found to be beneficial to Blackgram in Satna and Soyabean in Ujjain. The application of $N_{20} P_{20}$ was also found to be beneficial to Blackgram in Satna. In groundnut good responses varying between 3.4 to 5.7 q/ha. were obtained to $N_{20} P_{60}$ at Amravati, Nanded and Amreli. In Sangli, the treatment $N_{20} P_{60} K_{60}$ gave the highest response of 6.2 q/ha.

The application of $N_{90} P_{60} K_{30}$ was found to be more beneficial in Banas-kantha raising the yield rate of castor from 15 q/ha. to 34 q/ha.

(N.K. CHOWDHARY AND A.K. BHATIA)

2.2 Co-ordination and Planning Unit of National Index of Agricultural Field Experiments.

The objective of the project were (i) to co-ordinate and plan the work of projects on statistical analysis and interpretation of experimental data collected under, 'National Index of Agricultural Field Experiments in North-Western, Southern and Eastern Zones', (ii) to maintain at a central place the results of all the Agricultural field experiments excluding purely varietal trials, conducted at research stations in Uttar Pradesh and (iii) to prepare critical summaries of results on important agronomic aspects for various crops.

The data of agricultural field experiments were analysed by adopting the appropriate statistical techniques according to the designs of the experiments.

Under the project, data relating to agricultural field experiments, other than purely varietal trials, conducted at various agricultural research stations and institutes in the country, were being collected. After statistical analysis and consolidation, two series for the periods 1948-53 and 1954-59 have been published.

For the third series, which pertain to the period 1960-65, the printing of compedia volumes for all the states have been completed except for Uttar Pradesh and Central Institutes. However, now region-wise reports on summarised results on different crops are being prepared. Two such reports, viz., on cultural practices of wheat in Uttar Pradesh and on Paddy for Eastern Region have been prepared.

The 'Annual Index of Agricultural Field Experiments' giving brief details of the experiments, collected by the regional staff during a year, are being periodically published and circulated among the different scientists connected with agricultural research and extension. The latest in the series e.g. Vol. VI in respect of experiments received at the Institute during the year 1977 has been published.

The regional staff reported during the year data relating to 2,735 experiments conducted since 1972. Inclusive of these, data of about 17,700 experiments conducted since 1972 have so far been reported to the Institute.

The printing of "Annual Index of Agricultural Field Experiments" Vol. VII, in respect of experiments reported to the Institute during 1978 was in progress and the material other than for the States of Uttar Pradesh and West Bengal was completed. The processing of the material for the subsequent volume in respect of the experiments reported to the Institute during 1979 was completed. For loading the data on tapes, the punch cards in respect of the experimental data of Central Institutes for the period 1960-65 were compared and correction of cards was in progress. Work relating to formulation of coding schedules for Agricultural Field Experiments Information Systems was initiated.

Analysis of individual experiments, combining the results of similar experiments and critical analysis of experimental data were in progress for the preparation of reports on various crops.

Various graphs and charts relating to the 'National Index of Agricultural Field Experiments' were prepared for the Exhibition Room of the Institute.

(P.N. BHARGAVA AND M.P. SAXENA)

2.2.1 Statistical Analysis and interpretation of experimental data collected under 'National Index of Agricultural Field Experiments' in Eastern Zone.

During the year, data on 42 experiments were collected from West Bengal and 297 experiments from Bihar. Inclusive of these, the data for 1,259 experiments from West Bengal had so far been collected for the period 1972 and

onwards. The analysis of data was in progress. Analysis of individual expts. on wheat crop for Eastern region conducted during 1966 and onwards had been completed.

Monograph on summerisation of experimental data on Paddy Vol. I for Eastern Region (1966-75) was finalised and printed. Experimental data on Paddy Vol. II had been finalised for printing.

(J.K. KAPOOR AND N.K. SHARMA)

2.2.2 Statistical analysis and interpretation of experimental data collected under "National Index of Agricultural Field Experiments" in North-Western Zone

During the year under report, 387 experiments had been reported from Maharashtra State. With these experiments, the total number had reached 1,667 for the period 1972 and onwards. Data on 166 experiments had been reported from North-Western Region. Inclusive of these experiments, the total number reported upto 31st Dec., 1980 was 1572. The analysis of data was in progress. Analysis of experiments on Cotton Crop for central zone (Maharashtra, Gujarat and M.P.) in respect of manurial and cultural experiments had been completed. Results were being examined. The usual technique of analysis of variance was applied "Annual Index of Agricultural Field Experiments" Vol. VI in respect of experiments reported to IASRI, during the year 1977 had been printed.

(R.K. GHAI AND P.R. YERI)

2.2.3 Statistical Analysis and interpretation of the experimental data collected under the scheme of National Index of Agricultural Field Experiments in Southern Zone

During the year, data of 494 experiments from Andhra Pradesh, 143 from Karnataka and 304 from Kerala were reported by the regional staff. With this, the total number of experiments available for the period 1972 and onwards were as follows :

Andhra Pradesh	1,202
Kerala	304
Karnataka	2,040
Tamil Nadu	690

Most of the experiments received during the year had been analysed. Analysis of paddy experiments from the State of A.P. had been completed and the critical analysis of these experiments had been undertaken. Annual Index for 1978 was under print and for 1979 was being processed.

(P.K. BATRA)

2.2.4 Statistical Analysis and interpretation of experimental data collected under "National Index of Agricultural Field Experiments" in Uttar Pradesh.

The regional staff posted at Kanpur, Lucknow and Pantnagar regional centres located in Uttar Pradesh, reported during the year data relating to about 900 experiments conducted since 1972. Inclusion of these, data of about 5,400 experiments conducted since 1972 have so far been reported to the Institute.

Statistical analysis of individual experiments pertaining to the period 1966 and onwards conducted on groundnut in India and on wheat crop in Uttar Pradesh was in progress. About 800 experiments were analysed.

Critical analysis of wheat experiments for period 1966-75 with manurial inputs in respect of Uttar Pradesh was in progress.

(P.N. BHARGAVA AND M.P. SAKSENA).

2.3 Effect of different improved practices on the production of tobacco.

The objective of the project was critical summarisation of the results of different types of experiments on tobacco crop conducted in the country during the year 1966-74 using proper statistical methodology. The data of 491 experiments collected under the scheme of NIAFE on tobacco crop were sorted out. The designs adopted in all these experiments were CRD, RBD or split plot design. Usual method for simple and pooled analysis of the data with these designs were adopted. The salient results achieved are as follows :

The green leaf and cured leaf yield of different varieties increased in general with the increase in level of Nitrogen under irrigated conditions in Karnataka, Tamil Nadu, Gujarat and Andhra Pradesh. The yield level of green leaf for Delcrest variety in Gujarat was the highest to the application of fertilizer at 40 Kg. N/ha.

Application of phosphorous even upto 100 Kg. P_2O_5 /ha for any of the varieties did not benefit the crop yield (Green leaf and cured leaf yield). Application of potassium @ 100 Kg. K_2O /ha under irrigated conditions in Gujarat showed considerable increase in green leaf yield for the varieties Delcrest, Kicks and Virginia Gold. The increase in yield for different varieties were 4.78, 6.55 and 3.88 q/ha respectively. In Andhra Pradesh the yield for cured and bright leaf of these varieties remained unaffected with the application of 100 Kg. K_2O /ha under irrigated conditions.

The yield of almost all the varieties increased in all the States with the increase in the level of FYM application. The maximum increase of 1.52 q/ha in green leaf yield of HR-62-7 variety in Gujarat, was obtained when FYM was applied @ 50 tonnes/ha. Topping treatment increased the cured and bright leaf yield significantly in Karnataka and Andhra Pradesh for all FCV varieties under unirrigated conditions. The increase in yield of bright leaf varied from 0.24 q/ha. to 1.88 q/ha for different varieties. In case of cured leaf yield the increase varied from 0.29 q/ha to 1.09 q/ha.

In irrigation experiments a steady increase in total leaf and bright leaf yield was observed when the level of irrigation was increased to one, two and three irrigations upto 80% field capacity. The increase in total leaf yield with one, two and three irrigations are 3.57, 4.25 and 4.62 q/ha as compared to no irrigation. The variety used was Anand-2 in Gujarat State. The types of tobacco were FCV and Bidi.

(H.V.L. BATHLA, K.S. KRISHNAN AND PRABHA'I KUMAR).

2.4 Study of agronomic constraints in Tungabhadra River Valley Project Area

Project report of a case study was taken up to assess the progress in production and productivity of food grain and oilseed crops and indicate the possibilities of improvement in the command area of Tungabhadra River Valley Project was finalised. The command is spread-over Anantapur, Cuddappah and Kurnool districts of Andhra Pradesh and Bellary and Raichur district of Karnataka. Ultimate irrigation potential is 5.1 lakh hectares and 80-90% of the area was earmarked for light irrigation, growing crops like jowar, cotton, wheat and gram etc.

Constraints experienced in the adoption of cropping pattern arose out of the encouragement given to farmers to grow any kind of irrigated crops with a view to create a climate for irrigated agriculture. Over years, unauthorised

irrigation in certain pockets in upper reaches has upset the adoption of cropping pattern. The tenders receive inadequate/untimely/non-supply of water as the canals are not working to full capacity due to weakness and breaches. Drainage system neglected over years has added to the land management problems. Allocating the same outlet for perennial, wet, dry cum wet cultivation as well as kharif and rabi seasons in the left bank is a serious handicap.

The cereal, pulse and oil seed production which were 1.00, 0.04 and 0.09 lakh tonnes before the commencement of the project in 1953 have increased to 5.33, 0.12 and 1.07 lakh tonnes respectively in 1977-78 leaving a gap of 3.03 lakh tonnes in cereals and 0.57 lakh tonnes in oilseeds to attain targets on Karnataka side which covers nearly 70% of the command. Sugarcane which was not grown before 1953 has reached the targetted production of 16.32 lakh tonnes. The targetted area for rice and sugarcane have been exceeded by 116% and 37% respectively by 1977-78.

There is scope for increasing the productivity of crops in the command. Irrigation facility could be profitably utilised to grow crops like wheat, jowar, bajra, which require only one third of water and have economic advantage over growing rice. Spread of high yielding varieties of these crops could be encouraged. Productivity of cereals, pulses and oilseeds could be increased between 40-100% by growing high yielding/hybrid/improved varieties with irrigation. Experimental data have indicated the feasibility of increasing the crop intensity from 100 to 300% and obtaining grain production of about 12 tonnes/ha. Possibility of introducing pulse and oilseed crops in the crop sequence have also been shown by these experiments. Increasing the land use efficiency through inter-cropping of wheat and cowpea in sugarcane gave additional yield of 1856 Kg/ha of wheat and 1472 Kg/ha of cowpea while maintaining the yield of sugarcane at about 108 tonnes/ha. Experiments on cultivator's fields have shown that growing high yielding varieties of rice with irrigation and fertilizers at 120kg. N, 60 Kg. P_2O_5 and 60 Kg. K_2O /ha. can yield as much as 6800 Kg/ha. as against targetted productivity of 5000 Kg/ha. while that of groundnut could be raised from targetted productivity of 2500 Kg/ha. to 3260 Kg./ha. with 60 Kg. N, 30 Kg. P_2O_5 and 30 Kg. K_2O /ha.

(C. R. LEELAVATHI, K. S. KRISHNAN AND S. C. MEHTA).

2.5 Statistical assessment of changes in area and food production due to availability of water in the command area of Ghataprabha and Malaprabha River Valley Projects in Karnataka, Krishna River Valley Project in Maharashtra and Pochampad River Valley Project in Andhra Pradesh.

It is envisaged to study the changes in cropping pattern adopted, increase in area under cultivation, average yield of different crops, agricultural practices

adopted by farmers due to availability of irrigation in the command area and to find out the reasons for non-fulfilment of agronomic targets.

During the year, data collection for command of Ghataprabha and Mala prabha River Valley Projects had been taken up. Data on irrigation potential had been collected. Experimental data on irrigation from 119 expts. on 17 crops were collected. Information and data on the bench mark surveys conducted for the command had also been obtained. Summarisation of experimental data was in progress.

(C.R. LEELAVATHI AND S C. MEHTA).

2.6 Water Management in Rainfed Agriculture

The objectives of the project were ; (i) to assess water availability and to identify periods of water surplus and deficit for Jalgaon (Maharashtra) and Basti (U.P.) districts, (ii) To find out the safe growing season and to suggest suitable cropping pattern, (iii) To estimate the surplus amount of water (runoff) and to suggest measures of conserving and utilising it for agriculture and (iv) To study the socio-economic benefits of the conservation programme. 18 years daily rainfall data and 10 years evaporation data for Basti (U.P.) were collected during the year. 32 years rainfall and evaporation data for Jalgaon (Maharashtra) were analysed.

For analysis of the data (i) a Gamma distribution was fitted to weekly rainfall data by the method of moments (ii) A truncated geometric distribution was used to study the distribution of dry and wet spells in short intervals; and (iii) Water balance model was used to obtain the weekly soil moisture and runoff estimates.

In semi-arid areas like Jalgaon where precipitation is more than evaporation only in 2 to 3 months of a year, enough runoff water can be stored and can be used to give one or two life saving irrigations to kharif crop.

(ASHA SAKSENA AND P.N. BHARGAVA).

2.7 Methodological studies relating to experiments on perennial (Fruits) crop.

The objectives of the project was critical summarisation of the results of some of the fruit crops through proper statistical methodology. The report on mango crop had been prepared and sent for comments to the referee. Apart

from individual year only pooled analysis for various groups (years) of data and time trend analysis methodologies etc. were used for analysis of the data. The report was under finalisation.

(BASANT LAL, P.N. BHARGAVA AND G.L. KHURANA).

2.8 Methodological studies on crops having multiple harvestings

The objectives of the project were to carry out methodological studies relating to planning of experiments on crops having multiple harvestings and the analysis of data pertaining to them.

As per recommendations made in the Staff Research Council the project was started with two crops namely cotton and tomato. For the purpose, the detailed information including raw data were collected from PAU, GAU and G.B. Pant University. The data were subjected to detailed statistical analysis. Centre-wise position of the analysis is as below :—

(i) Punjab Agricultural University Ludhiana

A total number of 41 experiments on cotton were available. Number of pickings varied from 2 to 4 in different experiments. All the experiments were conducted in RBD with 3 or 4 replications. The number of varieties varied from 12 to 30. Percentage contribution of various pickings towards total yield, was calculated for all the experiments. The analysis of variance was performed separately for all the pickings and total yield also. The coefficients of variation for various pickings and total yield were calculated for all the experiments. The data on plant stand were made use of in performing the analysis of covariance.

(ii) Gujarat Agricultural University, Surat

Data were available for 12 groups of experiments (39 individual experiments) on cotton. Number of pickings varied from 2 to 5. Out of 39 experiments 9 were conducted in split-plot design, whereas remaining 30 were in RBD. The percentage contribution of various pickings towards the total yield was calculated for all the experiments. The analysis of variance was performed separately for all the pickings and total yield. The coefficient of variation were worked out for various pickings and total yield for all the experiments. As the data were available over a number of years the stability of various treatments/varieties was also examined by calculating the stability index.

(iii) **G.B. Pant University of Agriculture and Technology, Pant Nagar**

Data for 8 experiments on tomato have been collected from this university. Percentage contribution of various pickings towards total yield, analysis of variance and calculation of coefficient of variation for various pickings and total yield have been completed.

(H.V.L. BATHLA AND K.S. KRISHNAN).

2.9 Statistical evaluation of Agricultural field experiments conducted during 1966-71 on wheat crop in U.P. State

The objectives of the project were to evaluate statistically a set of 818 field experiments conducted on wheat crop in U.P. State during 1966-71. The purpose of study is to detect the shortcomings in planning, designing and selection of experimental units/materials and finally to assess the status of experimentation in the form of research index developed for the purpose. 818 field experiments collected under the Project, 'N.I.F.E.', 8 were analysed. Techniques applied for analysis of the data was research index developed by Bajpai and Nigam (1978-80).

The overall research index comes out to be 62.42% which indicates that research efforts were satisfactorily made. Some of the short falls are listed below :—

- (i) There were wrong judgement on the part of Scientists in selecting effective treatment levels in about 34% of the cases.
- (ii) Improper use of split-plot design was indicated in about 17% of the experiments.
- (iii) In considerable no. of cases disease control experiments were tried in the fields where there was no existence of disease.
- (iv) Cultural treatments mostly exhibit 10% of the general mean while as in 80% of the experiments C.V. is more than 15%. Actually more than 6 replications were needed in such cases but usually only 4 replications were taken.
- (v) In many experiments, no consideration was made of heavy basal manure applied in whole of the experiments while deciding the levels of treatments under study.

- (vi) There was no judicious use of plot size keeping in view the soil, climate and topography of land. Same plot size was tried in far apart places like Varanasi and Meerut for the same set of treatments.
- (vii) More than three levels of N and P should have been tried.

(A.K. NIGAM AND S.N. BAJPAI)

2.10 A study on agronomic and other factors in relation to the homogeneity of experimental errors in groups of experiments on Paddy crops

The objectives of the project were to study various agronomic and other factors like soil type, irrigated condition, number of plots per block, size of the plot, Block area, number of expts. in group etc, which were associated with the homogeneity of error variances in groups of experiments on paddy crop. Final calculations and χ^2 -tests of significance were carried out.

Analysis of variance technique was used for groups of experiments and χ^2 -tests were carried out to find out the association of different factors with homogeneity or heterogeneity of error variances. The optimum plot sizes and block sizes for experimentation on paddy crop under different soil types and irrigated conditions, were obtained. The salient results achieved were as follows :

To investigate the agronomic and other factors favourable for homogeneity of error variances in groups of similar experiments, as many as 445 groups of experiments conducted on Paddy crop under varied agro-climatic conditions all over the country were studied. The various factors considered were the soil type, irrigated condition, plot size adopted, no. of plots per block, block area, type of experiment and number of experiments per group. Association of homogeneity of error variances was tested with each of the above factors by χ^2 -test. The tests revealed association of some of the factors with homogeneity of error variances. A few of the findings are as given below :

The association of homogeneity of error variances appears to be strong with :—

- (i) plot area ≤ 45 sq. m. under light soil group.
- (ii) Block area ≤ 600 sq. m. under light soil groups but ≤ 200 sq. m. under irrigated condition or when the experiment relates to manurial type.
- (iii) Number of plots per block not exceeding 6 in case of m-type experiments or under Heavy soil group or under irrigated condition and ≤ 5 under unirrigated condition.

(P.P. RAO AND S.C. RAI)

2.11 A critical review of pot-culture and other laboratory experiments

The objective of the project was to study the critical reviews on the nature of these experiments, the designs adopted and the magnitudes of various components of variation.

The project was started in October, 1979. In this project, the Management committee had desired that in the first instance, the review work covering three organisations viz. IARI, PAU and HAU might be made. Accordingly, the review work was started from IARI, New Delhi. In all, 2050 experiments have been seen and out of these 72 were regarding pot-culture and other laboratory experiments. The relevant position pertaining to this project was noted down from these theses. Regarding PAU Ludhiana, out of the available 4130 theses 1975 had been checked and the relevant portion was available only in 30 theses.

(H.V.L. BATHLA AND K.S. KRISHNAN)

3. CROP FORECASTING METHODOLOGY

The work of Crop Forecasting Methodology was continued during the year under report as per programme laid down. The progress of work in respect of various items of research included in the programme is summarised below in brief and the names of the concerned principal investigator and his associate (s) are given in brackets at the end of description.

3.1 Pilot studies on pre-harvest forecasting of yield of crops on the basis of biometrical characters-Sugarcane, Jowar and Tobacco

The objective of the project was to evolve a suitable statistical methodology for the pre-harvest forecasting of crop yield on the basis of observations on biometrical characters-plant density, plant height, basal diameter, etc. recorded at different stages of crop growth.

The technique of multiple regression was employed to develop a suitable prediction model relating to yield and different biometrical characters after adjusting data for variations due to zones and villages. The best period of predicting yield rate of a crop was determined on the basis of amount of variation in yield accounted for by the multiple regression equations.

The progress of work in respect of three crops is as follows (Item Nos. 3.1.1, 3.1.2, 3.1.3 and 3.1.4).

3.1.1 Sugarcane-Meerut District (Uttar Pradesh)

During the year under report, analysis of data for the fourth and the final round of the survey conducted in 1978-79 was completed and drafting of the report was in hand. Annual progress report for 1977-78 relating to the third round of the survey was published.

In the pilot survey on sugarcane conducted in Meerut district during the year 1978-79, biometrical characters observed were, number of shoots/millable canes, their height and girth and width of third leaf. Significant and positive correlations between biometrical characters such as number of millable canes, their height and girth and dimension of 3rd leaf with yield were obtained. The regression analysis showed that those characters could explain about 75% variation in yield when the crop was about 7 to 8 months old which suggests that

yield forecasting is possible using biometrical characters about 2 to 3 months before harvest. Similar results were obtained in the earlier three rounds of the survey conducted in Meerut district during 75-76, 76-77 and 77-78. These results, however, need to be tested on a larger scale before wider adoption for obtaining forecasts of sugarcane yield.

The regression analysis was undertaken with seven different models. In the first one dependent variate (Y) and independent variates (X_i 's) were taken in the original scale. In models II, III and IV, X_i 's were transformed to logarithmic, square root and reciprocal scales respectively. In models V, VI and VII, both Y and X_i 's were transformed to logarithmic, square root and reciprocal scales respectively. Model-I was found at par with other models and superior to model-VII. Therefore, model-I could be used for forecasting purposes because of simplicity in computation and interpretation of results.

(M.P. JHA, R.C. JAIN AND S.R. BAPAT)

3.1.2 Sugarcane-Kolhapur District (Maharashtra)

The district was stratified into 7 strata and from each stratum, 8 villages were selected randomly. Three randomly selected fields in each village were used for recording the data. The total number of villages selected were 56 and the data from 134 fields could be utilized for analysis.

In the pilot studies on pre-harvest forecasting of yield of sugarcane in Kolhapur district (Maharashtra)—1977-78, significant and positive correlations, between yield and different biometrical characters, namely, number of canes height, girth and length and breadth of the third leaf were observed. The study of regression analysis showed that about 70-75% variation could be explained by these characters and it is possible to forecast the yield 3-4 months prior to harvest.

During the year under report, the data collected during 1978-79 were analysed. The data on biometrical characters namely, number of millable canes, height, girth and length and width of the third leaf, the selected canes were recorded at different stages of crop growth. The results revealed that as in the previous round of the survey, significant and positive correlation was observed between yield and these characters. The results of regression analysis showed that about 75% of the variation in yield could be explained by the biometrical characters when the crop was about 7 months old. Similar trend was observed in the previous round of the survey also. The study also revealed

that the three characters out of five, namely, height, number of canes and girth in this order, are the most important. The study of different models with variables in the original scale is in general best suited for prediction of yield.

The field work for the third round of the survey (1979-80) was completed and data were collected.

(S.R. BAPAT, M.P. JHA, CHANDRAHAS AND B.H. SINGH)

3.1.3 Jowar-Sangli District (Maharashtra)

During the year under report, analysis of data for 1978-79 had been completed and drafting of report was in progress. Report for the year 1977-78 had been brought out.

During 1978-79 survey on Jowar in Sangli district, biometrical characters observed were number of plants per plot, plant height, number of green leaves per plant, length and breadth of top most fully opened leaf, flag leaf and third leaf and length and circumference of earhead. Correlation studies showed that plant height, length and breadth of flag leaf and third leaf were positively correlated with yield in case of local jowar, while number of plants, plant height, breadth of flag leaf and third leaf and length of earhead were important characters contributing towards yield in hybrid jowar. The regression analysis revealed that about 40% variation in yield was accounted for by biometrical characters when the crop is 16 to 18 weeks old in case of local jowar. In hybrid jowar, 60% variation in yield could be explained by biometrical characters when the crop was 12-14 weeks old. Out of the seven regression models used model I, where all the variates were in original scale was found at par with other models and superior to model VII. Therefore, model I could be used for forecasting purposes because of simplicity in computation and interpretation of results.

(R. C. JAIN, M. P. JHA AND RANJANA AGARWAL).

3.1.4 Tobacco-Prakasam District (Andhra Pradesh)

During the year under report, analysis of the data for 1978-79 was completed. The annual report for the year 1977-78 had been finalised for publication.

In the third round of the survey on tobacco in Prakasam district conducted during the year 1978-79, the biometrical characters observed were plant density, its height, number of curable leaves, length and width of leaf, etc. The results of correlation studies showed that number of plants, number of curable

leaves, height of plant, length and width of leaves were correlated positively and significantly with yield at most of the stages of crop growth in red soil zone. In case of black soil zone, number of curable leaves was the only biometrical character contributing towards yield. Regression analysis was undertaken with four linear models in different scales. The results of regression analysis of red soil data revealed that about 40 to 55 per cent of the variation in yield could be explained by the above mentioned characters when the crop was about 10-14 weeks old. In black soil, about 40-50 per cent of the variation in yield was accounted for by the biometrical characters when the crop was about 12-14 weeks old. A comparison of four models suggested that linear model with variables in original scale is suitable for prediction of yield.

(CHANDRAHAS, B. H. SINGH AND M. P. JHA).

3.2 Pilot sample survey for estimating the incidence of pests and diseases and consequent crop loss in high yielding varieties of (i) Paddy-South Arcot District (Tamil Nadu) and (ii) Wheat-Gorakhpur District (U.P.)

The objectives of the project were (i) to estimate the level of incidence of pests and diseases in high yielding varieties of paddy and wheat, (ii) to estimate the extent of avoidable loss in crop yield through the adoption of plant protection measures and (iii) to estimate the crop loss as a consequence of the incidence of pests and diseases.

The progress of work in respect of these crops is as follows - (Item Nos. 3.2.1 and 3.2.2).

3.2.1 Paddy-South Arcot District (Tamil Nadu)

As reported earlier, the data for Samba 1976 were analysed and the results incorporated in the draft report (see item 3.7 of Annual Report, IASRI, 1979). Some aspects of these data for Samba 1976 were analysed further in connection with modification of this draft report in the light of the internal and external referees' comments. This involved estimation of crop loss due to pests and diseases by using principal components constructed from the combined data on incidences as regressor variables which provided a check on the loss estimated earlier by using the separately constructed principal components of these data as regressor variables. Some other work concerning the analysis of these data pertained to checks on computations like evaluation of characteristic roots and characteristic vector components. The report for Samba 1976 was finalised.

The data for Navrai 1977 (viz, the second season of the survey in Tamil Nadu) were scrutinised, punched, and part of their analysis was completed during the year under report. This pertained to zone-wise estimates of the level of incidence of pests and diseases. The data for Samba 1977 were also scrutinised during this period.

3.2.2 **Wheat-Gorakhpur District (U.P.)**

Analysis of part of the data pertaining to rabi 1978-79 season was completed and zone-wise estimates of the avoidable loss in crop yield through the adoption of suitable plant protection measures and also pooled estimate of such loss for the district were obtained. The scrutiny and coding of the remaining data *rabi* 1978-79 was also completed. The data for *rabi* 1979-80 were received during this period.

The zone-wise estimates of loss in crop yield available through the adoption of plant protection measures were obtained by averaging the paired differences in crop yield of 'protected' and 'control' plots. These zone-wise estimates were then weighted by crop areas of respective zones to get pooled estimate for the district. Estimate of the absolute avoidable loss in yield expressed as percentage of the estimated yield of protected plots was used to get the estimate of percentage avoidable loss in crop yield.

The avoidable loss in crop yield for the district for *rabi* 1978-79 was estimated as 323 Kg/ha. with a standard error of 6 per-cent. The loss in percentage basis was 9.69 per-cent of yield possible through the use of suitable plant protection chemicals. Zone-wise, this loss ranged between 206 kg/ha. to 384 Kg/ha. and in terms of percentage, between 6 to 14 per cent.

(G.N. BAHUGUNA, K.G. ANEJA AND V.K. MAHAJAN)

3.3 **Studies on forecasting crop yield based on weather parameters**

The objectives of the project were to develop a suitable methodology for forecasting crop yield and to construct a weather index which can be used in predictions.

Weekly data on weather parameters, viz., maximum temperature, relative humidity, rainfall and number of rainy days, corresponding data on rice yield and data on agricultural inputs viz, nitrogen consumption, percentage area under irrigation, percentage area under high yielding varieties and nitrogen-rice price ratio in respect of Raipur district were collected and analysed for 25 years

from 1947 to 1973 (Only those years were taken for analysis for which complete data were available). An attempt was made (i) to study the joint effects of maximum temperature and relative humidity (14 hrs) on rice yield at different stages of crop growth and (ii) to develop composite model for forecasting rice yield using weather variables and agricultural inputs.

In order to study the joint effects, multiple regression equation was fitted taking first and second order generalised weather variables as independent variables. First and second order generalised variables were obtained as weighted averages of weekly weather variables/their product taking correlation coefficients between yield and weather variables/their product in respective weeks as weights. Step-wise regression was used to select significant generated variables.

For composite model, weather index and agricultural inputs, alongwith trend were used as independent variables. Two weighted weather indices were constructed using correlations and standardised partial regression co-efficients as weights to be used in the composite model in place of weather variables.

Study on joint effects of maximum temperature and relative humidity (14 hrs) revealed that beneficial and detrimental effects of the above average relative humidity on yield increased with the increase in maximum temperature. Beneficial effects of the above average maximum temperature on yield increased with the rise in relative humidity while detrimental effects decreased.

Composite model for forecasting rice yield of Raipur district using weekly weather variables, namely, maximum temperature, relative humidity, total rainfall, number of rainy days ; agricultural inputs, such as fertilizer consumption, per cent area under high yielding varieties and percent area under irrigation and fertilizer-crop price ratio was studied. Results showed that additional contribution of agricultural inputs over trend was negligible suggesting that model using weather variables and trend alone could be used for forecasting which explained above 70 per cent variation in rice yield.

(RANJANA AGARWAL, R.C. JAIN AND M.P. JHA).

4. STATISTICAL RESEARCH IN ANIMAL SCIENCES

The work of statistical research in Animal Sciences was continued during the year under report as per the programme laid down. The progress of work in respect of each of the various research projects included in the programme is described below in brief and the names of the concerned project leader and his associate (s) are given in brackets at the end of the description of each project.

4.1 Estimation of availability and cost of production of milk and its index in : (a) I.C.D. area, Bhopal (Madhya Pradesh) ; (b) I.C.D. area, Bikaner (Rajasthan)

The objective of the project was to evolve suitable sampling technique (i) to estimate the availability of milk and its disposal in different seasons of the year ; (ii) to estimate the cost of production of milk with a reasonable degree of precision ; (iii) to estimate the components of cost of production both in monetary terms and in terms of physical quantities ; (iv) to secure information on factors influencing production of milk and its cost and (v) to build up an appropriate index of cost of production of milk. The nature and extent of data collected under the project was reported earlier (item 3.2 of Annual Report 1977). Ratio method of estimation in a stratified two stage random sampling was used for working out the estimates. The progress in respect to both the areas is as follows :

(a) Estimation of availability and cost of milk production in I.C.D. area, Bhopal, (Madhya Pradesh)

The report brought out during the year under report gives the sampling design, plan of work, estimation procedure along with the salient results. The average number of households per village in I.C.D. area, Bhopal was 69, of which 78% were having bovines. Among the households having bovines, as many as 85% had milch animals. On an average, 281 cattle and 77 buffaloes were maintained per village. About 52% of the households maintained only milch cows and 38% had both cows and buffaloes and 10% had only buffaloes. Cultivator class of producer was predominant and accounted for more than three-fourth of the total milk producers. On an average, 17 milch cows and 8 milch buffaloes were maintained in every 10 households. Ninety-nine percent of breedable cows were Non-descript (N.D.). Among breedable buffaloes, 95%

were N.D. and the remaining 5% were Murrah. The overall daily production of milk in the I.C.D. area, around Bhopal, was about 70 tonnes of which 44% was accounted for by cow milk and 56% by buffalo milk. The average daily milk yield of a cow in milk was about 0.79 Kg. as compared to 1.80 Kg. per buffalo in milk. The corresponding estimates of average milk yield for a milch cow and a milch buffalo were 0.40 and 1.07 Kg. per day respectively.

The overall net cost per Kg. of cow milk during the period of survey was estimated to be 212 ± 10.4 P including family labour and 146 ± 7.7 P excluding it. The prevailing market rate of cow milk in the area during the same period was Rs. 1 80 per Kg. The net cost per Kg. of buffalo milk was 169 ± 4.7 P including family labour and 113 ± 3.1 P excluding it. The prevailing market rate of buffalo milk was Rs. 1.97 per Kg.

In the case of cow milk, feed cost, paid labour, family labour, depreciation on animals, interest on capital, depreciation on assets and equipments and miscellaneous recurring expenditure accounted for 46,6,28,5,8,5 and 2 percent of the gross cost. The corresponding figures for buffalo milk were 42,7,23,10,12,4 and 2 percent.

As much as 71 to 81% of total cow milk produced in commercial households in each season was consumed in fluid form, 9 to 11% was converted to milk products and the remaining was sold. Out of the total buffalo milk produced, 42 to 50% was sold and the remaining utilised either as fluid milk or in the form of products.

The proportion of death in the area was about 6 5% among milch buffaloes as compared to 4 to 7 percent among cows. The proportion of death was more among buffalo calves than among cow calves. The maximum death rate among male buffalo calves of 1 to 3 years of age was 19.2%.

In addition to the studies mentioned earlier, other studies made include market prices of feeds, procurement of feeds, mode of feeding, grazing practices, labour wage rates, purchase and sale prices of animals, variation in milk yield according to order and stage of lactation, age at death, general information about selected households and basis and mode of payment received by commercial milk producers.

(b) Index of cost of milk production in I.C.D. area, Bikaner (Rajasthan)

The report gives the method of constructing the index of cost of milk production. The method consists in first working out the indices of the major

components of cost viz., feed and labour using Laspeyre's method and then combining these indices with suitable weights to obtain the desired index.

The production cost per Kg. of cow milk in I.C.D. area, Bikaner was 98 P during 1975-77. This was increased by 12% during 1977-78 and 19% during 1978-79, as compared to the cost during 1975-77. The market rate of cow milk during 1975-77 was 113 P. per Kg. There was an increase of 1% in the market rate of cow milk in 1977-78 and 6% in 1978-79, over the base period 1975-77.

The report also gives the indices of market rates of major feeds and fodders fed to animals as well as the labour wage rates for different categories of labour for the years 1977-78 and 1978-79, with respect to the base period 1975-77.

(K.C. RAUT, SHIVTAR SINGH AND R.L. RUSTAGI).

4.2 **The studies of the impact of milk supply scheme on rural economy in milk collection area of (a) Greater Calcutta Milk Supply Scheme, Calcutta (W.B.) - Repeat Survey : (b) Madhavaram Milk Supply Scheme, Madras (T.N.)-Repeat Survey**

The objectives of the project were to develop and to test statistical methodology on assessing the impact of milk supply scheme on rural economy in the milk shed areas, specially in respect of the milk production and its utilisation, employment due to milk production, its handling and fodder production and the gross annual income. A stratified two-stage sampling design with clusters of villages as the first stage unit and the households within a cluster as the second stage unit was applied for the collection of the data and its analysis.

The progress in respect to the areas is as follows :

(a) **G.C.M.S., Calcutta**

The field staff was imparted training for collection of data for the repeat survey at B.C.K.V.V., Kalyani. The data under preliminary enquiry was collected under the survey. The detailed enquiry started w.e.f. 1st Dec., 1980. The survey work remained in progress.

(b) **M.M.S., Madras**

The data collected under repeat survey during 1979-80 was received and the analysis of the data in different schedules was undertaken. The analysis work remained in progress.

(a) (H.P. SINGH, B.C. SAXENA AND S.R.S. ARYA).

(b) (H.P. SINGH, B.C. SAXENA AND S.P. VERMA).

4.3 National Index of Animal Experiments

The objectives of the project were to record on uniform lines the research of all experiments on animals conducted at various research stations in the country, during the past and to publish periodically the same in the form of compendia for the benefit of research workers and planners. The analysis of variance, co-variance and regression techniques were applied in the analysis of the data.

(a) Southern & Eastern Research Stations

During the year under report, 151 experiments conducted at Gujarat Agricultural University, Institute of Agriculture, Anand ; Kerala Agricultural University, College of Veterinary and Animal Sciences, Mannuthy (Trichur) and Marathwara Agricultural University, Parbhani were scrutinized. Out of these, 27 experiments belonging to animal nutrition and breeding were collected from Marathwara Agricultural University, Parbhani. A compendium viz. 'National Index of Animal Experiments' Vol-1: Part VI, pertaining to the animal nutrition experiments, 67 in number, conducted at G.A.U., Institute of Agriculture, Anand (Gujarat) during 1960-74 was published. The experiments pertaining to this compendium were classified into five categories (i) Feeding trials for growth and production, (ii) Feeding trials with subsidiary feeds, (iii) Studies on requirement of protein and minerals, (iv) Nutritive value of feeds and (v) Rumen studies.

The compendium 'National Index of Animal Experiments' Vol. I: Part VI, which was published during 1980, contains animal nutrition experiments conducted at G.A.U., Institute of Agriculture, Anand. As far as designs are concerned, about 37% experiments were of C.R.D. ; 5% of R.B.D. 3% of switch over design, 1% Factorial experiments, 6% experiments of latin square designs and about 48% of experiments were not under any standard design.

(b) Northern and Western Research Stations

During the year under report, information of about 25 experiments pertaining to animal and poultry nutrition research work done at College of Animal Sciences, H.A.U., Hissar was further collected. The results of experiments, 79 in number, pertaining to the above mentioned University were scrutinized, analysed and results were put in the final representation format and was ready for publication. Besides this, 41 experiments belonging to the Punjab rao Krishi Vidyapeeth, Akola Maharashtra were also scrutinized.

A compendium viz, 'National Index of Animal Experiments' Vol 1 ; Part V, Animal Nutrition experiments, 73 in number, conducted at R.B.S. College Bichpuri, Agra (1962-76) was published. The experiments were classified into five categories viz. (i) Feeding trials for growth & production (ii) Feeding trials with subsidiary feeds (iii) Studies on requirement of protein & minerals (iv) Nutritive value of feeds and (v) Rumen Studies. From design point of view, about 12% experiments were C.R.D., 5% R.B.D., 2% Switch over design and the rest were without any standard design mostly pertain to academic research.

(a) (ALOKE DEY AND G.C. CHAWLA),

(b) (ALOKE DEY AND S.N. BAJPAI)

4.4 Pilot Studies for estimation of birth and death rates in bovines

The objectives of the project were to evolve a suitable methodology for estimation of specific fertility and mortality rates among cattle and buffaloes. The procedures adopted for estimation of age specific fertility and mortality rates were : (i) Average Population Method, and (ii) Fractional Exposure Method. The numerator of the vital rates for any specified group of animals was taken as the observed number of births/deaths in the group while the corresponding exposed population formed the denominator. In the first method, the exposed population in any particular group of animals was estimated as the average of initial population and final population in the group during the period of observation. In the second method, this was determined by considering the fractional periods of exposure for each individual animal and cumulating the same over all animals in the particular age group for which the rates were being estimated. Combined ratio estimates were worked out using appropriate weighting factors.

(a) Punjab Centre :

Statistical analysis of the data pertaining to detailed enquiry was completed and report prepared. It was reviewed by the internal and external referees and was finalized in the light of their suggestions. The report deals with the structure of the bovine population, as per complete enumeration of households in selected villages with respect to species, breed, sex and age as well as age-specific fertility and mortality rates estimated from a sample of households drawn for detailed enquiry. As revealed from the census of households, more buffaloes than cows were being maintained in the region under survey. The breeds observed were Hariana and Sahiwal in cattle and Murrah and Nili in buffaloes in addition to the non-descript type under each species and a small

number of cross bred cattle and graded buffaloes. The percentage of cattle in the age group of 3 to 9 years to the total number of cattle under each sex in each area ranged from 51 to 66, the corresponding range in the case of buffaloes being 51 to 62. Age-specific fertility and mortality rates were worked out by Average Population Method and Fractional Exposure Method. Fertility rates generally showed an increasing trend over age within the fertile ages. Mortality rate was maximum among calves. It decreased as the animals grew in age and was generally low in the adult stock, though it again increased in the higher ages.

(b) Gujarat Centre :

The data collected during the complete enumeration in 150 villages were processed to get distribution over age groups of cattle and buffaloes of each sex in I.C.D. and non-I.C.D. areas. Punching of data relating to detailed enquiry conducted in 30 households from each village was completed. These data were analysed to obtain village-wise as well as stratum-wise tables for age specific exposures, births and death in cattle and buffaloes. Age-specific fertility and mortality rates were then obtained. A draft report based on the results was prepared and it would be reviewed.

In the selected villages of Kaira district (I.C.D. area), the strength of buffaloes was little less than three times that of cattle at time of complete enumeration. On the contrary, the number of cattle was three times that of buffaloes in the villages selected from Panchmahal district (non-I.C.D. area). While most of the cattle were males, females constituted a vast majority among buffaloes, thus indicating that cattle were kept mainly for draught purposes and buffaloes for milk production. The major breeds in the region were Kankrej in cattle and Surti in buffaloes which were predominant only in the I.C.D. area. Most of the bovines in the non-I.C.D. area were non-descript. Other breeds, observed in small numbers, were Gir and Jersey among cattle and Mehsani and Jaffarabadi among buffaloes. Besides, there were very few cross-bred cattle and graded buffaloes in the I.C.D. area. The percentages of animals in the age group 5 to 10 years in the two areas respectively, were 47 and 42 for female cattle, 59 and 52 for male cattle and 45 and 40 for female buffaloes. The percentage of male buffaloes in the same age group was less than 5 percent, most of the animals in this category being young calves below one year in age. Estimates of age-specific fertility rate were obtained. For the age groups 3 to 6, 6 to 9, 9 to 12 and '12 years and above' these rates ranged, in cattle, from 17.40 to 40.18 percent in I.C.D. area and from 19.10 to 26.50 in non-I.C.D. area, whereas in buffaloes these ranged from 27.96 to 33.77 in I.C.D. area and from 14.89 to 28.99 percent in non-I.C.D. area.

Age-specific mortality rates were estimated. For the age groups 0 to 1 year and 1 to 3 years in addition to the age groups mentioned above, these were found to be more in male bovines than in females. In I.C.D. area, mortality rate ranged from 0.28 to 17.43 per cent over the various age groups in female cattle, while it ranged from 1.04 to 19.02 percent in male cattle. In buffaloes, the mortality among females ranged from 0.51 to 20.22 percent. For male buffaloes mortality rates could be estimated only for the two age groups 0 to 1 year and 1 to 3 years and were as high as 61.55 and 29.94 percent respectively. In non-I.C.D. area the rates ranged from 1.92 to 10.72 percent in female cattle and from 2.39 to 16.43 percent in male cattle, while the corresponding percentages for buffaloes were between 2.21 and 15.41 in females and between 7.85 and 63.85 in males.

(c) Assam Centre :

The work of complete enumeration in all the 160 selected villages was completed. From the schedules received, selection of 50 households per village was done for detailed enquiry. Field staff were given necessary training for the conduct of detailed enquiry which continued during the year. The field work of the project was terminated in Dec., 1980. Requisite data were being received at I.A.S.R.I. and were being scrutinised.

(U.G. NADKARNI, S.N. ARYA AND JOSE ABRAHAM)

4.5 Study of economics of raising cattle and buffaloes in rural areas, West Bengal

The objective of the project was to develop a suitable methodology for estimating with objectivity and precision the cost of raising young stock particularly crossbred calves and maintenance of breeding females as well as working males. The variation in the cost of maintenance and its components due to season, breed, etc. will also be studied. The study would also furnish estimates of cost of production of cow milk and buffalo milk. Ratio method of estimation in stratified two stage random sampling design was applied for obtaining estimates.

The field work of the project, which was initiated in August, 1977, was completed in June, 1980. Details regarding the nature and extent of data collected had already been reported earlier (item 3.7 of Annual Report, 1977). Data received from field staff were scrutinised, coded and the information transferred to punch cards. Statistical analysis of data remained in progress.

(K.C. RAUT, SHIVTAR SINGH AND R.L. RASTOGI)

4.6 Index of cost of rearing calves and study of changes in rearing practices in rural areas, Haryana

The objective of the project was to build up different indices of cost of rearing calves and of maintenance of adult animals and to choose the appropriate index. Apart from this, changes which might have occurred since the date of completion of detailed survey conducted during 1963-66 in respect of composition and quantum of feeds and fodders fed to animals, rearing practices and milk yield of animals would also be studied.

During the year, a technical report was prepared and released. The salient results are as follows :

The report gives a method of constructing the index of cost of rearing/maintaining bovines utilising the data on prices of feeds and fodders and labour wage rates collected during 1977-78 and inputs as estimated in the detailed survey conducted earlier during 1963-66. The method consists in first working out the indices of different components of cost using Laspeyre's method and then combining these indices through a system of weighting, the weights being the proportions of the components of cost to the gross cost.

The study has revealed that the quantum of feeds fed to animals as well as the milk yield of milch stock during 1977-78 have undergone substantial changes, as compared to 1963-66. There is thus, an urgent need to repeat the detailed survey in the area to get precise estimates of rearing and maintenance of bovines.

(SHIVTAR SINGH AND K.C. RAUT)

4.7 Statistical investigations on economics of pig production

The objectives of the project were (i) (a) to investigate into the feasibility of studying the economics of pig production and development of suitable methodology for evaluating the commercial aspects of rearing pigs to an assigned stage of growth under farm and field conditions and (b) to study component-wise cost of raising and rearing pig, (ii) to study low cost balanced ration using linear programming techniques and (iii) to study appropriate conversion factors for estimating dressed weight from live weight.

By pooling the weekly and fortnightly data on feed consumed, labour employed and stock particulars together with their valuation, components of cost of maintenance of pigs of different categories were obtained separately for each farm and household by known techniques. Estimates of average components of cost viz., feed, labour, interest on investment, depreciation on assets

and equipment, depreciation on adult pigs and miscellaneous expenditure per pig per day were obtained separately from farm and the field data. The contributions due to these components to the total cost per pig per day were compared.

During the year under report full data from College of Veterinary and Animal Sciences, Mannuthy (Kerala) and remaining data from College of Veterinary Sciences, Tirupati (Andhra Pradesh) were collected. Statistical analysis of the data collected from five centres viz., I.V.R.I., Izatnagar, Composite Livestock Farm, Hessarghatta, Livestock Farm, Jabalpur, College of Veterinary Sciences at Mannuthy and Tirupati was completed. Statistical analysis of the data collected from randomly selected 140 households spread over 28 villages of Koil and Sikandra Rav tehsiles of Aligarh was also completed during the year.

The average daily cost of maintenance of an adult pig of Large White Yorkshire breed ranged from Rs. 3.60 at Hessarghatta to Rs. 7.20 at Tirupati; that of young pig ranged from about Rs. 1.20 at Hessarghatta to Rs. 4.20 at Jabalpur and that of a creeper ranged from 22 paise at Hessarghatta to 71 paise at Tirupati. The cost of maintenance per pig per day of Land Race breed at Izatnagar was Rs. 6.65 for an adult pig, about Rs. 4.50 for young pig and about 66 paise for a creeper. This cost in field survey was very less which is about 90 paise for an adult pig, 45 paise for young pig and 12 paise for a creeper. The cost on feed alone formed about 45 per cent to 80 per cent of the total cost in adult animals in farm data and only about 6 per cent in field data. Labour formed about 85 per cent of gross cost in field data and about 10 to 30 per cent in farm data.

(U.G. NADKARNI, L.B.S. SOMAYAZULU, T.B. JAIN, H.C. GUPTA AND S.C. AGARWAL)

4.8 **Studies for developing suitable methodology for estimation of cost of poultry and egg production under small scale poultry farming conditions (in the Warangal district of A.P. in collaboration with APAU)**

The objectives of the project were to evolve a suitable methodology for estimation of cost of poultry rearing and egg production under small scale poultry farming conditions. Third round of fortnightly collection of data was started with the commencement of the year, 1980. Under the detailed enquiry data was collected from the field for about 20 rounds, the last round of data collection closing by 30th Sept., 1980. The data collected under the preliminary enquiry during Aug-Nov., 1979 was analysed and analysis of data collected during the detailed enquiry was in progress.

(L.B.S. SOMAYAZULU, U.G. NADKARNI AND H.C. GUPTA).

4.9 **Statistical efficiency and operational feasibility of securing data on livestock and its products through different systems of collection, Ludhiana (Punjab)**

The objectives of the project were (i) to explore the possibilities of collection of reliable data on particulars of livestock maintained and production characteristics as reported by the respondents themselves and to standardise a suitable questionnaire for the purpose ; (ii) to study the feasibility of utilising the data so obtained for estimating various livestock production characteristics; and (iii) to compare the efficiency of the estimates obtained through collection of data by regular field staff and by the respondents themselves. Estimates obtained using double sampling technique will be compared by tests of significance.

Data on milk yield of individual animals and feeds and fodders fed to them, market rates of feeds and fodders, prices of animals etc. were being collected from 540 households spread in 20 villages of Ludhiana Tehsil (Punjab). The field work remained in progress. Data received from field staff were scrutinized, coded and the information was transferred to punch cards.

(SHIVTAR SINGH AND R.L. RASTOGI).

4 10 **A critical study on the changes in pattern of employment of rural working force in milk-shed areas of (a) Madhavaram Milk Supply Scheme-Chingleput (T.N.) and (b) Greater Calcutta Milk Supply Scheme, Calcutta (W.B.).**

The objectives of the project were to utilise secondary data collected in the survey "Study of impact of milk supply scheme on rural economy in milk collection areas" to work out the changes in (i) the time spent by the working force engaged in different main as well as subsidiary occupations for assessing whether they were regularly employed or under-employed, (ii) the relationship of holding size, literacy, family size etc. with the number of hours spent in different occupations by different families and (iii) total hours spent by adult male/female and child in different main as well as subsidiary occupations. A stratified two stage random sampling technique with cluster of 3 villages as the first stage unit and households with in a cluster as the second stage unit was used in the analysis of the data.

(a) M.M.S. Madras

A sizable section of adult working force in rural areas of Chingleput was engaged in Agriculture and field work. The proportion of under-employed, not fully employed and fully employed rural workers were roughly 32%, 40% and 28% respectively in supplying areas. In non-supplying area, these proportions were 32%, 48% and 20%. Of the working force 80% were males and 20% females. The average hours spent by an adult female worker in dairying as main occupation was higher than an adult male worker.

(b) G.C.M.S. Calcutta

The secondary data pertaining to rural working force already collected under the bench mark survey entitled "Impact of milk Supply scheme on rural economy in milk collection area of Greater Calcutta Milk Supply Scheme, Calcutta (W.B.)" carried out in 1976-77 was being analysed for preparing interim report.

(a) (S.P. VERMA, B.C. SAXENA AND H.P. SINGH).

(b) (S.R.S. ARYA, H.P. SINGH AND B.C. SAXENA).

4.11 Estimation of performance characteristics in bovines under village conditions (a) Bhopal Region, M.P. and (b) Chingleput Region, T.N.

The objectives of the project were to judge the statistical efficiency and feasibility of estimating performance characteristics like age at first calving, lactation length, calving interval, milk yield, mortality etc. in bovines maintained under village conditions and also to study the effect of various non-genetic factors of them. The data on various performance characteristics were analysed separately for cows and buffaloes. Simple averages, standard errors were worked out assuming the set of animals for which records were available as a simple random sample. To compare different effects the technique of analysis of two way classification with unequal number of observations in each cell was employed. For fitting different mathematical models for the lactation curve least square technique was employed.

(a) Bhopal Region (M.P.)

The secondary data obtained from a large scale sample survey conducted by IASRI for estimating the availability and cost of production of milk in I.C.D. area, Bhopal (M.P.) during 1975-77 was utilised.

The breeding performance was examined by studying the age at first calving, calving interval and breeding efficiency. The average age at first calving and overall calving interval were 67.1 ± 1.48 and 68.7 ± 2.06 months and 662 ± 20 and 650 ± 21 days for cows and buffaloes respectively. The breeding efficiency was about 80 per cent for both cows and buffaloes. Season of calving had significant effect on lactation length in the case of cows. Overall lactation length and dry period were 354 ± 9 and 418 ± 18 days and 293 ± 15 and 265 ± 12 days for cows and buffaloes respectively. The gain in efficiency in the estimate of production parameters obtained was of the order of 25 per cent by utilizing the available part of lactation records. The average lactation yield was 336.4 ± 16.97 and 849.6 ± 49.07 Kg. for cows and buffaloes respectively.

Overall estimates for different characters were estimated with a fair degree of precision than the lactation-wise averages. The results obtained on lactation length, dry period on lactation and calving interval were consistent within reasonable limits for overall and also for lactation-wise.

Mortality in male buffalo calves was significantly more compared to female buffalo calves. The deviation from the sex ratio of 50 percent was not significant. Analysis of distribution of calving indicated that the calving differ significantly in different seasons for both cows and buffaloes and was highest in the rainy season.

(b) Chingleput Region (T.N.)

The secondary data obtained from a large scale sample survey "Impact of milk supply scheme on rural economy in milk collection areas of Madhavaram Milk Supply Scheme Chingleput, Tamil Nadu" (Bench Mark Survey) conducted by IASRI during 1975-76 was utilised. The analysis of the data was in progress.

(R. P. SINGH)

4.12 Study of production functions of livestock products and determination of optimum feeding schedules

The main objective of the study was to determine the desirable combinations of the input-factors in terms of Digestible Crude Protein (DCP) and total Digestible Nutrients (TDN) for maximising out-put (milk yield).

Data on 9 experiments conducted on milk production and collected under the project, 'National Index of Animal Experiments' were utilised for the study.

Different types of production functions were fitted to choose the best fit. The linear function was considered to be the best fit in the majority of experiments. Combinations of the input-factors which maximised the output, could be found from only two experiments pertaining to Haryana cows and Surti buffaloes. Isoquants for fixed level of productions, marginal production of input-factors, marginal rates of substitution and production elasticities were worked out.

(G.C. CHAWLA).

4.13 Economics of Poultry keeping : Study of functional relationships between production and input factors

The objective of the study was (i) to fit various types of relationship between egg production and farm income each taken as output factor (dependent variable) and inputs (independent variables) like layer days, feed cost, labour cost and capital and (ii) to select the best relationship and test by statistical analysis whether a single function can be chosen over three seasons of a year and over years.

For this purpose data from the project "Estimation of cost of production of poultry and eggs" carried out in the Punjab and Delhi areas during the period 1967-71 by the Indian Agricultural Statistics Research Institute were utilised.

From the study it was observed that layer days and feed cost per layer explained a major part of the variation in egg production and farm income.

The quadratic and the Cobb-Douglas functions were found to fit well giving value of R^2 ranging between 50% and 97% in the various sets of data.

It is observed that single production function may be chosen for egg production with other inputs for the different seasons the relation being a square-root function in 1st year and Cobb-Douglas functions in 2nd year for the Punjab data. In case of 2nd year data from Delhi survey, a common quadratic function can be chosen over three seasons to represent the relationship between farm income and other input variables.

(L.B.S. SOMAYAZULU AND U.G. NADKARNI)

4.14 Some further statistical studies in relation to economics of poultry keeping-Study of the relationship of fixed and working capitals with egg production.

The objectives of the project were (i) to study the pattern of investment of two types of capitals in commercial poultry farms of Delhi ; (ii) to study the

separate and combined effect of fixed and working capitals on egg production and (iii) to find the optimum combination of the two capitals for varying levels of egg production and for different rates of changes of the two capitals. The data already collected from about 130 commercial poultry farms in the project "Cost of production of Poultry and Eggs" carried out at Delhi and its surrounding areas were utilised in this study. For analysis of the data-linear, quadratic, squareroot quadratic and Cobb-Douglas production functions were fitted for egg production with fixed and working capitals. The total investment over the commercial farms in two years ranged from Rs 1,052 to Rs. 1,76,056 per farm. About 55 per cent of the farms had working capital ranging from Rs. 5,000 to Rs. 30,000 and 64 percent of the farms had fixed capital also ranging from Rs. 5,000 to Rs. 30,000. In 66 percent of farms in both years, the egg production ranged from 1000 to 12,000 and in 22.6 percent it was more than 12,000 eggs. The correlation co-efficients of egg production with fixed and working capitals were 0.48 and 0.86 respectively. The Cobb-Douglas function accounted for maximum percentage of variation and was used for identifying isoquants and isoclines. For an average production of 9000 eggs and with a rate of substitution 5 total investment required was Rs. 44,324 with Rs. 29,644 as working capital and Rs. 14,680 as fixed capital.

(T.B. JAIN AND U.G. NADKARNI)

4 15 Statistical studies on milk production, income and employment under different categories of agricultural holdings in the milkshed area of Greater Calcutta Milk Supply Scheme—Calcutta, West Bengal

The objectives of the project were to study the relationship between the size of agricultural holdings and (i) Milk production in the area ; (ii) Employment due to milk production, its handling and fodder production and (iii) Gross annual income of milk producers and non-milk producers.

The present study was based on the data already collected during 1976-77 under a large scale survey "Impact of milk supply schemes on rural economy in milk collection areas of Greater Calcutta Milk Supply Scheme, Calcutta—West Bengal. The basic data collected at the time of complete enumeration of all the households in the selected clusters of villages in regard to the type of household whether milk producer or non-milk-producer, their size of agricultural holding, number of livestock maintained etc. and the data collected during the detailed enquiry in the selected households on items such as milk yield, income and pattern of employment were utilized in the present study. Since the main aim of the present investigation was to estimate the various characters under diffe-

rent holding groups, it was necessary to re-classify all the households in the selected clusters according to the following holding groups : viz. (i) less than 1 hectare (ii) 1 to 2 hectares (iii) 2 to 4 hectares and (iv) above 4 hectares. In order to utilize the entire data collected under the main survey, an additional group of non-cultivator households was also included in the study. Estimates of total milk-production, average milk-yield per animal, gross annual income and that on employment were obtained for each holding group separately for supplying and non-supplying areas.

The study showed that among cultivators, 63% had agricultural holding upto 1 hectare, 26% between 1 to 2 hectares, 9% between 2 to 4 and rest 2% possessed more than 4 hectares of land. The total daily milk production in milk producer households was highest in holding between 1 to 2 hectares and lowest in those possessing land above 4 hectares. The average family size was observed to be higher in larger holdings. Higher the size of holding lower was the proportion of workers engaged in field work. Larger proportion of working force in different holding groups was engaged in milk production trade as a subsidiary occupation rather than the main. As regards income, an increasing trend in gross income was observed as the size of holding increased. Commercial families of supplying area having holding above 4 hectares and that of non-supplying area with holding 2 to 4 hectares had maximum gross annual income viz. Rs. 7863 in the former and Rs. 8987 in the latter. Income of non-commercial and non-milk-producer families was lower than the commercial families.

(B.C. SAXENA, H.P. SINGH AND S.P. VERMA)

4.16 Optimum Amount of Experimentation in Animal Nutrition

The objective of the project was to evolve suitable statistical methodology for working out optimum amount of experimentation in animal nutrition research. The methodology would help in assessing the present status of the experimentation in animal nutrition and providing guidelines for efficient planning of future experiments. Present investigation had been made on the lines "Principles governing to amount of experimentation" given by F. Yates (1952) in the field of animal nutrition research work done in India during 1945-80. For the purpose, experimental data on animal nutrition, collected under the project 'National Index of Animal Experiments' was utilised. The experiments were divided into three major groups, viz. (i) experiments consisting of treatments on mixed feed utilised for the purpose of growth, production and maintenance (ii) experiments in which nutritive level of a single or mixed feed was expressed in terms of Digestible Crude Protein (D.C.P) and/or Total

Digestible Nutrients (T.D.N.) (iii) experiments conducted for the purpose of pure academic research like fasting metabolism, determining Endogenous Urinary Nitrogen (E.U.N.) and Metabolic Faecal Nitrogen (M.F.N.) requirement studies dealing with maintenance and growth in terms of D.C.P., T.D.N., metabolizable energy, metabolizable protein and rumen studies. For determination of optimum amount of experimentation, analysis of first two major groups had been made with respect to type and amount of experimentation done in past considering five species of livestock viz., cattle, buffaloes, sheep, goats and pigs and availability of their feed in the country. Each of major group (i) and (ii) further divided into four sub-groups according to pattern of experimentation. Validity of the inference drawn from the experiments was made on the basis of statistical decision theory based on the power criterion.

Analysis of the coverage of experimentation on species, breed and category indicate serious lapses of experimentation on important draught breed of cattle, buffaloes and important breeds of sheep, goats and pigs. There was not even a single experiment on pregnant animals of any specie. On the basis of present study it was found that country needs about 2143 experiments to be conducted in future for getting optimum return out of livestock population and its feed resources in the country.

(S.N. BAJPAI, A.K. NIGAM AND A. DEY)

4.17 Labour utilization in maintenance of bovines and animal production in ICD area, Bhopal (M.P.)

The objectives of the study were (i) to estimate the amount of labour utilized in maintaining bovines and animal production and possibility to compare with the extent of labour utilized for agricultural purposes ; (ii) to study the seasonal variation of labour inputs as also variation depending upon the bovine population ; (iii) to explore the possibility of suggesting the interval of recording data on labour utilization without affecting precision of the estimates and (iv) to attempt to work-out norms on labour utilization for various stall operations.

Data collected from the survey on "Estimation of availability and cost of production of milk in I.C.D. area, Bhopal (M.P.)" was utilized.

Analysis of variance technique was being used for testing the differences of the average labour utilized during different fortnights. Detailed analysis of data was carried out.

The report was being drafted.

(K.P.S. NIRMAN, K.C. RAUT AND SHIVTAR SINGH)

4.18 Utilization of labour in commercial poultry farms

The objectives of the project were (i) to study the relationship between productivity and labour input and (ii) to find out the feasibility of getting norms for efficient use of labour.

The data already collected from 120 commercial poultry farms in the project "Estimation of cost of production of poultry and eggs" carried out at two centres viz., (a) Hoshiarpur district (Punjab) and (b) Delhi area were utilized. The weekly information on stock particulars of different categories of birds, egg production, labour put in and family labour available at the farms for the second year of the surveys, was utilized in the present study.

The distribution of labour inputs by farms would be studied in relation to labour available. In order to work out norms on labour inputs, different categories of birds would be converted to 'standard layers' utilising the ratios of feed intake and the entire labour put in by different categories to 'standard man hours' utilising the ratio of wage rates. The average labour required per standard bird obtained from those set of farms where the level of production was higher than the overall average would be considered as norm for efficient utilisation of labour. The relationship between productivity and labour input would be studied. It was observed from Punjab survey data that 103 farms utilized only family labour, 2 farms only paid labour and 14 farms paid as well as family labour. Percentage of man, woman and child labour were 72, 26 and 2 respectively. Out of total number of farms utilising family labour, only man labour worked in about 56 percent farms and both man and woman in 40 percent farms. Further analysis was in progress.

(T.B. JAIN AND D.K. BHATIA)

STATISTICAL GENETICS

4.19 Measurement of genetic improvement due to scientific breeding in cattle and buffaloes

The objectives of the project were (i) Critical statistical analysis of the breeding data ; (ii) To develop statistical methodology for measuring genetic improvement actually brought about in dairy herds and (iii) to formulate breeding programme in cattle and buffaloes. The breeding data on 855 cows which were disposed off (died), transferred or sold during the period 1955 to 1978 were utilized for study on adaptability characteristics. These data pertained to Friesian x Sahiwal crosses and covered 11 different grades ranging

from 1/8 to 7/8 ths from five different farms viz., Jullundur, Dehradun, Meerut, Lucknow and Ambala. In addition information on Sahiwals was also included in order to gauge the performance of cross-breds vis-a-vis pure-bred herd.

Mortality rates adjusted for factors significantly affecting it were obtained by employing the least squares technique. The model was :—

$$y_{ijkl} = m + f_i + p_j + g_k + e_{ijkl}$$

Where Y_{ijkl} takes the value 1 if the kth grade lth animal of the ith farm in the jth period survives and takes the value 0 if the animal dies, m is the overall mean, f_i is the farm effect, p_j the period effect, g_k the grade effect and e_{ijkl} is the random error specific to a particular observation.

The farms and periods were highly significant due to differing conditions of feeding and management. Percentage mortality recorded at Dehradun was the least and highest at Ambala farm. Further, percentage mortality was least (16%) during 1966-70 and it was of the order of 26 to 30 percent in the remaining 3 periods.

Grade effect which perhaps is of greatest interest was also seen to be significant at 5 per cent level. Percentage mortality was higher in higher grades of cows ranging from 30 to 40 per cent. Nineteen per cent of the Sahiwal females which entered the milking herd died as against 39 per cent of half-breds.

In order to quantify the level by which mortality increases or decreases with an unit increase in the level of exotic inheritance, quadratic regression was fitted taking percentage mortality as the dependent variable Y and grade (proportion of exotic inheritance) as the independent variable. However, since the number of observations differed from grade to grade weighted regression was fitted, the weights being the inverse of the number of observations in each grade. The fitted curve was found to be as follows :

$$Y = 20.14 + 1.60 X$$

Traumatic pericarditis took the heaviest toll accounting for about one-fourth of the total mortality in all the different grades. Highly significant variation was observed in mortality rates in different grades. Mortality was lowest among 7/16 ths, 7 percent among half-breds and increased with the increase in the percentage of foreign blood and vice-versa.

About half the cows were culled before completing four lactations. The overall rate of abnormal calving was 8 percent. Rates among different cows

did not differ significantly. Male births were more than female births, male to female ratio varied from .78 to 1.75 for different grades of animals.

(L.K. GARG, PREM NARAIN, J.P. JAIN, LAL CHAND, P.S. RANA AND
INDRA SINGH)

4.2) Optimum progeny testing plans in herds of various sizes

The objectives of the project were (i) to develop the methodology for working out the annual genetic improvement through the adoption of a given scheme of selection and mating system taking into consideration both genetical and statistical considerations; (ii) to computerise the entire process of computation of annual genetic gain and (iii) to obtain the rates of genetic improvement for herds of various sizes under two different schemes of progeny testing as well as under no progeny testing in respect of pure-bred indigenous cattle, pure-bred and graded buffaloes and cross-bred cattle.

Any programme of breeding in which bulls are selected on the basis of their progeny performance is specified by number of sires that are selected in each generation either for further use or for obtaining young sires, the number of young sires to be tested in each cycle and the number of daughters on which test is based. For a given herd size the method of determining an optimum programme of selecting young bulls for a given set of genetic and phenotypic parameters and vital characteristics, therefore, is to vary the number of tested bulls and young bulls under test and the number of daughters recorded per bull and then evaluate for each combination of values of these parameters the expected superiority per year. Rates of genetic improvement alongwith the accuracy of selection under two alternative schemes of progeny testing using the vital characteristics of cross-bred dairy herds had been computed for various herd sizes. For comparison, the rates had also been given for the selection scheme in which young sires were selected solely on the basis of their dam's performance (i.e. no progeny testing). Procedure for estimating the annual genetic gain was the same as suggested by Rendel and Robertson (1950) with slight refinements in the pattern of selection among females and in the manner of computing intensities. For herd sizes between 300 to 600 cows the optimum strategy would be to use 2 tested and 10 young bulls each cycle and saving the best two from among the ten young bulls after their progeny tests become available. This would give an annual genetic improvement ranging from one sixth to one-fourth above that expected without progeny testing. In small sized herds although progeny testing is seen to have slight advantage over no progeny

testing but its use may not be warranted in view of the accompanying high rate of inbreeding. Similar study on rates of genetic gain for herds of indigenous cattle and buffaloes remained in progress during the year.

(J.P. JAIN, L.K. GARG AND R.K. JAIN)

4.21 Estimation of genetic trends in Beetal goats

The objectives of the project were : (i) to estimate the genetic changes per year in various economic characters in Beetal goats by separating accurately the environmental trends from genetic trends; (ii) to work out Sanders connection factors ; and (iii) to estimate genetic parameters like repeatability and heritability. The breeding data of about 1,200 Beetal goats spread over a period of 37 years (1931-67) were analysed for six economic characters. Repeatability and heritability of their characters were estimated. Genetic changes in various economic characters were worked out by three methods viz. (i) intra-sire regression on time of sire progeny deviations from populations (Smith 1962), (ii) intra-sire regressions of sire progeny on time adjusted for the effects of age and culling of dams (Everett *et al* 1967) and (iii) pooled intra-sire regression coefficient of the weighted difference between the herd and the individual sire means on time (Narain & Garg, 1972). Although genetic changes in lactation yield were not found to be significant, yield per day of lactation as well as per day of kidding interval were found to have decreased significantly over 37 years.

(L.K. GARG, P.S. RANA AND LAL CHAND)

4.22 Some aspects of yield survival relationship in dairy cattle.

The objectives of the project were to study some aspects of relationship between the retention of a cow in the herd and its milk production characteristics in the first lactation.

The work pertaining to collection of cross-bred data from the project entitled "Measurement of genetic improvement due to scientific breeding in cattle and buffaloes" was in progress.

(V. K. BHATIA AND PREM NARAIN)

4.23 Design and Analysis of experiments on bovine semen metabolism

The objective of the project was to develop suitable experimental design as well as the methodology for their analysis for studies on metabolic behaviour of sperms in bovines. Data collected for four different experiments viz., (i) Effect of dialysis, (ii) Effect of ethanol, (iii) Effect of ultra-centrifugation and (iv) Effect of heat treatment on the characters-motility of spermatozoa

and eosinophilic property of spermatozoa from the National Dairy Research Institute, Karnal were being analysed. For the analysis of the data, the usual technique of analysis of non-orthogonal data was applied. The project report was prepared and sent to internal referee.

(V. K. BHATIA AND PREM NARAIN).

4.24 Selection indices for economic merits in poultry

The objectives of the project were ;

- (i) to study in economic terms the profit accruing at the Poultry Farm due to adoption of selection index for rate of lay based on Srborne's procedure for six generations.
- (ii) to develop selection indices including restricted selection indices for economic merits involving production and adaptability traits in poultry for eggs and
- (iii) to study the efficiencies of various selection indices developed in terms of expected genetic gains. During the year under report, the literature relevant to this project was being reviewed and analysis of data, thus collected was in progress.

(P.K. MALHOTRA, PREM NARAIN AND INDRA SINGH)

4.25 Growth studies on cross-bred cows and graded buffaloes available at various military farms in the country

The objectives of the project were ;

- (i) to study the growth curves in respect of cross-bred cows and graded buffaloes upto four years of age.
- (ii) growth rate and its relationship with weight and age at first calving and first lactation milk yield.
- (iii) body weight changes in cross-breds in relation to level of exotic inheritance.
- (iv) influence of genetic groups, farms, periods & season on body weights of cross-bred females at different ages.
- (v) phenotypic & genetic correlations among traits of growth and production and
- (vi) estimates of genetic parameters of various stages of growth and their relationship with production traits.

The body weight records at weekly intervals upto one year of age and at monthly intervals from 13 to 48 months pertaining to various grades of cross-bred cows in respect of military farms at Ambala, Jullundur and Pimpri were tabulated and transferred on punched cards for further processing.

(J.C. MALHOTRA, PREM NARAIN, J.P. JAIN AND P.K. MALHOTRA)

SAMPLE SURVEY METHODOLOGY

Sample survey investigations are undertaken by the Institute with a view to evolve suitable sample survey techniques and demonstrate the applicability of the techniques of collection of information to various disciplines of agriculture and animal husbandry. The investigations which were in progress during the year under report, as per the programme laid down, are briefly described in the following sub-sections. Names of principal investigator and his associate (s) are given at the end of each sub-section.

5.1 Sample Surveys for methodological investigations into high yielding varieties programmes

The objectives of the project were (i) to develop a suitable sampling methodology for studying the changes in area, productivity and adoption of agricultural practices under cultivators' conditions for high yielding/improved varieties of important cereals and cash crops and (ii) to study the extent to which the potential of high yielding/improved varieties was realised under field conditions and investigate the limiting factors. The project had been extended upto Sept., 1980. Printing of Annual report of the project for 1976-77 was in progress. Scrutiny of data schedules and yield data for 1978-79 was also in progress for a number of participant States. The usual statistical techniques were applied for analysis of the data. During the year, the data for 1977-78 was analysed. The salient results embodying the findings of (i) yield estimation survey and (ii) area estimation surveys, season-wise and crop-wise, are given below :—

A. KHARIF

1. Rice

The estimated HYV area expressed as a percentage of the total area under the crop was the highest (99 per cent) in Coimbatore ; 84 to 96 per cent in Guntur, Madurai, Amritsar, Patiala and 24-Parganas (Aus) ; 54 to 71 per cent in Chittoor, Karimnagar, Sibsagar (Autumn), Monghyr, Ambala and Varanasi. In the remaining districts it was below 47 per cent. Jaya was the most important variety grown by the cultivators in Monghyr, Ambala, Shimoga, Moradabad, Varanasi, Amritsar, Patiala and Midnapur (Aus) ; Mashori in Guntur,

Chittoor and Karimnagar ; IR-8 in Sibsagar (Autumn), Saran and Gonda ; Ratna in Champaran and Bilaspur; IR-20 in Coimbatore and Madurai ; Pankaj in 24-Parganas and Midnapur (Aus) ; Manohar Sali in Sibsagar (Winter) ; Hamsa in Kolar ; Triveni in Trichur (Autumn) ; Saket-4 in Meerut ; Padma in Bolangir ; Jagannath in Cuttack and RRI in 24-Parganas (Aus). The highest average yield of 35.3 Q/ha was recorded for IR-8 variety in Patiala. Pooled over the different high yielding varieties of rice, the average yield was in the range 26 to 29 Q/ha in Chittoor, Sibsagar, Ambala, Shimoga, Kolar, Coimbatore, Madurai and Amritsar. In the remaining districts the average yield of HYV rice was below 25 Q/ha. Nitrogen was applied close to the recommended level in Guntur, Chittoor, Coimbatore, Madurai, 24-Parganas and Midnapur. In the remaining districts it was generally between 50 to 80 per cent of the recommended level. The rate of application of phosphatic fertilizer was close to the recommended level in Sibsagar (winter), Coimbatore, Meerut, Moradabad, Amritsar, Patiala, 24-Parganas and Midnapur ; 60 to 80 per cent of the recommended level in Guntur, Sibsagar (Autumn), Ambala, Shimoga, Kolar, Trichur (Autumn) and Madurai. In the remaining districts it was 50 per cent or below 50 per cent of the recommended level. Potash was generally applied close to the recommended level in Karimnagar, Sibsagar, Saran, Monghyr, Shimoga, Kolar, Trichur, Coimbatore, Madurai, Varanasi, Gonda, 24-Parganas and Midnapur. In the remaining districts it was much below the recommended level.

2. Maize

The estimated HYV area expressed as a percentage of the total area under the crop was 99 per cent in Champaran, 80 per cent in Monghyr, 60 per cent in Meerut, 55 per cent in Saran and 32 per cent or below in the remaining districts. The important variety grown was Ganga Safed-2 in Saran, Champaran, Ambala, Jullundur and Chittorgarh, Ganga Safed in Monghyr and T-41 in Gonda and Meerut. Pooled over the different hybrid maize varieties the highest average yield of 21.6 q/ha was recorded in Chittorgarh. This was closely followed by a yield rate of 20 q/ha recorded in the districts of Ambala and Jullundur.

Nitrogenous fertilizers were applied at rates ranging between 34 to 62 per cent of the recommended level in all the districts. Application of phosphatic and potassic fertilizers was also below the recommended level in all the districts.

3. Jowar :

The estimated HYV area expressed as a percentage of the total area under the crop was 96 per cent in Shimoga, 74 per cent in Dharwar, 47 per cent in

Mandsaur and 33 per cent in Akola. Vidisha-60 was the popular variety grown by the cultivators in Mandsaur. While CSH-1 was popular in the other districts. The highest average yield of 27.80 q/ha. was recorded for CSH-5 variety in Shimoga. Application of chemical fertilizer was generally below 70 per cent of the recommended level.

4. Bajra

The estimated HYV area expressed as a percentage of the total area under the crop was 98 per cent in Mehsana, nearly 88 per cent in Kaira and Sabarkantha, 61 per cent in Hissar and Madurai, around 42 per cent in Morena and Jaipur and 32 per cent in South Arcot. The important variety grown was CJ-104 in Kaira, HB-3 in Sabarkantha, HB-5 in Mehsana, BJ-104 in Hissar and Jaipur, Vijaya in Morena, BJ-104 in Aurangabad and KM-2 in Madurai and South Arcot. The highest average yield of 19.8 q/ha. was recorded for KM-1 in South Arcot. In Kaira, Sabarkantha, Mehsana and Hissar application of K fertilizer to hybrid bajra and in South Arcot application of P and K fertilizers was not recommended. Nitrogenous fertilizers were generally applied in the range of 50 to 70 per cent of the recommended level in all the districts.

5. Groundnut :

The estimated HYV area expressed as a percentage of the total area under the crop was around 90 to 100 per cent in Chittoor, Karimnagar, Kolar, Aurangabad, Patiala and South Arcot. In the remaining districts this percentage ranged between 48 to 75. The main variety grown was TMV-2 in Guntur, Chittoor, Karimnagar, Dharwar and South Arcot ; Spanish in Kolar ; SB-11 in Aurangabad ; Pb-1 in Jullundur and Patiala and T-28 in Moradabad. Pooled over the different HYV of groundnut the highest average yield of 11.6 q/ha. was recorded in Jullundur. Nitrogenous fertilizer was applied at around 50 to 70 per cent of the recommended level in Guntur, Chittoor, Dharwar, Kolar. In Jullundur and Patiala the rate of application of N was double the recommended level. Application of P and K fertilizer was below the recommended level in all the districts.

6. Cotton :

The estimated HYV area expressed as a percentage of the total area under the crop was 100 per cent in Coimbatore, 97 per cent in Jalgaon, 92 per cent in Sabarkantha, around 60 to 80 per cent in Kaira, Hissar, Amritsar and Chittorgarh and 37 per cent in Mehsana. The important variety grown was H-4 in Kaira, Sabarkantha, Mehsana and Jalgaon ; 320-F in Hissar J-34 in Amritsar ; C Indore-1 in Chittorgarh and Varalaxmi in Coimbatore. The highest average

yield of 8.9 q/ha. was recorded for Varalaxmi variety in Coimbatore. The rates of application of chemical fertilizer were as per the recommended level in Coimbatore. Nitrogenous fertilizer was applied around 50 to 80 per cent of the recommended level in the remaining districts. Application of P and K fertilizers in the rest of the districts was lower than that recommended.

B. RABI

1. Wheat :

The estimated HYV area expressed as a percentage of the total area under the crop was 90 to 100 per cent in Sibsagar, Champaran, Kaira, Sabarkantha, Morena, Aurangabad, Jalgaon, Amritsar, Jullundur, Patiala, Meerut, Moradabad, Varanasi, 24-Parganas and Midnapur ; 60 to 90 percent in the rest of the districts except for Akola (54 per cent), Jaipur (48 per cent) and Dharwar (20 per cent). Sonalika and Kalyan Sona were the most popularly grown HYV of wheat in almost all the districts. Pooled over the different HYV of wheat the highest average yield of 34.9 q/ha. was recorded in Morena district. In 50 per cent of the districts the yield rates of HYV was 24 q/ha. or more. The rates of application of N generally ranged between 60 to 90 percent of the recommended level in a majority of the districts. Rates of application of P and K were lower than those recommended in the districts.

2. Rice :

The estimated HYV area expressed as a percentage of the total area under rice was 88 to 100 per cent in Guntur, Shimoga, Kolar, Bolangir, Coimbatore, Madurai, 24-Parganas and Midnapur ; 57 to 77 per cent in the remaining districts except for Trichur where this percentage was 32. The important varieties grown were Jaya, IR-20, Triveni, White Hamsa and RP-4-14. Pooled over the different HYV of rice the highest average yield of 33.8 q/ha. was recorded in Shimoga district. Nitrogen was applied close to the recommended level in Guntur, Trichur, Bolangir, Coimbatore, Madurai and Midnapur. In the remaining districts N was applied in the range of 70 to 80 per cent of the recommended level. The rate of application of phosphatic fertilizer generally varied in the range of 40 to 80 per cent of the recommended level in the different districts. The proportion of fields receiving potash was of a low order.

3. Maize :

The survey was conducted in Kolar (Karnataka) district only, 100 per cent of the area under maize was covered by HYV of maize. Deccan Hybrid was the most extensively grown hybrid variety in the district. The average yield for variety worked out to 19.7 q/ha. The rate of application of chemical fertilizer was around 50 per cent of the recommended level.

4. **Jowar :**

The survey was conducted in Shimoga (Karnataka) district only. 100 percent of the area under the crop was covered by HYV of jowar. CSH-1 was the popular variety grown by the cultivators in the district and gave an average yield of 27.2 q/ha. The rates of application of chemical fertilizer were higher than those recommended in the district.

5. **Bajra :**

The survey was conducted in Madurai and South Arcot (Tamil Nadu) districts only. Cent percent of the area under the crop was covered by HYV of bajra in South Arcot while in Madurai this percentage was 65. The popular variety grown was KM-2 in both the districts. The highest average yield of 18.6 q/ha. was recorded for KM-2 variety in South Arcot. Application of P and K fertilizer to hybrid bajra was not recommended in South Arcot. Chemical fertilizer was applied around 80 percent of the recommended level in Madurai.

6. **Groundnut :**

The survey was conducted in South Arcot (Tamil Nadu) district only. 98 percent of the area under groundnut was covered with HYV of groundnut. TMV-2 was the most popular variety grown by the cultivators. The highest average yield of 20.3 q/ha. was recorded for TMV-7. For this crop the fertilizer recommendation was in respect of potash only which was applied at nearly 19 percent of the recommended level.

7. **Cotton :**

The survey was conducted in Dharwar (Karnataka) and Coimbatore (Tamil Nadu) districts only. 100 percent of the area under cotton in both the districts was covered by HYV of cotton. The popularly grown HYV of cotton was Jayadhar in Dharwar and Varalaxmi in Coimbatore. The highest average yield of 6.7 q/ha. was recorded for Varalaxmi variety in Coimbatore. Application of chemical fertilizers was almost as per the recommended level in Coimbatore and at around 25 percent of the recommended level in Dharwar.

(S.K. RAHEJA, A.K. BANERJEE, P.C. MEHROTRA, V.S. RUSTOGI AND S.S. GUPTA)

5.2 **Monograph on yield rates, area and extent of adoption of improved practices for high yielding varieties of wheat in India**

The objective of the project was to bring out comparative information on yield rates, area and adoption of improved practices for high yielding varieties of wheat from the data collected under "Sample surveys for assessment of

high yielding varieties programme" during the years from 1970-71 to 1973-74. The data collected under the scheme "Sample surveys for assessment of high yielding varieties programme" for yield estimation surveys as also for agro-economic enquiry for 1970-71 to 1973-74 in 15 states of the country, were utilized. The draft report has been prepared and is under finalisation.

(S.K. RAHEJA, A.K. BANERJEE, P.C. MEHROTRA AND V.S. RUSTOGI)

5.3 **A study on cost and return from inter-crops in apple cultivation in U.P.**

The objectives of the project were (i) to study the cost and return from inter-cropping in apple cultivation ; (ii) to study the impact of inter-crops on cost of cultivation of apple. During the period under report the data on inter-crops was collected from the study of cost of cultivation of apple and its marketing practices in Almora, Tehri, Nainital and Uttar Kashi district of U.P. earlier. The data consist of observations regarding inputs like seed, F.Y.M., fertilizers, insecticides and pesticides utilized, human and bullock labour for different operations on different crops in the orchards. The number of crops grown and the yield from them for the year 1972-73 and 1973-74 were taken into account. In all, 217 orchards were observed for the yield of apple. The present study pertains to the inter-crops in the orchards.

The design adopted for the collection of data was stratified two-stage simple random sampling, with clusters of three villages selected as primary unit of sampling and the orchards as the second-stage units. The analysis of data was in progress using the appropriate estimation procedures.

The important findings worked out provisionally were that on an average more than half of the orchardists had grown inter-crops in addition to apple cultivation. In Almora and Tehri districts about one-third of the orchardists had grown potato and maize whereas in case of Tehri district one-third orchardists had also taken bean crops. In Nainital district, half of the orchardists had grown wheat and potato and one-third orchardists had also taken bean crops. But in the district Uttarkashi, about half of the orchardists had grown wheat and one third beans also.

(JAGMOHAN SINGH AND S.D. BOKIL)

5.4 **Pilot sample survey for estimating yield of cotton.**

The objectives of the project were (i) to develop a suitable sampling methodology for estimating yield of cotton and (ii) to suggest a suitable procedure for building up advance estimate of the yield of cotton on the basis of

data of first few pickings. The data collected for the second-year (1977-78) of the survey in Hissar (Haryana) and for the first year (1977-78) of the survey in Jalgaon (Maharashtra) analysed and those for the third year (1978-79) of the survey in Hissar and for second year (1978-79) for Jalgaon were scrutinized and tabulated. Techniques applied for analysis were appropriate to the sampling design adopted. The annual reports for the year (1977-78) in respect of the above mentioned two districts were under preparation.

(B.B.P.S. GOEL, S.K. RAHEJA, P.C. MEHROTRA AND V.S. RUSTOGI)

5.5 Pilot sample survey to evolve sampling methodology for the estimation of losses in marketing and price spread at various stages and cost of cultivation of important vegetable crops at Delhi and Ahmedabad

The objectives of the project were to evolve a sampling methodology (i) to estimate the losses taking place in marketing of vegetables, (ii) price spread at various stages of marketing of vegetables and (iii) to estimate the cost of cultivation of important vegetable crops. The report of the survey in Delhi regarding the aspect of losses in marketing and price spread at various stages had been finalised. The field work on the cost of cultivation of vegetables in Delhi was in progress and data was received upto Rabi season of the year 1979-80 which was under scrutiny and compilation. The field work of the survey at Ahmedabad had been completed and the analysis of data was under progress. The technique for statistical analysis was in correspondence with sampling design used. The data was under the process of analysis.

(A.K. SRIVASTAVA AND S.K. RAHEJA)

5.6 Pilot sample survey to study the impact of new technology on crop production, its disposal and employment in agriculture in Delhi State

The objectives of the project were to develop suitable sampling methodology for studying the impact of new technology on (i) area, yield and production of crops (ii) storage and disposal of crops including sale and (iii) labour employment in the holding and employment of the members of the family of the cultivator. During the year under report the data of crop cutting experiments in 36 fields each on high yielding and local varieties of wheat during rabi 1979-80 and that of agronomic and agro-economic enquiry from 360 cultivators during kharif and rabi 1979-80 were collected and scrutinized. The appropriate statistical techniques for analysis of the data were applied. The data for 1979-80 were under analysis.

Report for the year 1977-78 was prepared and was under scrutiny in the Division.

(P.C. MEHROTRA, S.K. RAHEJA, V.S. RUSTOGI AND K.K. TYAGI)

5.7 **Monograph for the estimation of extent of cultivation and production of fresh fruits**

The objective of the project was to prepare a monograph on sampling methodology for estimation of extent of cultivation and production of fresh fruits on the basis of the various sample surveys carried out by the Institute during the last two decades.

During the year, some further investigations were carried out in order to suggest the guidelines for conducting such surveys in future. The report was in the process of finalisation.

(A.K. SRIVASTAVA)

5.8 **Pilot sample survey for estimation of number of pigs slaughtered and study of attendant swine practices**

The objectives of the project were (i) to evolve a suitable sampling technique for estimating the number of pigs slaughtered, (ii) to study the attendant swine husbandry practices (iii) to study the economic conditions of farmers rearing pigs and (iv) to obtain intercensal estimates of pig numbers. The project was undertaken in the districts of Allahabad and Aligarh of Uttar Pradesh. The techniques applied for analysis of the data were appropriate to the design of the survey adopted. The design adopted was stratified multi-stage random sampling. The data collected was analysed. The salient results achieved are as follows :

In the districts of Aligarh and Allahabad the number of pigs was estimated at 19.1 and 75.8 thousands with standard errors of 11.0 and 13.0 percent respectively.

The estimate of the number of pigs slaughtered during the year was 8.9 and 33.9 thousands with a standard error of 14.0 and 11.9 percent in the districts of Aligarh and Allahabad respectively. The average price of pork per kg. was Rs. 5.10 and Rs. 4.51 in the districts of Aligarh and Allahabad respectively.

The highest percentage number of farrowing took place during the winter (November to March) in both the districts and the percentages were 66 and 56

in the districts Aligarh and Allahabad respectively. The average number of piglets born per sow was 4.9 and 4.0 in the districts of Aligarh and Allahabad respectively.

In Aligarh district the average body weight of pigs was 44.5 kg. in the age group of 25 to 36 months whereas in the Allahabad district the corresponding figure was 40.9 kg.

The average family size of pig rearing households was 5 and 6 in the district of Aligarh and Allahabad respectively. Mostly the pigs were kept for a small additional income without much investment. In Aligarh district pig rearing was mostly with the landless farmers but in Allahabad district the same was also popular with the farmers having land. The average family income of pig rearing farmers in Aligarh district was about Rs. 205/- p.m. whereas in Allahabad district it was Rs. 185/- p.m., while average income through pig rearing was Rs. 47/- and Rs. 17/- p.m. in the two districts respectively.

(B.B.P.S. GOEL, J.S. MAINI AND K.B. SINGH)

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

The objectives of the project were (i) to develop the statistical methodology for obtaining reliable estimates of cost of production of orange and to standardize procedures, programme, etc. and (ii) to collect reliable data for studying existing marketing practices of orange in the region. Data for 120 orchards, half bearing and half non-bearing, were being collected under the survey. During the year, some non-bearing orchards became bearing. Additional non-bearing orchards were therefore selected. Data collected for the orchards cover fixed and durable assets as well as flow inputs, viz. labour and materials. Cost on account of various components of cost as well as aggregate costs according to various concepts were being estimated. Data for one season had been tabulated and preliminary report was being prepared.

(S.D. BOKIL AND B.L. KAUL)

5.10 Pilot sample survey on cost of production of Banana/Mango and its marketing practices in Surat and Bulsar districts of Gujarat State

The objectives of the project were (i) to develop a suitable statistical methodology for obtaining reliable estimates of cost of cultivation of Banana/

Mango and to standardize procedure programme etc. for planning future surveys for the collection of such data and (ii) to collect reliable data for studying existing marketing practices of banana/mango in the region of study. Data on marketing and cost aspects of the survey were being collected by the field staff posted in the region of study for the year 1980. The data, thus received were being scrutinized and the clarifications received from the state were being incorporated. Regarding cost aspect of the survey, the clarifications to discrepancies pointed out are yet awaited for the first round data. Data on marketing for the year 1979 (1st round) were processed. Scrutiny of data for the 2nd round in respect of labour input was also started and was in progress. There are two aspects of the surveys (i) marketing of banana/mango in the selected markets of Gujarat state and (ii) determining the cost of production of banana/mango in Surat and Bulsar districts of Gujarat state. Cost of production per unit of fruit would be worked out by considering the cost of raising a young orchard to its bearing stage and that of maintaining a bearing orchard for the period of reference. For the above purpose two sets of orchards had been selected in each selected cluster of villages. The major constituents of the cost would be the material and labour inputs and depreciation on assets and equipment.

(MOHINDER SINGH BATRA AND S.D. BOKIL)

5.11 A study of suitable sampling methodology for estimating the yield of vegetable crops on the basis of partial harvests data

The main objective of the project was to develop a suitable sampling methodology for estimating the yields of different vegetable crops based on the data of partial harvests. In the present study data used was taken from the surveys on vegetables conducted during 1971-74 in Bangalore district of Karnataka State by the Indian Agricultural Statistics Research Institute with a view to evolve a suitable sampling methodology for estimation of extent of cultivation, average yield and total production of important vegetable crops. The survey was carried out for three years each of the one year duration. During the period under report, tables on variety-wise study of vegetable crops were prepared. The technique of double sampling was applied on the interval-wise tabulated data and the number of fields required to be sampled for usual procedure, large and small samples (in case of double sampling) were calculated. The relative efficiencies were compared and the gain due to reduction of relative costs was calculated.

The results indicate that like pickings, here also in studying interval-wise tabulated data, double sampling efficiently used gives appreciable gain in terms of reduction of relative cost.

The report of the project had been drafted and was under finalisation.

(SATYA PAL AND A.K. SRIVASTAVA)

5.12 **Pilot sample survey for estimation of area of grazing land and its utilisation in Puri district**

The objectives of the scheme were (i) to estimate the area of grazing land; (ii) to estimate the average yield per unit of grass area; (iii) to determine the botanical and chemical composition of grasses; and (iv) to obtain detailed information on grazing practices. The estimates of area, production, yield etc. were built up. The formulae as relevant to the sample survey technique were adopted for analysis of the data. The results demonstrate the feasibility of estimation of parameters through sample survey technique.

(ANAND PRAKASH, J.S. MAINI AND B.C. SAXENA)

5.13 **Study to find out the causes of land lying idle in the operational holdings during agricultural year 1977-78**

The objectives of the project were to ascertain reasons for non-utilization of cultivable but not cultivated lands within operational holdings for evolving suitable measures for their proper utilization and also to obtain estimate of waste-land for comparing it with existing data.

The survey was conducted in the six centres of Anantapur, Belgaum, Jabalpur, Ratnagiri, Chittorgarh and Jhansi. The results of the Interim report are as follows :

(i) *Estimate of proportion of cultivators having waste-land :*

It was observed that in the three districts of Ratnagiri, Chittorgarh and Jhansi the proportion of cultivators having waste-land was very high being as much as 72 per cent. In Anantapur and Jabalpur the proportion was 30 and 37 per cent respectively, while in Belgaum this was only 19 per cent. In the context of spread of land lying idle in a district, Ratnagiri topped the list with nearly 3 lakh cultivators having waste-land followed by Chittorgarh where this number was nearly 2 lakhs. In Belgaum too, although the proportion of cultivators having waste land was lowest, the number of cultivators having such land was substantial being around 80,000. The smallest number of such cultivators was in Jabalpur even though their proportion was quite substantial.

(ii) *Proportion of area under waste-land to total cultivable area :*

The highest proportion of area under waste land was in Ratnagiri district being of the order of 62 per cent. In Chittorgarh and Anantapur it was of the order of 48 and 42 per cent respectively. In the remaining 3 districts it was around 25 per cent. These estimates were comparable to those reported in land utilisation statistics except in Anantapur and Jhansi where the proportion of area under waste land as estimated from the survey was much higher than that reported in the land use statistics thereby showing that larger area had become idle for various reasons.

(iii) *The causes of land lying idle :*

Non-availability or lack of irrigation facilities was the main or an important cause in the various districts except in Jabalpur and Anantapur. Unlevelled, uneven or the sloping land was the second most important reason in these districts. The third major cause was the non-availability of resources or in adequate finances with the cultivator required for bringing the land under cultivation. The other reasons mentioned were low fertility of soil, rocky land, non-availability of crucial inputs including seeds and fertilizers, heavy weed infestation etc.

(iv) *Remedial measure-wise distribution of farmers in different districts :*

It was seen that provision of irrigation facilities would be beneficial to a large proportion of farmers having waste land ranging between 25 to 70 per cent in different districts. Levelling of land was considered important by 25 to 40 per cent of the farmers and the need for additional resource availability was felt by 25 to 50 per cent of the farmers. Other remedial measures were also suggested by farmers in different districts.

The remedial measures discussed above are not merely indicative of the general problems of the area but are important from the point of view that if not provided in reasonable time the land quality might be further impaired due to lack of care and attention. Also further area may similarly be affected pushing up the area under waste land thereby aggravating the situation as has been observed in some districts. Suitable action programme for undertaking the remedial measures appropriate for the area should therefore be prepared and implemented in a time bound programme to ensure that the area of wasteland is put to productive use which will help improve the food situation in the country as well as the economic status of the farmers having such land.

(A.K. BANERJEE AND S. K. RAHEJA).

5.14 **Pilot sample survey for estimating the catch of inland fish in the regions of West Bengal and Orissa**

The objectives of the project were to develop suitable sampling methodology for estimation of (i) resources and (ii) catch of Inland fish in West Bengal. Data on enumeration of inland fisheries resources in 24-Parganas districts of West Bengal State had been collected. The data were processed, coded and checked and tabulation and analysis were in progress.

(O.P. KATHURIA, A.K. GHOSH (CMFRi, BARRACKPORE), S.K. RAHEJA AND PRANESH KUMAR).

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

The objectives of the project were (i) to study the relative merits of the data obtained by actual weighment and those through enquiry for estimation of milk production and (ii) to obtain the estimates of annual milk production at district level with a reasonable precision. The data collected under the above said project are being utilised for investigating the feasibility of replacing the method of recording data on milk yield by actual weighment by that of enquiry. The survey was conducted in the districts of Rohtak (Haryana) and Barabanki (U.P.) and it was spread over the entire year covering all the three seasons viz. rainy, winter and summer. The design adopted in the survey was one of the stratified multi-stage random sampling. In each district the tehsils were adopted as strata. The p.s.u. was a group of 2 villages each and a household having an animal in milk was a sampling unit at 2nd-stage. The ultimate unit of sampling was an animal in milk. From the households observed for recording data, information on feed given to the animals, sale and death of animals, veterinary aid availed of and the utilisation of milk was also collected. Appropriate estimation procedures were being used for estimation of milk yield by actual weighment and by enquiry. The analysis of data was in progress.

(K.B. SINGH, B.B.P.S. GOEL AND J.P. GOYAL).

5.16 **Pilot sample survey for estimation of production of hides and skins**

The objectives of the project were (i) to evolve a suitable sampling technique for estimation of production of hides and skins and (ii) to study practices like flaying of slaughtered and fallen animals, curing of hides and skins and their disposal.

The field work under the above project had been started in July 1980. The analysis of data for rainy season was in progress.

(J.S. MAINI, J.P. GOYAL AND D.P. MALHOTRA).

6. ECONOMETRIC ANALYSIS

The progress of work in respect of each of the various research projects included in the programme is described below in brief and the names of the concerned project leader and his associate (s) are given in brackets at the end of the description of each project.

6.1 Identification of socio-economic and other constraints operating in the spread of modern technology on Rice Farms in the Operational Research Project (ORP) Areas located in Puri district of Orissa

The objectives of the project were (i) to examine the untapped yield potential of rice crop at farmers' fields and (ii) to identify the major biological, socio-economic and other important constraints responsible for existing yield gap at micro level.

To achieve the above objectives, a socio-economic survey of the selected farm households was carried out. The information on land holding, land-utilisation, tenurial structure, cropping pattern, yield levels, technical know-how, agronomic practices followed on the farms and reasons for partial/non-adoption of recommended practices, credit facility availed, availability of crucial inputs for crop production, storage, marketing and disposal of the products and other socio-economic characteristics of the sampled farms pertaining to kharif season of 1978 were collected. The survey data and data pertaining to the demonstrations in the ORP Area and other research data collected from Puri district were subjected to the following type of analysis :—

- (i) Tabular analysis : Village-wise and holding size group-wise ;
- (ii) Pattern of adoption of different packages of improved practices : Village-wise and holding size group-wise ;
- (iii) Estimation of yield gap ;
- (iv) Identification of constraints contributing to low productivity utilizing tests of significance as applied to differences in yield levels due to production/characteristics.

- (v) Evaluation of constraints for the acceptance of modern technology by utilising discriminant function technique.
- (vi) Testing of association between various input-use and socio-economic characteristics utilising χ^2 test of significance.

The study revealed a significant yield gap of 1.73 tonnes per hectare between the potential farm yield as demonstrated on farmers' fields in the study on area and average farm yield of the area estimated on the survey data. The behaviour of the yield gap among different categories of farmers indicated that the yield gap decreased as the farmers adopted more and more improved practices. Adoption pattern of improved practices among different holding size groups indicated that the adoption index was highly associated with the holding size groups. As regards intensity of adoption, it was however, revealed that the intensity of adoption was higher in packages of less practices comparatively in all the holding size groups. The analysis further depicted that low level of input use viz., HYV, fertilizers application and plant protection measures (biological), poor economic condition and indebtedness (social) and type of land (physical) were the main factors contributing to this yield gap.

6.2 Identification of the socio-economic and other constraints operating in the spread of modern technology on rice farms in operational research project areas located in Nalgonda district of A.P. and Raipur district of M.P.

The objectives of the project were to measure the gap between the yields of rice crop obtained on farmers fields with the modern production techniques or input levels giving maximum yields and the average yields of farmers and (ii) to identify the major biological socio-economic and other constraints responsible for the existing yield gap.

The data collected was subjected to the following types of analysis.

- (i) Tabular analysis ;
- (ii) Estimation of yield gap ;
- (iii) Identification of constraints contributing to low productivity by utilising tests of significance.
- (iv) Evaluation of constraints for acceptance of modern technology by using discriminant function technique.

During the year, the report pertaining to kharif, 1978-79 for Nalgonda district was prepared and cyclostyled. The data pertaining to Raipur district for the same period was analysed.

The study in the operational area of the ORP on rice cultivation in Nalgonda district of A.P. fields revealed a gap of 1504 kg. per hectare between the potential farm yield as demonstrated on farmers' fields in the study area and average farm yield of the area. The main factors contributing to this yield gap were fertilizer application (N,P and K), Zn SO₄ application, plant protection chemicals and literacy. To probe further into the discriminating characteristics of the farmers applying low and high levels of fertilisers and taking plant protection measures and not taking any measure discriminant function technique was utilised. The results indicate that the average yield and literacy are the major characteristics discriminating the two groups of farmers applying low and high levels of fertilizers. The other discriminating characteristics are area under HYV, ZnSO₄ application, plant protection measures taken and seed rate. In the case of farmers taking plant protection measures and not taking any measure also, average yield and literacy are the two major discriminating characteristics. The other characteristics in this case are area under HYVs and N, K application.

(B.L. KUAL AND SHANTI SARUP)

6.3 Determination of constraints operating in transfer of technology for economic development of ORP villages of tribal area in Nanded district of Maharashtra

The objectives of the project were (i) to identify the constraints of economic development of the tribal area and (ii) to determine the constraints operating in transfer of modern technology among tribal people. The project work was initiated during August, 1980. The preliminary work was undertaken, area visited and an indepth study relevant to the objectives of the study was undertaken. Data on selected villages was also collected and a few households were interviewed to test the schedule comprising of 12 proformae. Data from the household proposed to be collected is both of quantitative and qualitative nature, viz ;

- (i) Inventory of assets.
- (ii) status of the family, viz., education, employment, income, consumption, etc.
- (iii) Agriculture, cropping, inputs/outputs, disposal of produce.
- (iv) Constraints of adoption of technology.
- (v) General constraints.
- (vi) Opinions.

Collection of data was in progress.

(BHAGAT SINGH)

6.4 Study of assessment of yield constraints in adoption of new farm technology in operational research project area, Chittorgarh (Rajasthan).

The objectives of the project are (i) to determine yield potential of modern wheat variety when grown with improved technology and (ii) to identify the factors responsible for yield gap.

During the year under report the data pertaining to follow up survey was analysed and the report of the project had also been completed. F-test was applied to study the significant difference between the holding size with respect to different characters. In order to study the yield gap the selected cultivators in each holding size were divided into two groups. Reasons for not applying the recommended doses of inputs have been highlighted in the report.

(H.B. CHOUDHRY AND R.K. PANDEY)

6.5 Econometric study of acreage response function for pulses in India

The objectives of the project are (i) to study the causes of changes in acreage, production and yield of pulses in India ; (ii) to study the price effect on acreage and production and (iii) to investigate the overall causes of decline in pulses. The secondary data on pulses and other competitive crops for rabi and kharif seasons was collected for the study. Time-series data on prices and output was studied to examine the price response on the lines of Nerlovian Model. The data had been analysed and the report was being finalised.

(U.N. DIXIT)

6.6. Study of price behaviour of agricultural commodities (Oilseeds)

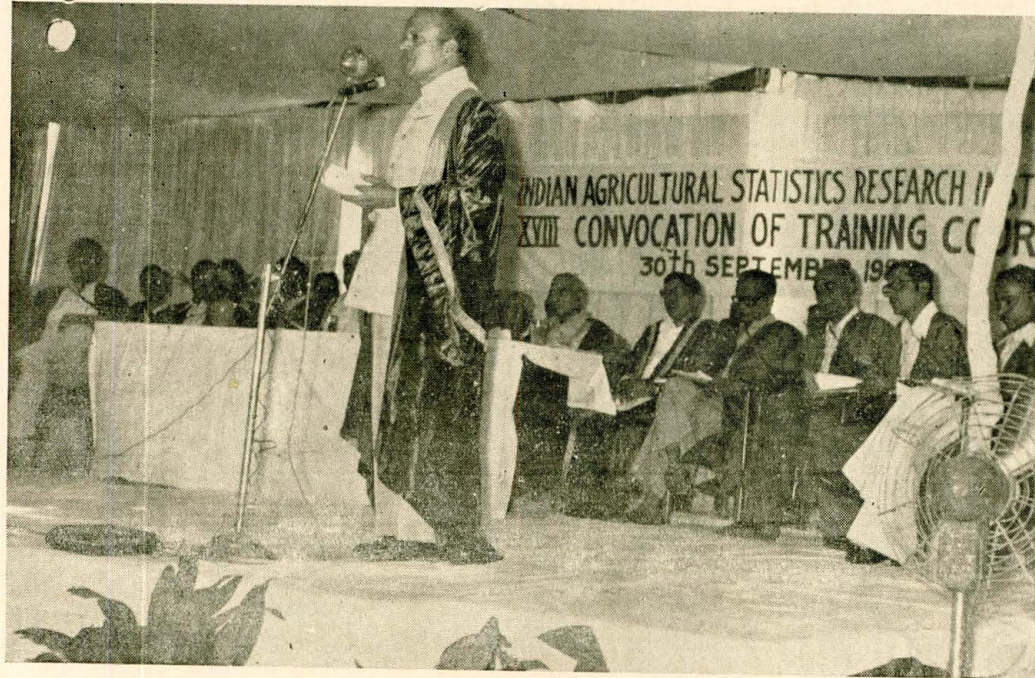
The objectives of the project are (i) to examine the price variations for oilseed and (ii) to analyse the causes of variation. Data on whole-sale prices, farm harvest prices, population, area, production, yield and market arrivals of groundnut in Maharashtra and Gujarat States and for rapeseed and mustard in Haryana and West Bengal for 13 years, with effect from 1964-65 to 1976-77 have been collected and analysis is in progress.

(GEETA BISARIA, S.S. CHOUDHARY AND O.P. DATTA)

6.7 Evaluation methodology of research and training activities of the IASRI

The objective of the project was to evaluate the methodology of research and training activities of the IASRI. Qualitative data for the years 1971-74 on the training programme of IASRI already collected was analysed. Simple tabular analysis was carried out since data was mostly qualitative. The report of the study had been drafted and was under revision.

(BHAGAT SINGH, R.K. PANDEY AND S.K. RAHEJA)



Dr. M. S. Swaminathan, Member, Planning Commission, delivering the Convocation Address.



National Anthem after the Convocation.

7. TRAINING AND BASIC RESEARCH

7.1 Training Activities

The Institute conducts three training courses viz ; Senior Certificate Course, Professional Statisticians Certificate Course and Diploma Course, besides two degree courses viz ; M. Sc. and Ph. D. in Agricultural Statistics. Senior Certificate Course is intended for those persons who are engaged in research in agriculture, animal husbandry and for whom knowledge of statistics is essential for their research work. In this course generally persons deputed by various State Departments of Agriculture and Animal Husbandry and Agricultural Universities are admitted. Professional Statisticians Certificate Course is intended for those who have got Post-Graduate degree in Statistics or Mathematics and deputed by State Departments and Research Institutes having experience in handling statistical data. Diploma course is offered for those who successfully complete P.S.C. Course or M. Sc. in Agri. Statistics : M. Sc. and Ph. D. programmes in Agricultural Statistics are being conducted in collaboration with the Indian Agricultural Research Institute which awards these degrees. This year, 17 students of the Institute completed successfully the degree courses of which 12 were from M. Sc. Programme and 5 were from Ph. D. Programme.

The XVIII convocation of the Training Courses of IASRI, for the award of Diploma/Certificates to students completing successfully various courses of training in Agriculture and Animal Husbandry Statistics, was held on the morning of September 30, 1980. Dr. M.S. Swaminathan, Member, Planning Commission, was the Chief Guest on this occasion. The convocation programme was preceded by a two days programme including an elocution contest, held on 27th Sept., at 10.00 A.M. in which all students belonging to various courses participated. The topic for the contest was 'The role of Agricultural Statistics in planning for Rural Development'. The session was presided over by Dr. A. S. Sirohi, Head, Division of Agri. Econ. of I.A.R.I., New Delhi. Three prizes of Rs. 50/-, Rs. 30/- and Rs. 20/- each in the form of books were awarded to the speakers who were adjudged first, second and third respectively in order of performance in Elocution Competition. Dr. Y.P. Singh, Prof. Div. of Agri. Extension, IARI, Dr. Padam Singh, Dy. Advisor, Planning Commission and Dr. Prem Narain, Jt. Director (Trg.), I.A.S.R.I., New Delhi acted as judges on the occasion.

At this, Convocation in all, a total number of 26 candidates were awarded certificates viz ; 5 for Junior Certificate Course (J.C.C.), 9 for Senior Certificate Course (S.C.C.), 9 for Professional Statisticians Certificate Course (P.S.C.C.) and 3 for Diploma Course. Gold medals were presented to those who secured highest aggregate of marks in each of the certificate course, viz; J.C.C., S.C.C. and P.S.C.C. and also to the Candidate whose Diploma thesis was adjudged as the best from among those considered for the award of Diploma during the year.

In addition to the gold medal, the candidate who stood first in the P.S.C. Course was awarded the V.V.R. Murthy Memorial prize in the form of books of Rs. 100/-. Four cash prizes of Rs. 50/- each in the form of books were also awarded to candidates of P.S.C.C. who secured highest marks and not less than 75 percent in each of the papers I, II, III and the practical papers.

During the year under report, eight students were admitted to M. Sc. Course and twelve students were admitted to Ph. D. Course.

A list of dissertations approved during the year under report for award of Ph. D. and M. Sc. degrees and Diploma in Agricultural Statistics is appended (Appendix III).

The Division of Training and Research conducts and coordinates the above training programmes. Besides class room lectures and practicals, the students are given field training by taking them to some locations for collection of data which would be analysed and reported by them in the form of a project report.

Experts in the field of statistics are also invited from time to time for giving special lectures to the students. M. Sc., Ph. D. and Diploma students are excepted to give seminar talks on some aspects of statistics both theoretical and applied.

A number of important seminars/lectures were delivered by eminent Statisticians during the year under report.

<i>Name of the Speaker</i>	<i>Seminar Title</i>
1. Dr. J.S. Rustagi, Professor, Ohio State University, U.S.A.	(i) Graphical representation of multivariate data. (ii) Structure of American lotteries and statistical implications. (iii) Compartmental models in pharmacokinetic and bio-availability.

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| 2. | Dr. M.N. Das, Director
(Statistics), C.W.C.,
Delhi. | A method of systematic sampling yielding unbiased estimator of variance and BIB Designs with any block size given a minimum number of blocks. |
| 3. | Prof. D.S. Tracy,
Professor of Statistics,

University of Windsor,
Ontario, Canada. | (i) Expectation and estimation in sampling from finite populations.

(ii) Some modifications of ratio and product methods of estimation. |
| 4. | Prof. N.R. Brockington.
University of Reading, (U.K.). | Modelling Animal Production Systems. |
| 5. | Dr. M.N. Murthy,
Institute for Asia & Pacific,
Tokyo (Japan). | Symbolic representation of Survey Design. |
| 6. | Dr. F.C. Leone, American,
Statistical Association. | Many Words of Statisticians. |
| 7. | Dr. B.K. Sinha, I.S.I.,
Calcutta. | On a matrix characterisation problem with application to optimal (block) design. |
| 8. | Dr. G.M. Saha, I.S.I.,
Calcutta. | On some combinatorial aspects of designs useful in groups testing experiments. |
| 9. | Prof. M.C. Agarwal, Research
Scholar, Institute of Mathematics
& Statistics, University of
Umea Sweden. | The economics of certain Two-Phase Regression Estimators. |

About 52 seminars by the members of staff and the students of the Institute on various topics of interest were held during the year under report.

Special training programme were also arranged for the benefit of trainees deputed from other organisations, such as I.C.A.R. Institutes, Agricultural Universities, C.S.O. and other research organisations.

7.2 Basic Research in Statistics

During the year under report, some of the contributions are given below :
Investigations were carried out for devising unequal probability sampling schemes ensuring inclusion of probabilities proportional to size.

Comparisons between several estimators based on auxiliary information was attempted on actual populations.

Technical reports nos. T & R 6/80 and 7/80 and 3 project reports were brought out.

A study on the effect of enumerations on non-response rate as well as on the response errors was made.

A new model was evolved for analysis of the data obtained from incomplete block experiments when they do not follow normal distributions.

A method of analysis was developed for analysing the experiments in fractional paired comparisons, when ties are present.

A new IPPS sampling strategy was developed through known configurations of block designs.

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8. DIVISION OF COMPUTER SCIENCE & NUMERICAL ANALYSIS

The Division of Computer Science and Numerical Analysis caters to the Electronic data processing requirements of Scientists, Research Workers and Students from various institutes under I.C.A.R. and Central Agricultural Universities and other Agricultural Colleges and Agricultural faculties affiliated to other Universities and the Directorate of Economics and Statistics, Government of India. The division is equipped with two electronic Computers one is IBM-1620 system, this has got a memory of 40,000 digits of storage with one card read punch, line printer and auxilliary storage comprising of three disk drives each with a capacity of storing two million digits of information and a console typewriter and the other system is a third generation Burroughs B-4700 with a memory of 150 K-Bytes, two card readers, one line printer, four disk drive units and four magnetic tape units and one operator display terminal. This system has the capability of working in a multi-programming environment.

Computer Utilization

During the year 1980, B-4700 was run between 9 a.m. to 6 p.m. and IBM-1620 during the normal working hours. Many times B-4700 System was also run on Sundays and holidays to complete back log. About 15,000 Production jobs and 4000 testing jobs were processed during the year.

Programming and Data processing facilities

About 220 Ph. D., 100 M. Sc. and 90 other research workers from the Institutes under I.C.A.R. and Agricultural Universities/Colleges were given help in Computer Programming, Data processing and interpretation of the results.

Software Development

To meet the data processing and statistical analysis requirements of the research workers 25 new computer programs were developed. A number of old programs were modified and up-dated according to specific needs of research workers.

The Scientists of the division have undertaken a few projects to develop efficient program packages, which would reduce, the TURN AROUND time of the Research workers to a considerable extent.

Source Programme Library

The Source Programme Library on tape developed by the Scientists of the Division is being extensively used by the computer users. During the year, the Source Programme Library was supplemented and up-dated by adding 28 new programs. A list of the new programs added during the year is given in appendix IV. The Source Programme Library now contains 216 Source programs.

Data Base Applications

Up-dating of the AGRIS Information System on receiving the Tapes from Vienna continued to be done every month and the selective Dissemination of Information Services to be done for Scientists in India was made available from this data base. Software development for the data base on BIO-DATA of Agriculture Scientists under I.C.A.R. is complete and the data base has become functional.

Training Programs

During the year under report, the following regular and ad-hoc Training Courses were conducted by the Division.

1. The course AS-129 for Ph. D. and M. Sc. students of PG-School of I.A.R.I. and courses on Computer Programming for PSCC and SCC, JCC students of I.A.S.R.I.

2. A 6-week training course in FORTRAN-IV Programming, Sorting and Merging of data files and use of SPSSG programming package, for the benefit of staff members of IASRI.

3. A 3-week intensive training course in Computer Programming for Scientists from different Agricultural Institutes, 22 participants attended this course. These participants were awarded certificates.

4. A short duration course in Report-Program Generator (RPG) was organised for staff members of IASRI.

One student of "Diploma in Advance Computer Sciences" from I.S.I., Calcutta, was given practical training in Computer Programming for a period of 3 months.

A number of Seminar lectures were delivered by the Scientists of the division. These lectures covered the introduction to different topics to be taught in the proposed "Advanced Diploma Course in Computer Programming" at I.A.S.R.I. from next year.

MECHANICAL TABULATION UNIT (M.T. Unit) :

During the year 1980, Mechanical Tabulation Unit undertook punching work of various Projects & Schemes of I.A.S.R.I. Facilities of punching and processing of data on unit record machines were extended to projects of various Agricultural Institutes under I.C.A.R. namely I.A.R.I., N.D.R.I., C.S.W.R.I., C.A.Z.R.I., C.R.R.I., I.V.R.I., C.S.S.R.I., National Bureau of Plant Genetic Research, All-India Co-ordinated projects etc. In addition similar facilities were also made available to large number of students from various Agricultural Universities and Institutes in India viz. I.A.R.I., H.A.U., P.A.U., J.N.K.V.V., B.H.U., H.P.K.V.V., M.A.U., Parbhani, G.A.U., Anand, Tamil Nadu Agricultural university, University of Udaipur, Allahabad Agricultural University, etc.

During the year 14 lakh cards were punched, 2289 Listing, 780 Sorting, 269 Reproduction, 26 Collator and 18 Tabulation jobs were completed. Out of the total 1866 jobs of punching completed by the M.T. Unit. 7% were from I.A.R.I., 4% from N.D.R.I. and 18% from other Agricultural Universities and other institutes.

Large number of students, Scientists and Research workers were guided and assisted in data preparation.

Visits to Computer Centre:

1. 30 participants of "Workshop on Computer technique in Information processing" visited the Computer Centre and saw the working of selective Dissemination of Information Services using AGRIS-Tapes.

2. Participants of the training course on "Epidemiology & Control of Animal Diseases" from I.V.R.I. visited the centre. The concepts of data processing and use of Computer in Agriculture and Animal Sciences research were explained to them.

3. The students of B. Stat. and M. Stat. courses of I.S.I., Calcutta and "Junior Certificate Course in Statistics" of C.S.O., New Delhi visited the centre. The working of the computer systems was explained to them.

4. A group of students and Scientists from N.D.R.I. Karnal visited the centre.

5. Professor N.R. Brockington from the University of Reading (U.K.) was with the Computer Centre for a week's time in connection with "Modeling Animal Production Systems" during his visit to centre, he used the Computer System.

6. A batch of 19 M. Sc. (Stat.) students of Andhra Pradesh University visited the Centre. They were shown the working of computer systems.

The following projects of programme preparation were also undertaken by the Scientists of the Computer Centre during the year. The name of the project leaders and his associate (s) are given in parenthesis.

1. Development of software for storage and retrieval of information from

(a) NIAFE (b) NIAE

(S.L. GARG, R.C. GOYAL, P.K. BATRA AND G.C. CHAWLA).

2. Development of storage and retrieval software on a medium system computer with application to bio-data of Scientists of Agricultural Research Service.

(D.K. AGARWAL, S.S. PILLAI, R.P. JAIN AND R. GOPALAN).

3. Computer programmes for "THREE WAY CROSS" analysis.

(K. C. GUPTA AND S.P. DOSHI).

4. Graphical Representation of Data using computers.

(R.P. JAIN AND S.S. PILLAI).

5. Development of program. Package to analyse Animal Breeding data using Harvey's Least Square Analysis technique.

(O.P. DUTTA AND MAHESH KUMAR).

6. Development of two program. Packages in FORTRAN for Statistical Analysis of Diallel Data.

(S.P. DOSHI AND K.C. GUPTA).

7. Development of program. for the analysis of data from Gross-Breeding experiments by least square with unequal sub-class numbers.

(MAHESH KUMAR AND O.P. DUTTA).

9. OTHER UNITS/CELLS AND THEIR ACTIVITIES

9.1 Director Cell

The functions and activities of the Cell are (i) to collect requisite material from the different Divisions of the Institute and prepare the Annual Reports, Statistical Newsletters, Quarterly Progress Reports, Fortnightly Reports, etc. for various purposes, (ii) to convene meetings of the Heads of Divisions, Senior Officers of the Institute and of the various technical committees and sub-committees of the Institute from time to time where policy decisions regarding scientific/technical matters, etc. are taken ; to prepare the minutes of such meetings to take necessary follow-up action, (iii) to organise annual Conferences of Agricultural Research Statisticians and to prepare and distribute the proceedings thereof ; to take follow-up action on the recommendations made therein and (iv) to dispose of such other work as may be assigned by the Director from time to time.

During the year under report, the Cell collected the requisite material from the various Divisions as well as from administration of the Institute which also required scrutiny, editing and preparation of abstracts of the papers published, dissertations approved and summarisation of the results of research projects and prepared the consolidated material in respect of this Institute for the following reports/publications etc. brought out by this Cell.

- (i) The Annual Report of the Institute for the year, 1979.
- (ii) The Quarterly Progress Reports of the Institute falling due during 1980.
- (iii) "IASRI Statistical Newsletters, Vol. V, No. 4, 1979 and Vol. VI Nos. 1-3, 1980.
- (iv) Proceedings and Abstracts of Contributed Papers of the 4th Conference of Agricultural Research Statisticians held at Palampur from 25th to 27th June, 1979.

The Cell also organised the 5th Conference of Agricultural Research Statisticians in collaboration with the 34th Annual Conference of the Indian Society of Agricultural Statistics from 23rd to 26th Dec., 1980 at Directorate of Agriculture, Uttar Pradesh, Lucknow (U.P.).

In addition to the compilation and preparation of the above publications, reports, etc. the scientific material in respect of this Institute was also collected

and supplied in the appropriate format to such organisations/agencies as given below in brief for their publications for onward transmission to the respective co-ordinators for National/International Research programmes.

- (i) To ICAR for the General Body Meeting of the ICAR society.
- (ii) To ICAR for DARE report (1980) to be placed in the budget session of the Parliament.
- (iii) To C.S.O., New Delhi for inclusion in their publication "Statistical System in India".
- (iv) To C.S.O., New Delhi for inclusion in the Directory of Statistical Officers in India.
- (v) To C.S.O. for inclusion in the 31st Annual Report on "Sample Surveys of current interest in India", a C.S.O. publication.
- (vi) To C.S.O. for inclusion in the 17th Report on "Sample Surveys in ESCAP region" an ESCAP Publication.
- (vii) To the Department of Science and Technology regarding "Directory of Forthcoming Conferences/Symposia/Meetings/Workshops on Science & Technology in India" in respect of this Institute.
- (viii) To C.S.O. regarding 21st session of U.N. Statistical Commission to be held at New York during 17-26 Feb., 1981—Preparation of a paper on International Technical Co-operation in Statistics 1981-85.
- (ix) To ESCAP regarding the Institute.
- (x) To League for International Food Education, Washington, regarding Post Harvest Grain Loss Assessment Methods—A Manual.
- (xi) To C.S.O. for inclusion in the issue of Statistical Newsletters—a quarterly publication.
- (xii) To British Council Library regarding forthcoming Conferences, Seminars and Workshops during 1980.
- (xiii) To Dte. of E & S—updating and modification of the report on National Methods of Collection of Agricultural Statistics in India to be presented at the 8th session of Asia and Far East Commission on Agricultural Statistics of the United Nations in respect of the Institute.

- (xiv) To C.S.O. regarding ESCAP Regional Programme on Government Information Systems.

The Cell also offered the comments on the research papers, bulletins, research project reports, etc. as desired by the Director.

Monthly meetings of the Heads of the Divisions, Senior Officers of the Institute as well as meetings of the various technical committees and sub-committees of the Institute were also convened by the Cell. The number of such meetings held during the year under report was about twenty. Proceedings of all those meetings were prepared, circulated and follow-up action taken.

In addition to the above, other miscellaneous items of scientific and technical work assigned by the Director during the year under report were also attended to.

Sh. R.K. Khosla, Scientific Secretary to Director was Scientist-in-charge of the cell during the year under report.

9.2 Field Unit

The field unit of the Institute is comprised of one Field Officer (T-7), one Field Officer (T-6), one Assistant Field Officer (T-5), two Inspectors, six Supervisors and thirty Enumerators. The collection of field data of the schemes sponsored by the Institute either through its own staff or through the ad-hoc staff of the concerned State Departments/Institutes has been one of the important activities of the field unit. The objective of employing its own field staff is to collect reliable data through intensive supervision of the field work of the surveys by the field officers and other supervisory staff in collaboration with the concerned project leaders of the Institute so as to evolve a suitable methodology for collection of data and making different types of estimates viz., area under different crops, yield rates, birth and death rates in bovines, cost of production of agricultural and animal husbandry products, etc. The feasibility of data collection with maximum precision is also studied by the Institute by employing its own field staff in different pilot studies.

(a) Field Training :

During the year under report, the field training was imparted to the field and supervisory staff of the schemes mentioned below in the collection of data canvassing of different schedules and planning and organisation of field work of the surveys at the places shown against them in collaboration with the concerned project leaders.

- (i) All-India Co-ordinated Agronomic Research Project (AICARP)—Bhubaneswar (Orissa) ; Coimbatore, Salem, Bhawanisagar, Thanjavur, Karaiyiruppu (T.N.) ; Pattambi, Karamanai and Kottayam (Kerala); Bangalore (Karnataka); Hyderabad, Chittoor (A.P.); Bundi, S. Madhopur, Banswara and Chittorgarh (Rajasthan); Hissar, Kurukshetra (Haryana) ; Pura Farm (U.P.); Patna (Bihar) ; Nagpur (Maharashtra) ; and some districts of Gujarat State.
- (ii) Pilot studies on pre-harvest forecasting of crop yield of Sugarcane based on biometrical observations — Kolhapur district (Maharashtra).
- (iii) Pilot studies for estimation of birth and death rates in bovines — Gauhati (Assam).
- (iv) Statistical efficiency and operational feasibility of securing data on livestock and its products through different systems of collection — Ludhiana (Punjab).
- (v) Pilot sample survey for studying the relative merits of data obtained by actual weighment and those through enquiry for estimation of milk production—Rohtak (Haryana) and Barabanki (U.P.).
- (vi) Pilot sample survey to study the impact of new technology on crop production, its disposal and employment in agriculture — Delhi.
- (vii) To study the effect of drought on agricultural production during the season kharif 1979 — Delhi.
- (viii) Summer Institute on “Advanced Statistical Methodology applied to Animal Sciences”—Hardwar, Dehradun and Mussorie (U.P.).
- (ix) Identification of socio-economic and other constraints operating in the spread of modern technology on rice farms in Operational Research Project areas—Raipur (M.P.) and Puri (Orissa).
- (x) Study of the impact of milk supply schemes on rural economy in milk collection areas of Greater Calcutta Milk Supply Scheme, (Repeat Survey)—Kalyani (W.B.).

(b) Field Work Inspection/Supervision

During the year under report, the field work of the following projects was carried out by field unit through its own staff concerned. Project leaders,

State Departments and ICAR Institutes at the places/areas mentioned against them and the inspection/supervision of the same was also undertaken.

- (i) Statistical efficiency and operational feasibility of securing data on livestock and its products through different systems of collection—Ludhiana (Punjab).
- (ii) Pilot sample survey to evolve a sampling methodology for estimation of losses in marketing and price spread at various stages and cost of cultivation of important vegetable crops, Delhi.
- (iii) All India Co-ordinated Agronomic Research Project (AICARP) Agronomic Research Centres (ARC)—Bhubaneswar (Orissa); Kalyani (West Bengal); Pura Farm (U.P.); Banswara (Rajasthan); Hissar (Haryana); Salem, Bhavanisagar, Tiruchirapalli, North Arcot, Thanjavur and Karaiyiruppu (T.N.); Chittoor (A.P.); Karamanai and Kottayam (Kerala); Hazaribag and Muzzaffarpur (Bihar); Cultivators' Fields-Bundi, Sawai Madhopur, Chittorgarh (Rajasthan) and Hissar, Kurukshetra (Haryana).
- (iv) To study cost of poultry and egg production under small farming conditions—Warangal (A.P.).
- (v) Pilot sample survey on cost of production of orange—Nagpur, Amravati (Maharashtra).
- (vi) Pilot sample survey for studying the relative merits of the data obtained by actual weighment and those through enquiry for estimation of milk production—Rohtak (Haryana), and Barabanki (U.P.).
- (vii) Study of economic of raising cattle and buffaloes in rural area, W.B. Kalyani (W.B.).
- (viii) Pilot sample survey on cost of cultivation and marketing practices of mango in district Bulsar and banana in the district Surat (Gujarat)—
- (ix) Co-ordination and planning of National Index of Agricultural Field Experiments—Lucknow (U.P.).
- (x) Sample survey for estimation of livestock products in U.P.—Meerut, Dehradun and Mussorie.
- (xi) Pilot sample survey for estimation of production of hides and skins—Kanpur and Agra districts (U.P.).

- (xii) Statistical assessment of changes in area and food production due to availability of water in the command areas of Ghataprabha and Malaprabha River Valley Project—Belgaun, Dharwar and Bangalore (Karnataka).

9.3 Monitoring Cell

The Monitoring Cell was set up at IASRI to review the physical and financial achievements in the implementation of the Plan Schemes in November, 1979, the composition of Monitoring Cell being Jt. Director (Trg. & Res.) as Chairman and Joint Director (C.S. & N.A.), all Heads of the Divisions and Cells, C.A.O. and Accounts Officer as members with Sh. S.D. Bal as the Convenor. Dr. S.S. Pillai, Joint Director, (C.S. & N.A.) was the Chairman in the absence of the Jt. Director (Trg. & Res.).

Functions and Activities of the Monitoring Cell

The functions and activities of the Monitoring Cell are to collect the information from the Heads of the Divisions/Administration, Scheme Section etc. regarding the implementation of the various projects in terms of the targets laid down. The progress of the projects should be reviewed for each quarter (3 months). The Monitoring Cell should submit the minutes of each of the meetings to the Director for discussion in the meetings of the Heads of the Divisions taking remedial measures and removing bottlenecks in respect of the projects in which the progress is hampered or progress is slow due to some reasons.

During the year 1980, there were three meetings of the Monitoring Cell. The first meeting was held on 3rd March, 1980, the second was held on 7th Aug., 80 and the third meeting was held on 30th Oct., 1980. The Monitoring Cell devised the proformae for the purpose of monitoring the progress of the research projects of the Institute which were approved in the meeting.

10. ADVISORY SERVICE

The Institute continued to play its important role of giving technical advice and guidance in regard to problems in agricultural statistics and sampling techniques particularly in the statistical aspects of the projects financed by the ICAR. During the year under report, the research projects submitted by the various Research Institutes, Universities, State Departments of Agriculture and Animal Husbandry and other Research Organisations as were referred to the Institute by the ICAR were examined critically by the Institute from the statistical point of view. Also, officers, of the Institute attended meetings of the various ICAR Scientific Panels as well as some of the workshops of the All India Co-ordinated Projects of the ICAR held during the year and took active part in the discussions on statistical aspects of projects.

Technical advice and guidance were also rendered to research workers and students of the various Research Institutes, Universities and other Research Organisations in planning their experimental investigations and statistical analysis of data as well as in processing of their data at the Computer Centre and Mechanical Data Processing Unit of the Institute.

Some details of the technical advice and guidance given by the Institute during the year under report are briefly given below :

Crop Sciences :

(i) Dr. Sharma (Associate Prof. Hort.) Konkan Agricultural University, Dapoli (Maharashtra) was given technical advice regarding different types of designs for fruit crops.

(ii) Offered comments on the ad-hoc scheme entitled "Studies on the causes and correction of Chlorosis in crops like sugarcane, turmeric, jasmine etc." received from ICAR, New Delhi.

The comments were offered on the following reports/projects received (iii to xvi) from various Universities/Institutions.

(iii) Development and standardization of soil testing methodology for low land growing acid soils of Assam (Assam Agri. University).

- (iv) Multipurpose geochemical surveys and mapping of trace-element distribution in some district of Andhra Pradesh (Osmania University, Hyderabad).
- (v) Research on recycling of effluents of Agro Based Industries (Punjab Agril. University, Ludhiana).
- (vi) Studies on the causes and correction of Chlorosis in crops like sugarcane, turmeric, jasmine etc. (Agri. College and Research Institute, Coimbatore).
- (vii) Ad-hoc scheme on soil water evaporation and deep percolation Orissa University of Agri. & Technology, Bhubneswar).
- (viii) Ad-hoc scheme "Utilization of sub-soil brackish waters in Haryana" (Harvana Agri. University, Haryana).
- (ix) Ad-hoc scheme "Studies on simultaneous nutrient and water movement in soils in relation to water and fertilizer use efficiency" (Punjab Agri. University, Ludhiana).
- (x) Toxicity of pesticides (agricultural chemicals) to blue-green algae : biological effects on rice and grass crop (fish) (Khavikote College, Berhampur, Ganjam Orissa).
- (xi) Physico-chemical studies on the interaction of herbicides with organic and in-organic soil colloids (A.P. Agri. University, Rajendra Nagar, Hyderabad).
- (xii) Efficient use of solar energy for crop production (Punjab Agri. University, Ludhiana).
- (xiii) Agronomic investigation in wheat under rice-wheat rotation (N D. University of Agri. & Technology, Faizabad).
- (xiv) Spatial variation and change in land use and cropping pattern in Andhra Pradesh (Osmania University, Hyderabad).
- (xv) Water pollution of rivers of Upper Ganga-Yamuna Doab by industrial wastes and its effects on agricultural soils (Aligarh, Muslim University, Aligarh).
- (xvi) Studies on simultaneous nutrient and water movement in soils in relation to water and fertilizer use efficiency (Punjab Agri. University, Ludhiana).

Crop Forecasting Methodology

Sh. Y.R. Deshmukh, Scientist (S-1), Central Institute of Cotton Research (C.I.C.R.), Nagpur (Maharashtra) was given advice regarding the planning, technical programme and organising surveys on forecasting cotton production.

Animal Sciences

(i) Sh. S.S. Lahiri, Scientist (S-1) of Central Sheep and Wool Research Institute (CSWRI) Garsa, Kulu (H.P.) was given advice regarding the analysis of the data on quality characters, wool yield, and general growth.

(ii) Shri N.K. Nam, Ph. D. student from Viet Nam, was advised and guided in regard to collection and analysis of data pertaining to project 'National Index of Animal Experiments'.

Statistical Genetics

(i) Dr. Sheila Roy of All India Institute of Medical Sciences (A.I.I.M.S.) New Delhi was given advice on the presentation of results of the investigations on the inheritance of Indian Childhood Cirrhosis.

(ii) Dr. S.B. Goswami, Jt. Commissioner, Deptt. of Agri., Ministry of Agri. & irrigation, New Delhi was given advice on the plan of progeny testing under field conditions.

(iii) Dr. P.N. Ravindran, Scientist (S-2) from C.P.C.R.I., Regional Station, Calicut was given technical advice on genetic divergence analysis between different species of cinnamomum.

(iv) Dr. M.P. Nagpal, Director, Central Cattle Breeding Farm, Dhamroad (Gujarat) was given technical advice on selection of second set of bulls under the progeny testing programmes in Surti buffaloes.

(v) Shri R.R. Singhal, Scientist from IVRI, Izatnagar was advised on the methodology for evaluating dairy sires under the All India Co-ordinated Project on Cattle.

(vi) Shri N. Gurnani, Associate Professor from Division of Dairy Cattle Genetics, NDRI, Karnal was given technical advice/guidance regarding analysis of dairy cattle breeding data.

(vii) Dr. B.G. Katpatal, Project Co-ordinator of All India Co-ordinated Research Project on Cattle IVRI, Izatnagar was helped in the finalisation of

performae for assessing the progress of the project and also advised regarding the methodology for studying the genotype x environment interaction in *Bos taurus* and *Bosindicus* half-breds.

(viii) Shri Dharmendra Kumar, Joint Director (Statistics), Directorate of Animal Husbandry, U.P., Lucknow, was given advice regarding the technical programme for the scheme entitled "Analysis of cattle breeding data".

(ix) Dr. Mukherjee, Joint Director, (Veterinary Services), Madhya Pradesh Government, Bhopal was given advice in connection with the progeny testing programme for buffaloes.

(x) Sh. S.C. Aggarwal, Scientist (S-1), IVRI, Izatnagar was given advice on the methodology for the estimation of heterosis when the performance of parents is not known.

Sample Survey Methodology

- (i) Directorate of Plant Protection, Quarantine and Storage, Ministry of Agri. & Irrigation, Govt. of India, New Delhi was given advice regarding planning of the survey to study the effect of insecticides on mustard.
- (ii) National Seeds Corporation, (N.S.C.), New Delhi was given advice regarding scrutiny/evaluation of project proposals for All India Seed Demand Survey.
- (iii) Agricultural Marketing Adviser was given technical advice regarding sixth plan survey on marketable surplus of foodgrains.
- (iv) Shri Dharmendra Kumar, Joint Director from the Directorate of Animal Husbandry, U.P. and Shri Sunder Lal Gupta, Dy. Director from the Directorate of Animal Husbandry, Haryana, were given advice in the conduct of sample surveys for estimation of livestock products in these States.
- (v) Director of Extension, Delhi was given advice in formulation of rules and procedures for All India Crop Competition Scheme.
- (vi) State Farms Corporation of India (SFCI), New Delhi was advised in regard to the analysis of yield data of wheat.
- (vii) Dte. of Plant Protection, Quarantine and Storage, Ministry of Agriculture & Irrigation was advised in regard to the analysis of data and

finalisation of report for a survey to study the effect of aerial spray of insecticide on yield of mustard crop.

- (viii) Sh. I.J.S. Khurana, Dy. Secretary, Ministry of Shipping and Transport was given advice on the use of factor analysis in data of road transport undertaking of the country.
- (ix) Regional Co-ordinator (National Demonstration, ICAR), Jabalpur was given advice on selection of farmers and laying out of demonstration and National Demonstration Scheme.

Econometric Analysis

- (i) A.P. Agricultural University, (A.P.A.U.), Hyderabad (A.P.) was given technical advice regarding improvement of their final report on economic aspects of yield increasing technology in producing food-grains in A.P.
- (ii) Dr. J.L. Anthony of Rubber Research Institute, (R.R.I.) Malaysia was imparted training and rendered advice on constraints analysis methodology.

Computer Science and Numerical Analysis

A large number of scientists and students from various ICAR Institutes, Agricultural Universities and other research organisations were given technical advice and guidance in the preparation, punching, programming and processing of their research data at the Computer Centre and M.T. Unit of the Institute.

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

During the year under report, papers by the officers, members of the staff and research students of the Institute, were presented in several inter-organisational seminars, workshops, etc. The titles and authorships of the papers presented and the particulars of the seminars, workshops, conferences etc. at which these were presented are given below :—

1. Symposium of progeny testing programme under field conditions held at Red Dane Project Hassarghatta, Bangalore (Karnataka) from 10th to 11th March, 1980.
 - (i) MALHOTRA, J.C. AND JAIN, J.P.—A plan for performance recording of cows in progeny testing programme of dairy bulls under fields conditions.
 - (ii) JAIN, J.P.—Methods for appraising progeny tests of dairy bulls under field conditions.
2. "Third Indo US-Workshop modelling of "National Scientific and Technological Information" held by the Deptt. of Sci. & Tech. during 10-12 March, 1980 at New Delhi.

PILLAI, S S.—Impact of information services on the farming community.

3. National symposium on conservation of soil and water management held at the Central Institute of Conservation of Soil and Water Management (C.I.C.S.W.M.), Dehradun (U.P.) from 12th to 14th March, 80.

BHARGAVA. P.N.—Conservation of water and agricultural productivity.

4. XVI Dairy Industry Conferences held at Pune (Maharashtra) from 21st to 23rd March, 1980.

RAUT, K.C.—Estimation of loss in milk production due to mortality of milch stock.

5. Annual Convention on "Computer Applications for Development (Pune Chapter)" organised by Computer Society of India during 7-8 June, 1980 at Pune.
SATHE, K.V. AND MATHUR, S.N.—Computer applications for development.
6. 4th All India Workshop on animal husbandry and dairying statistics, held at Gandhi Nagar (Ahmedabad, Gujarat) from 18th to 20th Aug., 1980.
RAUT, K.C.—Cost of milk production in milk-shed procurement areas of dairy plants.
7. Workshop on All India Co-ordinated Rabi Pulses Improvement Project held at Udaipur during 16-18 Sept., 1980.
 - (i) BHARGAVA, P.N. AND JAIN, H.C.—Economics of fertilizer use for pulses grown under rainfed conditions.
 - (ii) SINGH, D., BHARGAVA, P.N. AND BATRA, P.K.—A statistical study on trend in area and production of gram.
8. Seminar on "Maximising Fertilizer use Efficiency" organised by the FAO/Govt. of India/Govt. of Norway held at Vigyan Bhawan, New Delhi, from 15th to 19th Sept., 1980.
 - (i) KRISHNAN, K.S.—Crop response towards economics of fertilizer use in India.
 - (ii) PURI, D.N. AND RAHEJA, S.K.—Fertilizer use efficiency under field conditions.
9. Seminar on "Role of Sample Surveys in Education" held at N.C.E.R.T., New Delhi from 13th to 15th Oct., 1980.
SINGH, D.—Sample survey methods in education.
10. National Workshop on "Documentation of Genetic Resources" held during 25-27 Nov., 1980 by International Bureau of Plant Genetic Resources and the NBPGR at Delhi.
PILLAI, S.S.—Use of computers in Documenting Genetic Resources.
11. Silver Jubilee Seminar on "Fertilizers in India in the 80's held at F.A.I., New Delhi from 4th to 6th Dec., 1980.
BHUMBLA, D.R. AND RAHEJA, S.K.—Constraints analysis in rice production.

12. 5th Conference of Agricultural Research Statisticians & 34th Annual Conference of Indian Society of Agricultural Statistics held at Lucknow from 23rd to 26th Dec., 1980.

About 40 papers were presented by the scientists and students of the Institute in the Joint Conference and in the two symposia organised during this Conference.

13. 40th Annual Conference of the Indian Society of Agril. Economics held at Pune from 30th Dec., 1980 to 1st Jan., 1981.

(i) JAIN, T.B. AND NADKARNI, U.G.—On relation of fixed and working capitals with egg production.

(ii) PANDEY, R.K., SINGH, H.P. AND SAXENA, B.C.—Economic impact of dairy development programmes in the milk collection areas of MMS, Chingleput-Tamil Nadu.

**12. CONFERENCES/SEMINARS/SYMPOSIA/WORKSHOPS,
ETC. ATTENDED BY THE SCIENTISTS**

During the year under report, officers of the Institute participated in several inter-organisational seminars, workshops, conferences etc. The names of the officers (with designation) and the particulars of the seminars, workshops, conferences etc. in which they participated are given below :—

Date	Name of Seminar etc.	Name of the Scientists with designation.
1. Feb., 1-3	First Annual Conference of the Indian Society of Animal Genetics and Breeding held at Ajmer (Rajasthan).	Dr. J.P. Jain, Scientist S-3
2. Feb., 28-29	Fifth Indo-US-Sub-Commission on Science and Technology and working group on Science and Technology held by the Deptt. of Science & Technology at New Delhi.	Dr. S.S. Pillai, J.D. Director
3. March, 5-7	Sixth Workshop of All India Co-ordinated Research Project on Poultry Breeding held at Punjabrao, Krishi Vidyapeeth, Akola (Maharashtra).	Sh. P.K. Malhotra, Scientist S-1
4. March, 10	15th F.A.O. Regional Conference for Asia and the Pacific.	Dr. K.G. Aneja, Scientist S-2
5. March, 10-12	Third-Indo. U.S. Workshop on Modelling of National Scientific and Technological Information Systems held at Technology Bhawan, New Delhi.	Dr. S S. Pillai, Jt. Director

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| 6. | March, 10-11 | Symposium for Progeny Testing Programme under field conditions held at Red Dane Project, Hassarghatta, Bangalore (Karnataka). | Sh. J.C. Malhotra,
Scientist S-2 |
| 7. | March, 12-14 | National Symposium on Conservation of Soil and Water Management held at the Central Institute of Conservation of Soil and Water Management (C.I.C.S.W.M.), Dehradun (U.P.). | Sh. P.N. Bhargava,
Scientist S-3 |
| 8. | March, 21-23 | XVI Dairy Industry Conference held at Pune (Maharashtra). | Dr. K.C. Raut,
Scientist S-3 |
| 9. | April, 7-8 | Symposium on "Scientific Assessment of Learning and Achievement" held at Indian National Science Academy, New Delhi. | Dr. Daroga Singh,
Director and Dr.
Prem Narain, Jt.
Director |
| 10. | April, 7-10 | Kharif Pulses Workshop of the "All India Co-ordinated Pulse Improvement Project" held at C.S.A. University of Agri. & Technology, Kanpur. | Sh. H.C. Jain,
Scientist S-1 |
| 11. | April, 21-23 | Workshop on All India Co-ordinated Research Project on Cattle held at IVRI, Izatnagar. | Dr. J.P. Jain,
Scientist S-3 |
| 12. | May, 1-3 | Indo-British Workshop on Computer Facilities Management held at I.I.T. Hauz khas, New Delhi. | Sh. S.N. Mathur,
Scientist S-2 &
Sh. K.V. Sathe,
Scientist S-2 |
| 13. | June, 29 | International symposium on "The Brandt Commission Report on Delhi Chapter of the Society for International Development". | Dr. Daroga Singh,
Director |
| 14. | Sept, 4-5 | Workshop of "Agricultural Officers of Himachal Pradesh" at Palampur. | Sh. P.N. Soni,
Scientist S-2 |

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| 15. | Sept., 16-18 | Workshop on Rabi Pulses held at Udaipur. | Sh. P.N. Bhargava,
Scientist S-3 |
| 16. | Oct., 13-15 | Seminar on "Role of Sample Surveys in Education" held at NCERT, New Delhi. | Dr. D. Singh,
Director |
| 17. | Nov., 25-27 | Workshop on Documentation of plant genetic resources held at New Delhi | Sh. R. Gopalan,
Scientist S-2 |
| 18. | Dec., 4-6 | Silver Jubilee Seminar on "Fertilizers in India in 80's" at FAI, New Delhi. | Dr. D. Singh,
Director & Sh. S.K.
Raheja, Scientist S-3 |
| 19. | Dec., 8-13 | C.R. Rao Sixteenth Birthday Felicitation Conference held at New Delhi. | Dr. Prem Narain,
Joint Director. |
| 20. | Dec., 15-17 | Fifth workshop on "All India Co-ordinated Research Project on Pigs" held at the College of Veterinary Science, A.P. Agricultural University, Tirupati (A.P.). | Sh. J.C. Malhotra,
Scientist S-2 |
| 21. | Dec., 17 | Symposium on "The Development Options for 1980's" held at Delhi School of Economics, New Delhi. | Dr. D. Singh,
Director |
| 22. | Dec., 21-24 | Twelfth Annual Workshop on "All India Co-ordinated Agronomic Research Project" held at Dharwar. | Sh. P.N. Soni,
Scientist S-2 |
| 23. | Dec., 23-26 | 34th Annual Conference of Indian Society of Agricultural Statistics & 5th Conference of Agricultural Research Statisticians held at Lucknow. | 32 Scientists of the
Institute. |

24. 30th Dec., 80
to 1st Jan., 81

40th Annual Conference of
Indian Society of Agril.
Economics held at Pune.

1. Dr. D. Singh,
Director

2. Dr. R.K. Pandey,
Scientist S-3

3. Dr. K.C. Raut,
Scientist S-3

4. Sh. T.B. Jain,
Scientist S-1

13. PUBLICATIONS

During the year under report, forty-seven papers by the officers, staff and research students of the Institute, were published in standard journals, etc. A list of these papers with abstracts is given as Appendix - V. Also, Twenty Nine papers were accepted for publication in different journals during the year, a list of which is given as Appendix-VI. The technical reports, compendia, etc. mentioned below were published as "IASRI Publications" during the year under report :—

1. AGARWAL, RANJANA, JAIN, R.C. AND JHA, M.P.—Forecasting of rice yield based on weather parameters (Raipur district).
2. BAPAT, S.R., JHA, M.P., CHANDRAHAS AND SINGH, B.H.—Annual report of pilot studies on pre-harvest forecasting of yield of sugarcane in Kolhapur district (Maharashtra) 1977-78.
3. BAJPAI, S.N., NIGAM, A.K. AND DEY, A.—Optimum amount of experimentation in animal nutrition.
4. BAHUGUNA, G.N., ANEJA, K.G. AND MAHAJAN, V.K.—Annual report of pilot sample survey to estimate the incidence of pests and diseases and consequent loss in crop yield on high yielding varieties of wheat in Gorakhpur district (U.P.)—1977-78.
5. BHARGAVA, P.N., GHAI, R.K. AND YERI, P.R.—Annual Index of Agricultural Field Experiments, Vol. VI (in respect of experiments reported to IASRI, New Delhi during 1977)
6. BHARGAVA, P.N., KAPOOR, J.K. AND KRISHNAN, K.S.—Summarisation of experimental data on paddy for eastern region (1966-75)—Vol. 1.
7. BHARGAVA, P.N., AND KAPOOR, J.K.—Annual Index of Agricultural Field Experiments—Vol. 1.
8. CHANDRAHAS, JHA, M.P. AND SINGH, B.H.—Annual report of pilot study on pre-harvest forecasting of yield of tobacco in Prakasam district (A.P.)—1976-77.

9. CHOUDHARY, H.B. AND PANDEY, R.K.—Study of assessment of yield constraints in adoption of new farm technology in operational research project area, Chittorgarh (Raj.).
10. DEY, A., BAJPAI, S.N. AND CHAWLA, G.C.—National Index of Animal Experiments, Vol. I, Part V—Animal Nutrition Experiments (R.B.S. College, Bichpuri, Agra, U.P.)—1962-76.
11. DEY, A., CHAWLA, G.C. AND BAJPAI, S.N.—National Index of Animal Experiments, Vol. I, Part VI—Animal Nutrition Experiments (G.A.U., Institute of Agriculture, Anand, Gujarat)—1960-74.
12. GARG, L.K., RANA, P.S. AND LAL CHAND Estimation of genetic trend in beetal goats.
13. IYER, V.N. AND SEHGAL, D.K.—Statistical analysis and interpretation of data relating to experiments conducted under the AICARP in Southern region.
14. JAIN, H.C. AND VATS, M.R.—Statistical analysis and interpretation of data relating to experiments, conducted under the AICARP in Easterns and North-Eastern regions.
15. JAIN, R.C., JHA, M.P. AND AGARWAL, RANJANA—Annual Report of pilot studies on pre-harvest forecasting of Jowar yield in Sangli district—1976-77.
16. JAIN, T.B. AND NADKARNI, U.G.—Economics of poultry keeping : study of the relationship of fixed and working capitals with egg production.
17. KHOSLA, R.K. AND SINGH, D.P.—IASRI Annual Report, 1979—Golden Jubilee Special.
18. KHOSLA, R.K., SINGH, D.P. AND BAL, S.D.—IASRI Statistical Newsletter, Vol. V, No. 4, October-December, 1979.
19. KHOSLA, R.K., SINGH, D.P. AND BAL, S.D.—IASRI Statistical Newsletter, Vol. VI, No. 1, January-March, 1980.
20. KHOSLA, R.K. AND SINGH, D.P.—IASRI Statistical Newsletter, Vol. VI, No. 2, April-June, 1980.
21. KHOSLA, R.K. AND SINGH, D.P.—IASRI Statistical Newsletter, Vol. VI, No. 3, July-Sept., 1980.

22. KHOSLA, R.K., KHATRI, R.S. AND ANEJA, D.S.—Proceedings and abstracts of contributed papers presented during IV Conference of Agricultural Research Statisticians held at H.P.K.V.V., Palampur (H.P.) during 25-27 June, 1979.
23. LEELAVATHI, C.R., KRISHNAN, K.S. AND MEHTA, S.C.—Study of agronomic constraints in Tungabhadra River Valley Project Area"—A Statistical assessment.
24. MEHROTRA, P.C., RAHEJA, S.K., RUSTOGI, V.S., AND TYAGI, K.K.—Annual report 1976-77—Pilot sample survey to study the impact of new technology on crop production, its disposal and employment in agriculture in Delhi State.
25. NARAIN, P., GARG, L.K., JAIN, J.P., PURI, J.C., LAL, PRAKASH AND RANA, P.S.—Statistical methodology for developing efficient selection procedures in poultry breeding.
26. RAHEJA, S.K. AND BANERJEE, A.K.—Study to find out the causes of land lying idle in the operational holding during agricultural year — 1977-78.
27. RAI, S.C.—Assessment of Family Welfare Programmes at Indian Agricultural Statistics Research Institute, New Delhi-12.
28. RAUT, K.C., SINGH, SHIVTAR AND RUSTOGI, R.L.—Index of cost of milk production in I.C.D. area, Bikaner (Rajasthan).
29. RAO, P.P. AND RAI, S.C.—A study of agronomic and other factors in relation to the homogeneity of experimental errors in groups of experiments on paddy crop.
30. RAUT, K.C., SINGH, SHIVTAR AND RUSTOGI, R.L.—Estimation of availability and cost of milk production in I.C.D. area, Bhopal (Madhya Pradesh).
31. SAKSENA, ASHA AND BHARGAVA, P.N.—A technical report entitled "Water management in rainfed Agriculture Part I".
32. SARUP, SHANTI, GUPTA, S.C. AND PANDEY, R.K.—Constraints to higher yields on rice farms in operational Research Project area in Puri district (Orissa).
33. SAXENA, B.C., SINGH, H.P. AND VERMA, S.P.—Statistical studies on milk production, employment and income under different categories

of agricultural holdings in the milk shed areas of G.C.M.S., Calcutta (West Bengal).

34. SINGH, D., GOEL, B.B.P.S., MAINI, J.S. AND GOYAL, J.P.—Sampling methodology for estimation of wool production under pilot investigations for developing an integrated technique for estimates of livestock products and study of attendant animal husbandry practices in Northern region (1969-72) and Southern region (1971-74).
35. SINGH, H.P., SAXENA, B.C., NARAIN, P., ARYA, S.R.S. AND JAIN, J.P.—Impact of milk supply schemes on the rural economy in milk collection areas of Greater Calcutta Milk Supply Scheme—Calcutta, West Bengal (Bench Mark Survey).
36. SINGH, R.P.—Estimation of performance characteristics in bovines under village conditions, Bhopal, M.P.
37. SINGH, RANDHIR—Use of incomplete multi-auxiliary information in sample surveys.
38. SINGH, SHIVTAR AND RAUT, K.C.—Project report on index of cost of rearing calves and study of changes in rearing practices in rural areas, Haryana.
39. SOMAYAZULU, L.B.S. AND NADKARNI, U.G.—Economics of poultry keeping—study of functional relationships between production and input factors.
40. SONI, P.N. AND MUKHERJEE, A.K.—Statistical analysis and interpretation of data under AICARP in North-Western Regions 1978-79.

Technical Reports of the Division of Training and Basic Research.

The following Technical Reports Nos. T & R 6/80 and 7/80 were brought out during the year.

1. NARAIN, PREM AND SINGH, R.—Efficiencies of selective breeding in cattle (IASRI Technical Report T & R 6/80).
2. RAJAGOPALACHAR, K.R. AND RAI, S.C.—Impact of co-operative milk producers societies in rural areas of Anand Tehsil of Kaira district (IASRI Technical Report T & R 7/80).

The series of technical reports with distinctive Nos. T & R 1/78 to 5/79 had already been published during 1979 the following project report was brought out during the year 1980.

Rai, S.C.—Project report on 'Analysis of experiments involving rankings'.

14. CONFERENCE/TRAINING COURSE ORGANISED BY THE I.A.S.R.I.

(i) 5th Conference of Agricultural Research Statisticians and 34th Conference of Indian Society of Agricultural Statistics

The First and Second Conference of Agricultural Research Statisticians were held in 1974 and 1976 respectively with the objective of mutually discussing the problems by Statisticians on Designs and Analysis of Experiments, Sample Surveys, use of computer in Agriculture and Animal Sciences Research, Statistical Techniques in Plant and Animal Breeding, Teaching of Statistics in Agricultural Institutes and Universities, Research and Training Facilities and Personnel Policies, in six different Technical Sessions. These sessions were started with the speeches delivered by the invited speakers on the above mentioned topics.

The Third Conference was held from 24th to 26th April, 1978 and unlike earlier two conferences the pattern of session was changed where the participants discussed the main topic, i.e. the role of agricultural statistics research in Sixth Five Year Plan with special reference to integrated rural development with respect to agriculture, forestry, livestock and fisheries. This was done because one of the main policy objectives in the next Five Year Plan is the Agricultural Rural Development which could play a great role in the growth of social justice, employment in rural areas and removal of poverty.

The Fourth Agricultural Research Statisticians' Conference was held at H.P.K.V.V., Palampur (H.P.) from 25th to 27th June, 1979. The sessions were divided into five technical sessions mentioned below, besides plenary session. The sessions broadly related to (i) Agriculture and Forestry (ii) Livestock and Fisheries and (iii) Quality of Data. In the plenary session, the recommendations made in the earlier sessions, were discussed and finalised during each of the conferences for taking action thereon by the concerned Agricultural University/Institute/Department and were reviewed in the subsequent conference.

The 5th Conference of Agricultural Research Statisticians and 34th conference of Indian Society of Agricultural Statistics were jointly organised by the IASRI and ISAS during December 23-26, 1980 at Lucknow (U.P.). About 250 participants, including members of the ISAS and delegates representing Agricultural Universities, ICAR Institutes, State and Central Deptt. of Agriculture, Animal Husbandry, Forestry and Fisheries, engaged in research, participated in the joint conference. The host of this conference was the Directorate of Agriculture, U.P., Lucknow.

In the Inauguration on 23rd December, 1980 the delegates were welcomed by Sh. Shumshed Ahmad, Agricultural Production Commissioner, U.P., Lucknow. The Presidential address on the topic "Agriculture in the Sixth Plan" was delivered by Dr. M.S. Swaminathan, Member (Agriculture), Planning Commission, Govt. of India, New Delhi. The conference was inaugurated by Sh. Balram Singh Yadav, Minister for Agriculture and Animal Husbandry, U.P., Lucknow.

The Annual Report of the Society was presented by Dr. Daroga Singh, Secretary, ISAS and Director, IASRI New Delhi. For this conference, Dr. K.C. Seal, D.G., C.S.O., New Delhi, who was the Sessional President of this conference, delivered the technical address on 'Agricultural Statistics and National Income Estimates'. Vote of thanks was given by Dr. P.V. Sukhatme, Executive President of the ISAS.

On 23rd December, 1980, Dr. Rajendra Prasad Memorial Lecture on "Making the most of our Rural Population's Potential Productivity" was delivered by Dr. V. Kurien, Chairman, National Dairy Development Board, Anand (Gujarat). This lecture was chaired by Dr. M.S. Swaminathan, Member Planning Commission, New Delhi.

A symposium on 'Inter Regional Disparities in Growth Rates' was also organised on that day. The chairman of this symposium was Dr. P.V. Sukhatme, Hony. Professor of Biometry, Maharashtra Association for Cultivation of Science, Pune and the convenor, was Sh. S.D. Bokil, Sr. Scientist, IASRI, New Delhi.

On 24th December, 1980, the technical session-I of Agril. Research Statisticians (ARS) was held. During the session, action taken on the recommendations made in the last four conferences were discussed. The Chairman of this session was Dr. Daroga Singh, Director, IASRI, New Delhi.



**Sh. Balram Singh Yadav, Minister of Agriculture & Animal Husbandry, U.P.
Inaugurating the Conference.**



A view of the participants at the Convocation Hall.



(From L to R) Shri D. S. Aneja (Rapporteur), Shri R. K. Khosla (Rapporteur) and Dr. Daroga Singh Chairman on the Dias at the Technical Session-I.



(From L to R) Shri K. P. Avasthy (Rapporteur), Dr. B.B.P.S. Gosl (Rapporteur) and Dr. K. Kishan (Chairman) on the Dias at the Technical Session-II

The technical session-II on Current Statistical Research in Agriculture, Forestry, Livestock and Fisheries with reference to Rural Development was held on 24th and 26th Dec., 1980. The Chairman of this session was Dr. K. Kishan and the speakers were Sh. S.D. Bokil, Agri. (Crops), Dr. K.R. Satyamurti (Forestry), Sh. G.K. Shukla-Forestry (U.P.), Dr. K.C. Raut-Livestock (A.H.) and Sh. K.K. Ghosh, (Inland Fisheries) and an article on Marine Fisheries by Sh. T. Jacob was read by Sh. Sundram.

In the afternoon of 24th December, 1980, a popular lecture on "Distinction between poverty and mal-nutrition and implications for planning" was delivered by Dr. P.V. Sukhatme, Hony. Prof. of Biometry, M.A.C.S., Pune. The lecture was chaired by Dr. K.C. Seal, D.G., C.S.O., New Delhi.

Another symposium on "Use of ancillary information in sampling and experimental designs", was also organised on 24th Dec., 1980. The Chairman and the convenor of the symposium were Dr. M.N. Das, Director (Stat.), C.W.C., New Delhi and Sh. S.K. Raheja, Sr. Scientist, IASRI, New Delhi respectively.

Just after the symposium, the session of reading the contributed papers was held under the chairmanship of Dr. O.P. Srivastava, Head (Stat.), HAU, Hissar (Haryana). The reading of contributed papers was continued on 26th Dec., 80 into two groups under the chairmanship of Sh. K.S. Krishnan, Sr. Scientist, IASRI, New Delhi and Dr. B.N. Tyagi, Addl. Director of Agri., U.P. Lucknow.

The Plenary session in the afternoon of 26th Dec., 80 was devoted to the presentation of reports by the Chairman of the various sessions in regard to ARS Conferences. During the plenary session, several recommendations were made. One of the major recommendation was that since no record on fisheries statistics is available, a separate census for fisheries should be conducted. The details of the recommendations made in this session may be seen from "Summary of Recommendations and Proceedings" which would be published by the IASRI separately. The Chairman of this session was Dr. Daroga Singh.

Dr. P.K. Bose, Centenary Prof., Calcutta University, Calcutta, Dr. K. Kishan, Ex. Emeritus Scientist (ICAR), Lucknow and Dr. P.V. Sukhatme, Hony. Prof. of Biometry, Maharashtra Association for Cultivation of Science, Pune were the special invitees at the joint conference.

14.2 International Training Course : "FAO/APHCA Regional Training Course on Improvement of Data Base on Livestock Resources".

The Government of India organised a Training Course on "Improvement of Data Base on Livestock Resources" at the Indian Agricultural Statistics Research Institute, New Delhi-12 from 1-6 December, 1980 as per request from the FAO Regional Animal Production and Health Commission for Asia, The Far East and the South West Pacific (APHCA).

The purpose of the Training Course was to impart training on the development of the basic framework for research and analytical studies which will be needed in the in-country's training workshop for national statistical personnel and the development of a continuing statistical programme on livestock. 21 participants from 7 APHCA countries (Bangladesh-3 ; Malaysia-3 ; Pakistan-2 ; Philippines-1 ; Sri Lanka-3 ; Thailand-3 ; and India-6) attended the Training Course. Dr. D. Singh, Director, IASRI was the Course Director and Dr. K.C. Raut, Head, Division of Statistical Research in Animal Sciences, was the Co-Director of the Training Programme.

The Training Course was inaugurated by Shri Baleshwar Ram, Hon'ble Minister of State for Agriculture and Rural Reconstruction, Government of India on 1st December, 1980. Dr. Y. Prasad, Animal Husbandry Commissioner, Government of India and Permanent Delegate of India to APHCA welcomed the participants. Dr. Tim Bhannasiri, Chairman, APHCA and Director-General of the Department of Livestock Development, Thailand addressed the participants at the Inaugural Function.

A Manual "Methodology for improvement of data base on livestock resources" was brought out on the occasion of the Training Programme. This Manual formed the basis of discussion during the training period. Resource personnel for delivering lectures were drawn from Central and State Governments as well as ICAR Research Institutes in addition to the scientists of IASRI. A list of topics covered by various lecturers and discussants is as follows ;

<i>Sl. No.</i>	<i>Topic</i>	<i>Lecturer/Discussant</i>
1.	Role of livestock in national economy	Dr. D. Singh
2.	Plan for livestock development	Dr. Y. Prasad
3.	Methods of collection of livestock numbers and their improvements.	Sh. R. Raghunathan Sh. Dharmendra Kumar

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| 4. | Estimation of livestock products. | Dr. B.B P.S. Goel |
| 5. | Assessment of livestock development programmes. | Dr. H.P. Singh
Dr. J.P. Jain |
| 6. | Availability and requirements of feed stock and their nutritional aspects. | Sh U.G. Nadkarni
Dr. Shivtar Singh |
| 7. | Livestock breeding. | Dr. Prem Narain |
| 8. | Economics of livestock and its products. | Dr. K.C. Raut |
| 9. | Livestock management & labour utilization. | Dr. R K. Patel |
| 10. | Contribution of livestock and its production in national income. | Mrs. Uma Roy Choudhary
Sh. T.P. Abraham |
| 11. | World Census of Agriculture with special reference to improvement of livestock. | Dr. D. Singh
Sh. R.G. Pendse |
| 12. | Development of livestock Data Base. | Dr. S.S. Pillai
Sh. R. Gopalan |

In addition to the manual, a booklet containing the lecture notes was brought out as supplement to the manual. Each participant was given some publications brought out by IASRI dealing with statistical methodology as applied to livestock and its products. The participants were shown the charts and graphs displayed in the Exhibition Room of the IASRI. They discussed in brief the progress made in the respective countries in the field of livestock statistics and allied fields and problems faced. The participants were taken on a field trip to Agra, in addition to a visit to Delhi Milk Scheme and other places of interest in Delhi.

The Valedictory Function was presided by Dr. M.S. Swaminathan, Member, Planning Commission, Government of India. He addressed the participants highlighting the importance of data base and problems faced by various APHCA countries in Agriculture and allied fields. He distributed the certificates to the participants at this function. Dr. A.S. Alwan, FAO Representative in India also addressed at the Valedictory Function. On behalf of the participants Dr. N. Tilakratna from Sri Lanka offered thanks to APHCA, Govt. of India and the organisers of the Training Course. The Course Director expressed sincere thanks to Dr. B.K. Soni, Secretary, APHCA for his efforts to organise the Course in India and particularly at IASRI, New Delhi-12.

15. SUMMER INSTITUTE ON "ADVANCED STATISTICAL METHODOLOGY AS APPLIED TO ANIMAL SCIENCES"

The Summer Institute was organised from 6th May to 4th June, 1980 at the Indian Agricultural Statistics Research Institute, New Delhi-12. The objective of the Summer Institute was to provide necessary orientation to research workers and teachers of agricultural statistics working in ICAR Institutes, Agricultural Universities and Colleges and State Departments of Animal Husbandry/Dairying to update their knowledge of statistical methodology as applied to animal sciences and livestock development.

The Summer Institute was attended by 18 participants from various organisations besides 3 departmental candidates from IASRI. Out of these 21 participants, 11 were from agricultural universities, 6 from ICAR Institutes, and 4 from State Departments of Animal Husbandry and Veterinary Services.

Dr. K. C. Raut, Head, Division of Statistical Research in Animal Sciences, I.A.S.R.I. was nominated as Director of the Summer Institute. A Committee of scientists dealing with statistical research in animal sciences at IASRI was formed to assist him in various academic and organisational aspects.

During the period of the Summer Institute, 52 lectures, 7 practicals and 9 group discussions were organised. The lecturers and discussants were chosen from amongst the scientists of IASRI, and a few distinguished persons from other organisations specialised in the field. A list of topics on which the lectures were delivered, practicals conducted and group discussions held is given in appendix VII. Lecture notes were distributed to the participants in advance to enable them not only to appreciate and understand the theme of the lecture but also to help in clearing their specific doubts, if any. Each participant gave a Seminar Talk on his work as well as problems. They used to visit daily the Institute Library, Exhibition Room and consult individual scientist of the Institute on various research problems. Two Tests, one in the middle of the session and second at the end were conducted to assess the extent of participation and understanding.

A Field Trip was organised from 20th to 23rd May, 1980 during which they carried out a livestock survey both in a Ward in Dehradun City and in a village (Sinaula) in Dehradun district. The schedules were designed to work out the average milk yield of a cow/buffalo per day, daily milk production in a household, consumption and utilisation of milk, feeding and management practices of animals, wool yield of a sheep, egg production and their utilisation in a household etc. General information about the sample household as well as for the village was also recorded. The participants visited the Military Dairy Farm at Dehradun on 21st May, 1980 and acquainted themselves with the type of records maintained, breeding programmes followed etc. They also visited Pashulok Farm (U.P.) on 23rd May, 1980 where exotic sheep are maintained.

An assignment was given to the participants to formulate a project for estimation of current demand for milk and egg in a city and likely demand in five years hence. They were asked to give objectives, technical programme, practical utility, staffing pattern, items of information to be collected and a broad idea about the cost involved in undertaking such a project.

Evaluation proforma was prepared to judge the success of the Summer Institute and the same was filled in by the participants at the end of the Course. Based on the evaluation, it was worked out that 80% of the participants were satisfied about the duration of the Summer Institute whereas the rest suggested either for more or less duration.

Regarding the coverage and usefulness of the topics, 90% were satisfied with the content and quality of lectures, practicals and group discussions. About 90% expressed that the field visit was very useful. From the overall impression of the participants, about the Summer Institute, 50% expressed as either excellent or very good, 30% good and remaining 20% rated as useful.

At the end of the Summer Institute a Certificate was given to each participant for successful participation.

A detailed report on the Summer Institute has been submitted to the I.C.A.R. Attempts are being made to put together all the lecture notes and bring out a compendium which would be useful for all research workers engaged in statistical research as applied to animal sciences.

16. OTHER ACTIVITIES

16.1 LAB to Land Programme

Under the ICAR Lab to Land Programme implemented during 1979-80, the Institute had adopted 100 families in the village Garhi Randhala located in Kanjhawala block of Delhi. Due to economic and social changes that took place in the village during the last one year, the status of some of the households in the village also changed. The selection of 100 families under this programme was accordingly modified and during the year under report these families comprised 34 small farmers, 26 marginal farmers and 40 landless agricultural labourers. A programme of economic uplift of these families by communicating the latest agricultural technology in crop management and animal husbandry aspects and providing vocational training etc., as a means for regular source of income was taken up.

Achievements and progress of key components of the programme during the year ending December, 80 are given below :

16.1.1. Crop Production

(a) **Introduction of new crops** : There was no practice of cultivation of pulses in the village before the implementation of Lab to Land Programme. To encourage pulses cultivation in the village, 29 demonstrations on summer moong were conducted during 1980. The average yield of moong was obtained at 2.45 q/ha.

(b) **Popularisation of vegetable cultivation** :—As a result of extension activities in the field of vegetable cultivation the area under vegetables in the adopted holdings rose from less than 1 acre before the implementation of the programme to more than 22 acres during the year under report. Two demonstrations each on brinjal and cauliflower and four demonstrations on tomatoes were laid out. The results of these demonstrations were found to be very encouraging.

(c) **Supply of newly developed high yielding varieties of wheat and bajra** :—The cultivators used to grow mostly the Kalyan Sona variety of wheat as they could not procure seeds of other HYV from any source. With a

view to multiply seeds of new varieties, five demonstrations were conducted on wheat cultivation in 1979-80. They included one each on W.L. 711, HD-2204 and HD-2177 and two on HD-1553. With the adoption of recommended package of practices the per hectare yield of these varieties was recorded as under:—

HD-2177= 35.6 Q., W.L. 711=38.80 Q,
 HD-1553= 55.6 Q., HD-2204=46.0 Q,

During rabi 1980-81, 25 demonstrations on H.D.-2009 and 32 demonstrations on HD-2204 were laid out. The crop had made good progress in all the fields.

Similarly, hybrid bajra variety Cm-46 was supplied to 51 cultivators to conduct demonstrations on bajra cultivation during 1980 kharif season. The average yield of bajra was obtained at 12.60 q/ha.

(d) Fertilizer application :—The practice of applying superphosphate for crop production was not in vogue in the village. However, few cultivators used DAP in wheat crop. Therefore, use of single superphosphate was demonstrated in the production of *tomato crop*. It was also found that most of the cultivators were applying entire manures and fertilizers as basal dose. Therefore, the application of fertilizers was recommended in split doses for higher production of crops.

(e) Use of weedicides for control of weeds :—Demonstrations on use of weedicides 2, 4-D for control of broad leaved weeds in wheat crop were carried out for the first time in the village. The results were found to be quite satisfactory.

(f) Use of pesticides :—Demonstrations on spraying of pesticides against aphid attack in mustard crop were conducted in four fields in 1980. The use of lindane and Paratox proved to be very successful in controlling the pest. Similarly, Zink Phosphide was successfully used for control of rats in wheat crop.

(g) Use of Bacterial culture :—Demonstrations were carried out on use of moong culture for better germination of moong seeds. Cultivators were also educated about the use of Berseem culture. Literature in Hindi containing instructions for seed treatment with culture was also supplied to the farmers.

16.1.2 Reclamation of alkaline soils :

Two demonstrations on reclamation of alkaline soils with use of gypsum were conducted on the fields of two cultivators. Barley was sown in these fields after treating the soil with gypsum and flooding with water. The crop had germinated well in both the fields.

16.1.3 Land levelling and shaping :

There are a number of undulating fields comprising an area of about 20 acres in the village. Most of these fields belong to the families adopted under the programme. Due to steep gradient it was not possible to raise irrigated crops in these fields. Levelling of 8 such fields belonging to as many cultivators was taken up during the months of August and September, 1980. Now, the farmers are able to raise irrigated wheat crop in these fields. Levelling of other fields belonging to the adopted families will be taken up during the next June-July months.

16.1.4 Communication of improved practices in animal husbandry and dairy :

(a) **Animal health care** :—Almost all the cattle and buffaloes belonging to the adopted families as well as those kept by the Scheduled Castes families for grazing were vaccinated against HS diseases in July, 1980. Again 100 animals were vaccinated against Foot & Mouth disease in Sept., 1980. No animal was reported suffering from these diseases after vaccinated in the village.

(b) **Dairying** :—The use of HAFED balanced cattle feed for increasing milk yield was introduced in the village for the first time in January, 1980. 26 demonstrations on the holdings of landless agricultural labourers and 35 on those of small and marginal farmers were conducted from January to April, 1980. The demonstration conducted in Jan., 1980 showed an increase in milk yield by 1 to 3 kg. per animal per day while the improvement in milk yield in the month of April was reported to be 1 to 2 kg. in most of the cases. Demonstrations on balanced cattle feed were carried out in the holdings of 20 landless agricultural labourers in the month of November, 1980. On an average increase in milk yield of about 2 kg. per animal per day was obtained by these families. It was observed that some of the farmers had started use of HAFED feed from their own resources.

16.1.5 Vocational Training of Village Youths :

Under the various training programmes offered by the Delhi Administration five village youths—two belonging to the adopted families and three to other families were given 4 months training in khadi weaving. This training will provide self employment opportunity to these youths of landless agricultural labourers. It is expected that each of the youths will be earning about Rs. 20/- per day for his family.

16.1.6 Testing of soil and water samples :

52 soil samples and 1 water sample were got tested in the soil laboratory at IARI in 1980. The analysis results were communicated alongwith recommendations of fertilizer doses to the respective cultivators.

16.1.7 Publicity and extension activities :

(a) **Field days** :—Ten Field Days were organised in 1980 to educate the farmers about the improved package of practices for kharif, rabi and summer crops. The farmers were also shown various demonstration plots laid out under different crops like wheat, moong, bajra and vegetables. The demonstration plots for reclamation of alkaline soils were also visited by the cultivators. Levelling operation undertaken in undulating fields was also demonstrated to the farmers.

(b) **Extension Literature** :—Pamphlets and literature in local language i.e., Hindi containing package of practices for different crops were distributed among the farmers.

(c) **Kisan Melas** :—All the adopted farmers were invited to visit the Krishi Vigyan Melas organised by the IARI. A number of them visited the Mela. They were taken around different stalls and acquainted with the latest developments in various fields of agriculture, animal husbandry and agricultural engineering.

16.1.8 Social Forestry :

About 200 plants of different fruits like, guava, ber, amla and lemon were distributed to the adopted families belonging to small, marginal farmers and landless agricultural labourers to provide them with additional source of income.

16.2 All-India Inter-zone Final Sports Meet

As a part of the Golden Jubilee Celebrations of the ICAR, a beginning was made by the Council to organise sports activities in the ICAR. All the Institutes, excepting the three national Institutes, i.e., I.A.R.I., N.D.R.I. and I.V.R.I. were divided into four zones in accordance with their locations. The teams of the three national Institutes and the winners of the zonal tournaments will formulate the 7 groups, which will play the final tournaments.

Our Institute was placed in the North Zone and grouped with CPRI, Simla ; CSSRI, Karnal ; CSWCRTI, Dehradun ; VPKAS, Almora ; NBPGR, New Delhi and ICAR Headquarters. For this purpose, to promote and organise sports activities at the Institute, a Sports Committee has been constituted as follows :

1. Shri S.K. Raheja	Senior Scientist (S-3)	President
2. Shri R.N. Bakshi	C.A.O.	Vice-President
3. Shri K.K. Tyagi	Scientist (S-1)	Convenor
4. Shri O.P. Khanduri	Tech. Asstt.	member
5. Shri M.S. Verma	Tech. Asstt.	„
6. Shri Narain Singh	Assistant	„
7. Shri D.P.S. Mann	L.D.C.	„

In the North Zone Sports Meet held at CSSRI, Karnal from 28th Nov., to 1st Dec., 1979, the Institute Contingent consisted of Shri S.K. Raheja, contingent Leader, Shri P.N. Vali and Shri Panna Lal as Managers and Sh. S.L. Dua as Treasurer alongwith 22 sportsmen. For detail, please see the Annual Report, 1979.

The winners of the four zones along with teams from IARI, NDRI and IVRI met for the All-India Championship in the Inter-Zone Final Sports Meet held at NAARM, Hyderabad from 18th Feb. to 24th Feb., 1980. In all 27 ICAR Institutes participated. The following sportsmen of IASRI won position in the following events :

<i>S. No.</i>	<i>Events</i>	<i>Name</i>	<i>Position</i>
1.	Table-Tennis (Singles)	Sh. O.P. Khanduri	I
2.	Table-Tennis (Doubles)	Sh. O.P. Khanduri Sh. K.K. Tyagi	
3.	Hammer-Throw	Sh. P.S. Rai	III

The Sports Contingent consisted of Shri S.K. Raheja, Contingent Leader, Sh. Panna Lal, Manager and 15 sportsmen. Sh. R.S. Khatri was included in the Kabaddi-Team in place of Shri Ashok Kumar.

17. SUMMARY OF THE REPORT

17.1 Statistical Research In Crop Sciences

17.1.1 Planning of experiments and coordination of their statistical analysis under the All India Coordinated Agronomic Research Project.

The work done and the results achieved in different regions covered under the Project are as follows : (Item 17.1.2, 17.1.3, 17.1.4 and 17.1.5).

17.1.2 Planning of Experiments, Statistical Analysis and interpretation of data under the All India Co-ordinated Agronomic Research Project (AICARP) in Northern and North-Western Region of the Country.

During the year under report, data of 1950 experiments conducted on cultivators' fields and 120 complex experiments at Agronomic Research Centres during 1978-79 were statistically analysed. The salient results achieved have been briefly given in the IASRI Annual Report, 1979. Some more results for 1978-79 are as follows :—

(a) Experiments at Agronomic Research Centres (ARC)

For gram crop fertiliser application could be sealed down to the extent of 25% of the recommendations at Purafarm and Hanumangarh while at Bichpuri such a possibility existed only upto 75% of the recommended fertiliser level. For mustard crop 25% reduction in fertiliser level over the recommended dose was found possible at Bichpuri. At Banswara lower levels of irrigation caused a reduction in the yield by about 3.0 q/ha. At Purafarm fertiliser dose could be reduced to 75% of the recommended dose for rai crop.

At Pantnagar delayed sowing of RR-21 and HD-2204 by one month from normal period, resulted in increase in yields by 7-9 q/ha. At Ludhiana delaying sowing by a fortnight significantly increased the yields of HD-2204 by 3.0 q/ha.

At Hanumangarh WL-711 variety was found to be the best suited at 150 Kg. N/ha. At Talab Tilloo KSM L-3 and at Ludhiana WL-711 gave the highest yield at the level of 120 Kg. N/ha.

During kharif rhizobium culture was found to be more effective on cowpea than on moong in Hissar providing an additional response of about 1.6 q/ha. During rabi residual effect of rhizobium applied during kharif to cowpea was more pronounced than moong on succeeding wheat crop. Fallowing during kharif season resulted in significantly higher grain yield of wheat as compared to all the treatments.

To obtain higher yields of bajra economy in the use of fertiliser through FYM substitutions was indicated at 75% level ($N_{90}P_{45}K_{45}$) at Hanumangarh. To wheat crop no such possibility existed at any fertilizer levels.

To Bajra crop chemical weed control was not found to be more effective as compared to weed free check both at Bichpuri and Hanumangarh. No residual effect of the weed control treatments applied during kharif was exhibited in wheat during rabi at either of the centres.

(b) Experiments on cultivator's fields (ECF)

For irrigated rice application at $N_{120}P_{60}K_{60}$ gave the highest response in Kurukshetra, Gurudaspur and Kangra which ranged from 22-29 q/ha. Application at N_{120} alone gave response of about 10 q/ha in Hamirpur. A significant response to zinc sulphate was also observed in Kurukshetra, Gurdaspur and Kangra. In case of wheat application of $N_{120}P_{60}K_{60}$ was found adequate in all the districts. At this level the response was the highest in Agra (29.2 q/ha) followed by Bundi, Farrukhabad and Hissar (around 25.5 q/ha) while it ranged from 17-22 q/ha in other districts.

The newly released varieties of bajra BK-560 in Delhi, BJ-104 in Sawai Madhopur, CHS-5 variety of jowar in Bundi and Ganga-2 variety of maize in Chittorgarh performed steadily better than the locally popular varieties at these locations. These varieties gave consistently high response at all levels of nitrogen application. The pre-release variety K-468 of gram established its superiority over T-3 the standard variety in Lalitpur, Hamirpur and Agra. There was significant improvement in yield with increase in the level of phosphorus application in these districts.

For cereal crops wheat, barley and jowar grown under dry land conditions the nitrogen response continuously increased upto 90 Kg. N/ha, the highest dose tried. Application of phosphorus at moderate level of 30 Kg P_2O_5 /ha. in conjunction with nitrogen was useful in accelerating the yield rates. Responses to potassium as also to zinc sulphate were generally negligible.

For bengalgram and blackgram, results indicated that application of phosphorus alone is not adequate but it needs to be applied in conjunction with nitrogen at moderate level. A dose of $N_{20} P_{40}$ was found suitable at which responses of the order of 6-7 q/ha of blackgram were obtained.

For oil seed crops grown under rainfed conditions, high responses were obtained at 60Kg. N/ha when applied with increased levels of phosphorus in the districts of Farrukhabad, Bundi, Lalitpur and Hamirpur (for sesamum) Farrukhabad, Delhi, Sawai Madhopur, Kangra and Hissar (for mustard) and Hamirpur and Lalitpur (for linseed). A dose of $N_{60} P_{40}$ gave response of 3-4 q/ha for sesamum and 4-5 q/ha for mustard and linseed.

17.1.3 Planning of experiments, statistical analysis and interpretation of data under the AICARP in Arid Western Plains, Humid Bengal-Assam and Eastern Himalayan region

The Statistical analysis of 94 successfully conducted experiments at 10 ARC and of 1650 experiments conducted on cultivators' fields in 11 ECF districts during kharif and rabi 1979-80 were carried out. The project report for 1978-79 had been published. The salient results are presented in I.A.S.R.I. Annual Report, 1979.

17.1.4 Planning of experiments, statistical analysis and interpretation of data under the All India Co-ordinated Agronomic Research Project in Southern Region

During the Year under report, data of 75 experiments conducted during 79-80 at 6 Agronomic Research Centres and of 3142 experiments conducted on cultivators' fields in 18 districts were statistically analysed. The project report relating to the data for 1978-79 was published. The salient results achieved were briefly given in IASRI Annual Report, 1979. Some more results for 1978-79 are as follows :—

(a) Experiments at Agronomic Research Centres (ARC)

At Karaiyiruppu Maize-Rice-Bajra rotation gave the maximum grain production (130.8 q/ha) but Ragi-Rice-Cotton rotation was found to be more profitable (90.5 q/ha of grain + 15.8 q/ha of Kapas). At Siruguppa reducing the level of irrigation from 5 to 3 for crops like wheat, bengal-gram and safflower did not appreciably affect the yield and plots receiving reduced level of irrigation showed greater residual effect on the succeeding Jowar crop (17% increase). At Siruguppa onion was found to be the most suitable intercrop

with Sugarcane. At Karaiyiruppu and Bhavanisagar green-gram was found to be a suitable intercrop with Cotton. At Mangalore combined application of FYM at 12 tonnes/ha + $N_{30}P_{15}K_{15}$ was found to be beneficial while at Bhavanisagar FYM at 12 tonnes/ha was found to give more or less equal response at $N_{30}P_{15}K_{15}$ but their combined application was not found to be beneficial. At Bhavanisagar sulphur coated urea gave higher response in direct and cumulative phases. At Karaiyiruppu 5 tonnes/ha of azolla + 30 Kg N/ha gave higher yield than 60 Kg N/ha as fertilizer. At Maruteru medium duration rice variety in kharif followed by medium duration variety of rice in rabi gave highest annual production (12.8 tonnes/ha).

(b) Experiments on cultivators' fields (ECF)

(i) Fertilizer requirements of different crops

Rice :— At lower levels balanced application of fertilizer at $N_{40}P_{20}K_{20}$ was found to be beneficial in Madurai, Tiruchirappalli, North Arcot, Khammam, Krishna, Tumkur, Belgaun and Medak. At moderate levels $N_{80}P_{40}K_{40}$ was found to be beneficial in Madurai, Tiruchirappalli, North Arcot, Prakasam and Tumkur. Consistently higher response to $N_{120}P_{60}K_{60} + Z_{n25}$ was observed in Madurai district.

Wheat :— Balanced application of $N_{40}P_{20}K_{20}$ was found to be beneficial in Bidar, Belgaun and Khammam. Increasing the fertilizer levels beyond this was not economical in any of the districts.

Maize :— $N_{40}P_{20}K_{20}$ was found to be economical dose in Belgaun.

Jowar :— $N_{40}P_{20}K_{20}$ was found to be economical in Belgaun and Prakasam.

Bajra :— Economic response was obtained up to $N_{80}P_{40}K_{40}$ in Prakasam.

Ragi :— Beyond $N_{40}P_{20}K_{20}$ it was not economical in Prakasam district.

Cotton :— Varalaxmi gave almost double the response (13.5 q/ha) at $N_{120}P_{60}K_{60} + Z_{n25}$ as compared to Mysore Vijaya (6.7 q/ha) in Belgaun.

(ii) Relative performance of pre-release and standard varieties of cereals

Rice :— During kharif TKM-9 (Madurai), Masuri (Medak), NLR 9672, NLR 9674 (Prakasam), MTU 8002, MTU 8089 (Krishna),

Phalguna, Culture 3234 (Khammam), MTU 4569, MTU 9416 (East Godavari), Intan (Chikmagalur), IR 36 (Kozhikode and Kottayam) were found to be suitable varieties for the districts indicated in parenthesis. During rabi ADT 31 (North Arcot) and BPT 125 (East Godavari) performed well.

(iii) Fertilizer requirements of different crops under dryland

$N_{30}P_{30}$ was found adequate for kharif Jowar in Bidar and Medak for wheat in Chikmagalur and for variga (Common millet) in Prakasam. Application of phosphate alone was not found to be beneficial to groundnut and pulses. $N_{20}P_{20}$ was found to be adequate for green gram in Bidar and Khammam and for Blackgram in Bidar and Medak. Sesamum responded well to $N_{60}P_{40}$ in East Godavari and Sunflower to $N_{60}P_{40}K_{60}$ in Medak.

(iv) Fertilizer requirements under resource constraints

In East Godavari 25% reduction in recommended level of $N_{120}P_{60}K_{60}$ of fertilizer in Kharif and full application of fertilizer $N_{120}P_{60}K_{60}$ during rabi resulted only in 1% fall in annual production. In Kottayam application of 50% recommended fertilizer of $N_{120}P_{60}K_{60}$ both during kharif and rabi resulted in 3% fall in total production.

17.1.5 Planning experiments, statistical analysis and interpretation of data under AICARP in Sub-Humid to Humid-Eastern and South-Eastern uplands and Semi-arid Lava Plateaus and Central High Lands

During the year under report, the data of about 1920 experiments conducted in 9 districts on cultivators' fields both under irrigated/adequate rainfall as well as under dryland conditions and 170 complex experiments conducted at 16 Model Agronomic Centres were statistically analysed. The salient results have been briefly given in IASRI Annual Report, 1979. Some more results for 1978-79 are as follows :

(a) Experiments at Agronomic Research Centres (ARC)

In the production potential experiment the high intensity crop sequence including cereal and pulse was identified. At Navsari Rice-Wheat-Greengram gave a yield of 10.9 tonnes/ha and crop sequence including fodder crop Bajra-Wheat-Maize (Fodder) tried at Junagadh gave a maize fodder (Gs-2) yield of 18.1 q/ha besides a grain yield of 3.2 q/ha of cereals in a year.

In production potential experiment under resource constraints, for wheat crop the fertilizer level could be reduced by 25% at Akola and 50% at Raipur. For gram crop reduction to the extent of 75% at Jabalpur and Indore and 50% at Akola was found possible.

Studies on inter-cropping indicated that inter-cropping did not affect the yield of main crop. Rather at Rahuri, in normal planting pattern intercropping of groundnut increased the yield of main crop of jowar which ranged from 4.6 to 5.5 q/ha as against 4.4 q/ha for pure stand. In this pattern the yield of groundnut varied between 9.1 to 12.4 q/ha.

At Navsari by mixed cropping of wheat and mustard the yield rate of mustard improved but the wheat yield was affected substantially. At none of the other centres mixed cropping was found to be superior to single crops.

(b) Experiments on cultivator's Fields (ECF)

In Baroach, application of $N_{90}P_{60}K_{60}$ increased the yield rate of wheat from about 7 q/ha (for unfertilised plots) to about 21 q/ha. In Satna, the corresponding increase in the yield of wheat was from 9 q/ha (for control) to 22 q/ha.

Bengal-gram gave a good response of about 5 q/ha to 40 kg. P_2O_5 /ha in Satna and Ujjain. The gram varieties JG-62-404 in Ujjain and J-62 in Satna gave good response of over 6 q/ha to 20 Kg. N/ha. The treatment $N_{20}P_{20}$ was found to be superior in most of the districts.

Application of a small dose of nitrogen at 20 Kg. N/ha was beneficial to greengram in Baroach and Kutch. The same level of nitrogen application was found to be beneficial to black-gram in Satna and Soyabean in Ujjain. Application of $N_{20}P_{20}$ was also found to be beneficial to black-gram and Satna. For groundnut good responses varying between 3.4 to 5.7 q/ha were obtained to $N_{20}P_{60}$ at Amravati, Nanded and Amroli. In Sangli the treatment $N_{20}P_{60}K_{60}$ gave the highest response of 6.2 q/ha.

The application of $N_{90}P_{60}K_{30}$ was found to be more beneficial in Banas-kantha which raised the yield rate of castor from 15 q/ha to 34 q/ha.

17.1.6 Co-ordination and planning unit of National Index of Agricultural Field Experiments

The consolidated zone-wise (Eastern, North-Western, Southern and Uttar Pradesh) progress report is as follows :—

The regional staff reported during the year, data relating to 2,735 experiments conducted since 1972. Inclusive of these, data of about 17,700 experiments conducted since 1972 have so far been reported to the Institute.

The 'Annual Index of Agricultural Field Experiments' giving the brief details of the experiments, collected by the regional staff during a year, were being periodically published and circulated among the different scientists connected with agricultural research and extension. The latest in the series e.g. Vol. VI in respect of experiments received at the Institute during the year 1977 has been published.

The printing of Vol. VII in respect of experiments reported to the Institute during 1978 was in progress and the material other than for the states of Uttar Pradesh and West Bengal was completed. The processing of the material for the subsequent volume in respect of the experiments reported to the Institute during 1979 was completed. For loading the data on tapes, the punch cards in respect of the experimental data of central Institutes for the period 1960-65 were compared and correction of cards was in progress. Work relating to formulation of coding scheme coding sheets and detailed instructions for their codings for the initiation of Agril. Field Experiments Information System was initiated.

17.1.7 Effect of different improved practices on the production of tobacco

The data of 491 experiments collected under the scheme of NIAFE on tobacco crop were sorted out. The salient results achieved are as follow :—

The green leaf and cured leaf yield of different varieties increased in general with the increase in level of Nitrogen under irrigated conditions in Karnataka, Tamil Nadu, Gujarat and Andhra Pradesh. The yield level of green leaf for Delcrest variety in Gujarat was the highest to the application of fertilizer at 40 Kg. N/ha. The yields obtained were of the order of 54 q/ha and 60.7 q/ha for cured leaf as well as Delcrest was found to give the highest yield being about 10.5 q/ha at 20 Kg. N/ha and 11.5 q/ha at 40 Kg. N/ha.

Application of phosphorus even upto 100 Kg. P_2O_5 /ha for any of the varieties did not benefit the crop yield (Green leaf and cured leaf yield). Application of potassium @ 100 Kg. K_2O /ha under irrigated conditions in Gujarat showed considerable increase in green leaf yield for the varieties Delcrest, Kicks and Virginia Gold. The increase in yield for different varieties were 4.78,

6.55 and 3.88 q/ha respectively. In Andhra Pradesh the yield for cured and bright leaf of these varieties remained unaffected with the application of 100 Kg. K_2O /ha under irrigated conditions.

The yield of almost all the varieties increased in all the States with the increase in the level of FYM application. The maximum increase of 1.52 q/ha in green leaf yield of HR-62-7 variety in Gujarat, was obtained when FYM was applied @ 50 tonnes/ha. Topping treatment increased the cured and bright leaf yield significantly in Karnataka and Andhra Pradesh for all FCV varieties under unirrigated conditions. The increase in yield of bright leaf varied from 0.24 q/ha to 1.88 q/ha for different varieties. In case of cured leaf yield the increase varied from 0.29 q/ha. to 1.09 q/ha.

In irrigation experiments a steady increase in total leaf and bright leaf yield was observed when the level of irrigation was increased to one, two and three irrigations upto 80% field capacity. The increase in total leaf yield with one, two and three irrigations are 3.57, 4.25 and 4.62 q/ha as compared to no irrigation. The variety used was Anand-2 in Gujarat State. The types of tobacco were FCV and Bidi.

17.1.8 Study of agronomic constraints in Tungabhadra River Valley Project Area

The project report had been finalised. The salient results achieved are as follows :—

Project report of a case study was taken up to assess the progress in production and productivity of food grain and oilseed crops and indicate the possibilities of improvement in the command area of Tungabhadra River Valley Project spread-over Anantapur, Cuddappah and Kurnool districts of Andhra Pradesh and Bellary and Raichur districts of Karnataka, was finalised. Ultimate irrigation potential of the project is 5.1 lakh hectares and 80-90% of the area was earmarked for light irrigation, growing crops like, jowar, cotton, wheat, gram etc.

Constraints experienced in the adoption of cropping pattern arose out of the encouragement given to farmers to grow any kind of irrigated crops with a view to create a climate for irrigated agriculture. Over years, unauthorised irrigation in certain pockets in upper reaches has upset the adoption of cropping pattern inadequate/untimely/non-supply of water to the tailenders, as the canals are not working to full capacity due to weakness and breaches and

drainage system neglected over years has added to the land management problems. Allocating the same outlet for perennial, wet, dry cum wet cultivation as well as kharif and rabi seasons in the left bank is a serious handicap.

The cereal, pulse and oil seed production which were 1.00, 0.04 and 0.09 lakh tonnes before the commencement of the project in 1953 have increased to 5.33, 0.12 and 1.07 lakh tonnes respectively in 1977-78 leaving a gap of 3.03 lakh tonnes in cereals and 0.57 lakh tonnes in Oilseeds to attain targets., on Karnataka side which covers nearly 70% of the command. Sugarcane which was never grown before 1953 has reached the targeted production of 16.32 lakh tonnes. The targeted area for rice and sugarcane have been exceeded by 116% and 37% respectively by 1977-78.

There is scope for increasing the productivity of crops in the command. Irrigation facility could be profitably utilised to grow crops like wheat, jowar, bajra, which require only one third of water and have economic advantage over growing rice. Spread of high yielding varieties of these crops could be encouraged. Productivity of cereals, pulses and oilseeds could be increased between 40-100% by growing high yielding/hybrid/improved varieties with irrigation. Experimental data have indicated the feasibility of increasing the crop intensity from 100 to 300% and obtaining grain production of about 12 tonnes/ha. Possibility of introducing pulse and oilseed crops in the crop sequence have also been shown by these experiments. Increasing the land use efficiency through interc-ropping of wheat and cowpea in sugarcane gave additional yield of 1856 Kg/ha of wheat and 1472 Kg/ha of cowpea while maintaining the yield of sugarcane at about 108 tonnes/ha. Experiments on cultivator's fields have shown that growing high yielding varieties of rice with irrigation and fertilisers at 120 Kg.N, 60 Kg.P₂O₅ and 60Kg. K₂O/ha can yield as much as 6800Kg/ha as against targetted productivity of 5000 Kg/ha while that of groundnut could be raised from targetted productivity of 2500 Kg/ha to 3200 Kg/ha with 60 Kg. N, 30 Kg. P₂O₅ and 30 Kg. K₂O/ha.

17.1.9 Methodological studies on crops having multiple harvestings

The detailed information including raw data were collected from PAU, GAU and G.B. Pant University. The data were subjected to detailed statistical analysis. Centre-wise position of the analysis is as below :—

(i) Punjab Agricultural University, Ludhiana

A total number of 41 experiments on cotton were available. Number of pickings varied from 2 to 4 in different experiments. All the experiments were

conducted in RBD with 3 or 4 replications. The number of varieties varied from 12 to 30. Percentage contribution of various pickings towards total yield was calculated for all the experiments. The analysis of variance was performed separately for all the pickings and total yield also. The coefficients of variation for various pickings and total yield were calculated for all the experiments. The data on plant stand were made use of in performing the analysis of co-variance.

(ii) Gujarat Agricultural University, Surat

Data were available for 12 groups of experiments (39 individual experiments) on cotton. Number of pickings varied from 2 to 5. Out of 39 experiments 9 were conducted in split plot design, whereas, remaining 30 were in RBD. The percentage contribution of various pickings towards the total yield was calculated for all the experiments. The analysis of variance was performed separately for all the pickings and total yield. The co-efficient of variation were worked out for various pickings and total yield for all the experiments. As the data were available over a number of years the stability of various treatments/varieties was also examined by calculating the stability index.

(iii) G.B. Pant University of Agriculture and Technology, Pant Nagar

Data for 8 experiments on tomato have been collected from this university. Percentage contribution of various pickings towards total yield, analysis of variance and calculation of coefficient of variation for various pickings and total yield have been completed.

17.1.10 Statistical evaluation of Agricultural field experiments conducted during 1966-71 on wheat crop in U.P. State

818 field experiments collected under the Project, 'N.I.F.E.', 8 were analysed. The overall research index comes out to be 62.42% which indicates that research efforts were satisfactorily made. Some of the short falls are listed below :—

- (i) There were wrong judgement on the part of Scientists in selecting effective treatment levels in about 34% of the cases.
- (ii) Improper use of split plot design was indicated in about 17% of the experiments.
- (iii) In considerable number of cases disease control experiments were tried in the fields where there was no existence of disease.

- (iv) Cultural treatments mostly exhibit 10% of the general mean while in 80% of the experiments C.V. is more than 15%. Actually more than 6 replications were needed in such cases but usually only 4 replications were taken.
- (v) In many experiments, no consideration was made of heavy basal manure applied in whole of the experiments while deciding the levels of treatments under study.
- (vi) There was no judicious use of plot size keeping in view the soil, climate and topography of land. Same plot size was tried in far apart places like Varanasi and Meerut for the same set of treatments.
- (vii) More than three levels of N and P should have been tried.

17.1.11 A Study on agronomic and other factors in relation to the homogeneity of experimental errors in groups of experiments on Paddy crops

The salient results achieved were as follows :—

To investigate the agronomic and other factors favourable for homogeneity of error variances in groups of similar experiments, as many as 445 groups of experiments conducted on paddy crop under varied agro-climatic conditions all over the country were studied. The various factors considered were the soil type, irrigated condition, plot size adopted, no. of plots per block, block area, type of experiment and number of experiments per group. Association of homogeneity of error variances was tested with each of the above factors by χ^2 test. The tests revealed association of some of the factors with homogeneity of error variances. A few of the findings are as given below :—

The association of homogeneity of error variances appears to be strong with

- (i) Plot area \leq 45 sq. mts. under light soil group
- (ii) Block area \leq 600 sq. mts. under light soil groups but \leq 200 sq. mts. under irrigated condition or when the experiment relates to manurial type.
- (iii) Number of plots per block not exceeding 6 in case of m type of experiments or under heavy soil group or under irrigated condition and \leq 5 under unirrigated condition.

17.2 CROP FORECASTING METHODOLOGY

17.2.1 Pilot studies on pre-harvest forecasting of yield of crops on the basis of biometrical characters—Sugarcane, Jowar and Tobacco

The progress of work in respect of three crops is as follows (Item Nos. 17.2.2, 17.2.3, 17.2.4 and 17.2.5).

17.2.2 Sugarcane—Meerut District (Uttar Pradesh)

The data based on the pilot survey on sugarcane conducted in Meerut district during the year 1978-79 was analysed. The regression analysis was undertaken with seven different models. In first one, dependent variate (**Y**) and independent variates (X_i 's) were taken in the original scale. In models II, III and IV, X_i 's were transformed to logarithmic, square root and reciprocal scales respectively. In models V, VI and VII, both **Y** and X_i 's were transformed to logarithmic, square root and reciprocal scales respectively. Model-I was found at par with other models and superior to model-VII. Therefore, model-I could be used for forecasting purposes because of simplicity in computation and interpretation of results.

17.2.3 Sugarcane—Kolhapur District (Maharashtra)

In the pilot studies on pre-harvest forecasting of yield of sugarcane in Kolhapur district (Maharashtra)—1977-78, significant positive correlations between yield and different biometrical characters, namely, number of canes, height, girth and length and breadth of the third leaf were observed. The study of regression analysis showed that about 70-75% variation could be explained by these characters and it is possible to forecast the yield 3-4 months prior to harvest.

During the year under report, data collected during 1978-79 was analysed. The results revealed that as in the previous round of the survey, significant positive correlation was observed between yield and these characters. The results of regression analysis showed that about 75% of the variation in yield could be explained by the biometrical characters when the crop was about 7 months old. Similar trend was observed in the previous round of the survey also. The study also revealed that the three characters out of five namely height, number of canes and the girth in this order, are the most important. The study of different models with variables in original scale is in general best suited for prediction of yield.

17.2.4 Jowar—Sangli District (Maharashtra)

The survey data on Jowar in Sangli district for 1978-79 was analysed. The correlation studies showed that plant height, length and breadth of flag leaf and third leaf were positively correlated with yield in case of local jowar, while number of plants, plant height, breadth of flag leaf and third leaf and length of earhead were important characters contributing towards yield in hybrid jowar. The regression analysis revealed that about 40% variation in yield was accounted for by biometrical characters when the crop was 16 to 18 weeks old in case of local jowar. In hybrid jowar, 60% variation in yield could be explained by biometrical characters when the crop was 12-14 weeks old. Out of the seven regression models used model I, where all the variates were in original scale was found at par with other models and superior to model VII. Therefore, model I could be used for forecasting purposes because of simplicity in computation and interpretation of results.

17.2.5 Tobacco—Prakasam District (A.P.)

During the year under report, analysis of the data for 1978-79 was completed. The annual report for the year 1977-78 had been finalised for publication.

In the third round of the survey on tobacco in Prakasam district conducted during the year 1978-79, the results of correlation studies showed that number of plants, number of curable leaves, height of plant, length and width of leaf were correlated positively and significantly with yield at most of the stages of crop growth in red soil zone. In case of black soil zone, number of curable leaves was the only biometrical character contributing towards yield. Regression analysis was undertaken with four linear models in different scales. The results of regression analysis of red soil data revealed that about 40 to 55 per cent of the variation in yield could be explained by the above mentioned characters when the crop was about 10-14 weeks old. In black soil, about 40-50 percent of the variation in yield was accounted for by biometrical characters when the crop was about 12-14 weeks old. A comparison of four models suggested that linear model with variables in original scale is suitable for prediction of yield.

17.2.6 Pilot sample survey for estimating the incidence of pests and diseases and consequent crop loss in high yielding varieties of (i) Paddy—South Arcot District (Tamil Nadu) and (ii) Wheat—Gorakhpur District (U.P.)

The progress of work in respect of these two crops is as follows (item 17.2.7 and 17.2.8).

17.2.7 Paddy—South Arcot District (Tamil Nadu)

The report for Samba 1976 was finalised. Based on data for Navrai 1977, the results were obtained by applying the technique which involved the use of principal components of the incidences as regressor variables in the multiple regression analysis.

17.2.8 Wheat—Gorakhpur District (U.P.)

Analysis of part of the data pertaining to rabi 1978-79 season was completed and zone-wise estimates of the avoidable loss in crop yield through the adoption of suitable plant protection measures and also pooled estimate of such loss for the district were obtained. The avoidable loss in crop yield for the district was estimated as 323 Kg/ha with a standard error of 6 percent. The loss in percentage basis was 9.69 percent of yield possible through the use of suitable plant protection chemicals. Zone-wise, this loss ranged between 206 Kg/ha. to 384 Kg/ha. and in terms of percentage, between 6 to 14 percent.

17.2.9 Studies on forecasting crop yield based on weather parameters

The data in respect of Raipur district were collected and analysed for 25 years from 1947 to 1973. Study on joint effects of maximum temperature and relative humidity (14 hrs) revealed that beneficial and detrimental effects of the above average relative humidity on yield increased with the increase in maximum temperature. Beneficial effects of the above average maximum temperature on yield increased with the rise in relative humidity while detrimental effects decreased.

Composite model for forecasting rice yield of Raipur district using weekly weather variables namely, maximum temperature, relative humidity, total rainfall, number of rainy days, agricultural inputs such as fertilizer consumption, percent area under high yielding varieties and percent area under irrigation and fertilizer crop price ratio was studied. Results showed that additional contribution of agricultural inputs over trend was negligible suggesting that model using weather variables and trend alone could be used for forecasting which explained above 70 percent variation in rice yield.

173 STATISTICAL RESEARCH IN ANIMAL SCIENCES AND STATISTICAL GENETICS

17.3.1 Estimation of availability and cost of production of milk and its index in : (a) I.C.D. area, Bhopal (Madhya Pradesh); (b) I.C.D. area, Bikaner (Rajasthan)

The progress in respect to both the areas is as follows :—

(a) Estimation of availability and cost of milk production in I.C.D. area, Bhopal (Madhya Pradesh).

The report gives the sampling design, plan of work, estimation procedure along with the salient results. The average number of households per village in I.C.D. area, Bhopal was 69, of which 78% were having bovines. Among the households having bovines, as many as 85% have milch animals. On an average, 281 cattle and 77 buffaloes were maintained per village. About 52% of the households maintained only milch cows and 38% had both cows and buffaloes and 10% had only buffaloes. Cultivator class of producer was predominant and accounted for more than three-fourths of the total milk producers. On an average, 17 milch cows and 8 milch buffaloes were maintained in every 10 house holds. Ninety-nine percent of breedable cows were non-descript (N.D.), Among breedable buffaloes, 95% were N.D. and the remaining 5% Murrah. The overall daily production of milk in the I.C.D. area, around Bhopal, was about 70 tonnes of which 44% was accounted for by cow milk and 56% by buffalo milk. The average daily milk yield of a cow in milk was about 0.79 Kg. as compared to 1.80 Kg. per buffalo in milk. The corresponding estimates for a milch cow and a milch buffalo were 0.40 and 1.07 Kg. respectively.

The overall net cost per Kg. of cow milk during the period of survey was estimated to be 212 ± 10.4 P including family labour and 146.7 ± 7.7 P excluding it. The prevailing market rate of cow milk in the area during the same period was Rs. 1.80 per Kg. The net cost per Kg. of buffalo milk was 169 ± 4.7 P including family labour and 113 ± 3.1 P excluding it. The prevailing market rate of buffalo milk was Rs. 1.97 per Kg.

In the case of cow milk, feed cost, paid labour, family labour, depreciation on animals, interest on capital, depreciation on assets and equipments and miscellaneous recurring expenditure accounted for 46,6,28,5,8, 5 and 2 percent of the gross cost. The corresponding figures for buffalo milk were 42,7,23,10,12, 4 and 2 percent.

As much as 71 to 81% of total cow milk produced in commercial households in each season was consumed in fluid form, 9 to 11% was converted to milk products and the remaining was sold. Out of the total buffalo milk produced, 42 to 50% was sold and the remaining was utilised either as fluid milk or in the form of products.

The proportion of death in the area was about 6.5% among milch buffaloes as compared to 4 to 7 percent among cows.

(b) Index of cost of milk production in I.C.D. area, Bikaner (Rajasthan)

The report gives the method of constructing the index of cost of milk production. The method consists in first working out the indices of the major components of cost viz. feed and labour using Laspeyre's method and then combining these indices with suitable weights to obtain the desired index.

The production cost per Kg. of cow milk in I.C.D. area, Bikaner was 98 P during 1975-77. This was increased by 12% during 1977-78 and 19% during 1978-79, as compared to the cost during 1975-77. The market rate of cow milk during 1975-77 was 113 P. per Kg. There was an increase of 1% in the market rate of cow milk in 1977-78 and 6% in 1978-79, over the base period 1975-77.

The report also gives the indices of market rates of major feeds and fodders fed to animals as well as the labour wage rates for different categories of labour for the years 1977-78 and 1978-79, with respect to the base period 19 5-77.

17.3.2 National Index of Animal Experiments

(a) Southern & Eastern Research Station.

During the year under report, a compendium viz. 'National Index of Animal Experiments' Vol.1, Part VI, pertaining to animal nutrition experiments, 67 in number, conducted at G.A.U., Institute of Agriculture, Anand (Gujarat) during 1960-74, was published.

About 37% experiments were of C.R.D., 5% of R.B.D., 3% of switch over design, 1% Factorial experiments, 6% experiments of latin square designs and about 48% of experiments were not under any standard design.

(b) Northern and Western Research Stations.

A compendium viz., 'National Index of Animal Experiments' Vol. 1; Part V, Animal Nutrition experiments, 73 in number, conducted at R.B.S. College Bichpuri, Agra (1962-76) was published. About 12% experiments were of C.R.D., 5% of R.B.D., 2% of Switch over design and the rest were without any standard design mostly pertain to academic research.

17.3.3 Pilot studies for estimation of birth and death rates in bovines

The progress in respect to Punjab and Gujarat centres is as follows :

(a) Punjab Centre :

This report deals with the structure of the bovine population, as per complete enumeration of households in selected villages with respect to species, breed, sex and age as well as age-specific fertility and mortality rates estimated from a sample of households drawn for detailed enquiry. There were more buffaloes than cows in the region under survey. The breeds observed were Haryana and Sahiwal in cattle and Murrah and Nili in buffaloes in addition to the non-descript type under each species and a small number of cross-bred cattle and graded buffaloes. The percentage of cattle in the age group of 3 to 9 years to the total number of cattle under each area ranged from 51 to 66, the corresponding range in the case of buffaloes being 51 to 62. Age-specific fertility and mortality rates were worked out by Average Population Method and Fractional Exposure Method. Fertility rates generally showed an increasing trend over age within the fertility ages. Mortality rate was maximum among calves. It decreased as the animals grew in age and was generally low in the adult stock, though it again increased in the higher ages.

(b) Gujarat Centre :

The major breeds in the region were Kankrej in cattle and Surti in buffaloes which were predominant only in the I.C.D. area (Kaira distt.). Most of the bovines in the non-I.C.D. area (Panch Manhal Distt.) were non-descript. Other breeds, observed in small numbers, were Gir and Jersey among cattle and Mehsani and Jaffarabadi among buffaloes. Besides, there were very few cross-bred cattle and graded buffaloes in I.C.D. area. The percentages of animals in the age group 5 to 10 years in the two areas respectively, were 47 and 42 for female cattle, 59 and 52 for male cattle and 45 to 40 for female buffaloes. The percentage of male buffaloes in the same age group was less than 5 percent, most of the animals in this category being young calves below one year in age. Estimates of age-specific fertility rate were obtained. For the age groups 3 to 6, 6 to 9, 9 to 12 and '12 years and above', these rates ranged, in cattle, from 17.40 to 40.18 percent in I.C.D. area and from 19.10 to 26.50 in non-I.C.D. area, whereas in buffaloes these ranged from 27.96 to 33.77 in I.C.D. area and from 14.89 to 28.99 percent in non-I.C.D. area.

In I.C.D. area, mortality rate ranged from 0.28 to 17.43 per cent over the various age groups in female cattle, while it ranged from 1.04 to 19.02 percent in male cattle. In buffaloes, the mortality among females ranged from 0.51 to 20.22 percent. For male buffaloes mortality rates could be estimated only for the two age groups 0 to 1 year and 1 to 3 years and were as high as 61.55 and 29.94 percent respectively. In non-I.C.D. area the rates ranged from 1.92 to 10.72 percent in female cattle and from 2.39 to 16.43 percent in male cattle, while the corresponding percentages for buffaloes were between 2.21 and 15.41 in females and between 7.85 and 63.85 in males.

17.3.4 Index of cost of rearing calves and study of changes in rearing practices in rural areas, Haryana

The report gives a method of constructing the index of cost of rearing/maintaining bovines utilising the data on prices of feeds and fodders and labour wage rates collected during 1977-78 and inputs as estimated in the detailed survey conducted earlier during 1963-66. The method consists in first working out the indices of different components of cost using Laspeyre's method and then combining these indices through a system of working. The weights were the proportions of the components of cost to the gross cost.

The study has revealed that quantum of feeds fed to animals as well as the milk yield of milch stock during 1977-78 have undergone substantial changes, as compared to 1963-66. There is, thus an urgent need to repeat the detailed survey in the area to get precise estimates of rearing and maintenance of bovines.

17.3.5 Statistical investigations on economics of pig production

During the year, statistical analysis of the data collected from five farms viz., I.V.R.I. (Izatnagar), Composite Livestock Farm (Hessarghatta), Livestock Farm (Jabalpur), College of Veterinary Sciences at Mannuthy and Tirupati was completed. Data collected from 28 villages of Koil and Sikandra Rao tehsils of Aligarh district (U.P.) were also analysed.

The average daily cost of maintenance of an adult pig of 'Large White Yorkshire' breed ranged from Rs. 3.60 at Hessarghatta to Rs. 7.20 at Tirupati; that of young pig ranged from about Rs. 1.20 at Hessarghatta to Rs. 4.20 at Jabalpur and that of a creeper ranged from 22 paise at Hessarghatta to 71 paise at Tirupati. The cost of maintenance per pig per day of 'Land Race' breed at Izatnagar was Rs. 6.65 for an adult pig, about Rs. 4.50 for young pig and

about 66 paise for a creeper. This cost in field survey was very less which is about 90 paise for an adult pig, 45 paise for young pig and 12 paise for a creeper. The cost on feed alone formed about 45 per cent to 80 percent of the total cost in adult animals in farm data and only about 6 percent in field data. Labour formed about 85 percent of gross cost in field data and about 10 to 30 percent in farm data. Finalisation of the report was in progress.

17.3.6 A critical study on the changes in pattern of employment of rural working force in milk shed areas of (a) Madhavaram Milk Supply Scheme-Chingleput (T.N.) and (b) Greater Calcutta Milk Supply Scheme, Calcutta (W.B.)

(a) M.M.S. Madras

Secondary data collected under the bench mark survey "Impact of urban milk supply scheme on rural economy in milk collection areas of M.M.S.—Chingleput (T.N.)" were utilised for the study. A sizable section of adult working force in rural areas of Chingleput was engaged in agriculture and field work.

The proportion of under employed not fully employed and fully employed rural workers were roughly 32%, 40% and 28% respectively in supplying areas. In non-supplying area, these proportions were 32%, 48% and 20%. Eighty per cent of the working force were males and 20% females. The average hours spent by an adult female worker in dairying as main occupation was higher than an adult male worker.

(b) G.C.M.S. Calcutta

The secondary data pertaining to rural working force already collected under the bench mark survey "Impact of milk supply scheme on rural economy in milk collection area of Greater Calcutta Milk Supply Scheme, Calcutta, W.B." carried out in 1976-77 was utilised for preparing interim report.

17.3.7 Estimation of performance characteristics in bovines under village conditions (a) Bhopal Region, M.P. and (b) Chingleput Region, T.N.

(a) Bhopal Region (M.P.) :

The secondary data obtained from a large scale sample survey conducted by IASRI for estimating the availability and cost of production of milk in I.C.D. area, Bhopal (M.P.) during 1975-77 was utilised.

The breeding performance was examined by studying the age at first calving, calving interval and breeding efficiency. The average age at first calving and overall calving interval were 67.1 ± 1.48 and 68.7 ± 2.06 months and 662 ± 20 and 650 ± 21 days for cows and buffaloes respectively. The breeding efficiency was about 60 per cent for both cows and buffaloes. Season of calving had significant effect on lactation length in the case of cows. Overall lactation length and dry period were 354 ± 9 and 418 ± 18 days and 293 ± 15 and 265 ± 12 days for cows and buffaloes respectively. The gain in efficiency in the estimate of production parameters obtained was of the order of 25 per cent by utilising the available part of lactation records. The average lactation yield was 366.4 ± 16.97 and 849.6 ± 49.07 kg. for cows and buffaloes respectively.

Overall estimates for different characters were estimated with a fair degree of precision than the lactation wise average. The results obtained on lactation length, dry period on lactation and calving interval were consistent within reasonable limits for overall and also for lactation wise.

Mortality in male buffalo calves was significantly more compared to female buffalo calves. The deviation from the sex ratio of 50 percent was not significant. Analysis of distribution of calving indicated that the calving differ significantly in different seasons for both cows and buffaloes and was highest in the rainy seasons.

(b) Chingleput Region (T.N) :

The secondary data obtained from a large scale sample survey "Impact of milk supply scheme in milk collection areas of Madhvaram Milk Supply Scheme" Chingleput, Tamil Nadu (Bench Mark Survey) conducted by IASRI during 1975-76 was utilised for analysis.

17.3.8 Study of production functions of livestock products and determination of optimum feeding schedules

For the study, data on 9 experiments conducted on milk production and collected under the project, 'National Index of Animal Experiments' were utilised for the study. Different types of production functions were fitted to choose the best fit. The linear function was considered to be the best fit in a majority of experiments. Combinations of the input-factors which maximised the output could be found from only two experiments pertaining to Haryana cows and Surti buffaloes. Isoquants for fixed level of productions, marginal products of input-factors, marginal rates of substitution and production elasticities were worked out.

17.3.9 **Economics of Poultry keeping; Study of functional relationships between production and input factors**

From the study it is observed that layer days and feed cost per layer explained a major part of the variation in egg production and farm income.

The Quadratic and the Cobb-Douglas functions are found to fit well giving value of R^2 ranging between 50% and 97% in the various sets of data.

It was observed that a single production function may be chosen for egg production with other inputs for the different seasons, the relation being a square root function in I year and Cobb-Douglas functions in II year for the Punjab data. In case of II year data from Delhi survey, a common quadratic functions can be chosen over three seasons to represent the relationship between farm income and other input variables.

17.3.10 **Some further statistical studies in relation to economics of poultry keeping—Study of the relationship of fixed and working capitals with egg production**

The data already collected from about 130 commercial poultry farms in the project "Cost of production of Poultry and Eggs" carried out at Delhi and its surrounding areas were utilised in this study. The total investment over the commercial farms in two years ranged from Rs. 1,052 to Rs. 1,76,056 per farm. About 55 percent of the farms had working capital ranging from Rs. 5,000 to Rs. 30,000 and 64 percent of the farms had fixed capital also ranging from Rs. 5,000 to Rs. 30,000. In 66 percent of farms in both years, the egg production ranged from 1000 to 12,000 and in 22.6 percent it was more than 12,000 eggs. The correlation coefficients of egg production with fixed and working capitals were 0.48 and 0.86 respectively. The Cobb-Douglas function accounted for maximum percentage of variation and was used for identifying isoquants and isoclines. For an average production of 9000 eggs and with a rate of substitution 5 total investment required was Rs. 44,324 with Rs. 29,644 as working capital and Rs. 14,680 as fixed capital.

17.3.11 **Statistical Studies on milk production, income and employment under different categories of agricultural holding in the milk shed area of Greater Calcutta Milk Supply Scheme—Calcutta, West Bengal**

The study showed that among cultivators, 63 had agricultural holding upto 1 hectares, 26% between 1 to 2 hectares, 9% between 2 to 4 and rest 2% poss-

essed more than 4 hectares of land. The total daily milk production in milk producer households was highest in holding between 1 to 2 hectares and lowest in those possessing land above 4 hectares. The average family size was observed to be higher in larger holdings. Higher the size of holding lower was the proportion of workers engaged in field work. Larger proportion of working force in different holding groups were engaged in milk production trade as a subsidiary occupation rather than the main. As regards income, an increasing trend in gross income was observed as the size of holding increased. Commercial families of supplying area having holding above 4 hectares and that of non-supplying area with holding 2 to 4 hectares had maximum gross annual income viz., Rs. 7863 in the former and Rs. 8987 that in the latter. Income of non-commercial and non-milk-producer families was lower than the commercial families.

17.3.12 Optimum Amount of Experimentation in Animal Nutrition

Analysis of the coverage of experimentation on species, breed and category indicate serious lapses of experimentation on important draught breed of cattle, buffalo and important breeds of sheep, goats and pigs. There was not even a single experiment on pregnant animals of any specie. On the basis of present study it was found that country needs about 2143 experiments to be conducted in future for getting optimum return out of livestock population and its feed resources in the country.

17.3.13 Utilisation of labour in commercial poultry farms

It was observed from Punjab survey data that 103 farms utilised only family labour, 2 farms only paid labour and 14 farms paid as well as family labour. Percentage of labour put in by men, women and children were about 72,26 and 2 respectively. Out of total number of farms utilising family labour only man labour worked in about 56 percent farms and both men and women, in 40 percent farms. Further analysis was in progress.

17.3.14 Measurement of genetic improvement due to scientific breeding in cattle and buffaloes

Mortality rates adjusted for factors significantly affecting it, were obtained by employing the least square technique.

The model was :—

$$Y_{ijkl} = m + f_i + p_j + g_k + e_{ijkl}$$

where Y_{ijm} takes the value 1 if the k th grade, l th animal of the i th farm in the j th period survives and takes the value 0 if the animal dies, m is the overall mean, f_i is the farm effect, p_j the period effect, g_k the grade effect and e_{ijkl} is the random error specific to a particular observation.

The farms and periods were highly significant due to differing conditions of feeding and management. Percentage mortality recorded at Dehradun was the least and highest at Ambala farm. Further, percentage mortality was least (16%) during 1966-70 and it was of the order of 26 to 30 per cent in the remaining 3 periods.

Grade effect which perhaps is of greatest interest was also seen to be significant at 5 percent level. Percentage mortality was higher in higher grades of cows ranging from 30 to 40 per cent. 19 percent of the Sahiwal females which entered the milking herd died as against 39 percent of half-breds.

In order to quantify the level by which mortality increases or decreases with unit increase in the level of exotic inheritance, quadratic regression was fitted taking percentage mortality as the dependent variable Y and grade (proportion of exotic inheritance) as the independent variable. However, since the number of observations differed from grade to grade weighted regression was fitted, the weights being the inverse of the number of observations in each grade. The fitted curve was found to be as follows :

$$Y = 20.14 + 1.60x$$

Traumatic pericarditis took the heaviest toll accounting for about one-fourth of the total mortality in all the different grades. Highly significant variation was observed in mortality rates in different grades. Mortality was lowest among 7/16 ths, percent among half-breds and increased with the increase in the percentage of foreign blood and vice-versa.

About half the cows were culled before completing four lactations. The overall rate of abnormal calving was 8 percent. Rates among different cows did not differ significantly. Male births were more than female births, male to female ratio varied from .78 to 1.75 for different grades of animals.

16.3.15 Optimum progeny testing plans in herds of various sizes

For herd sizes between 300 to 600 cows the optimum strategy would be to use 2 tested and 10 young bulls in each cycle and saving the best two from among the ten young bulls after their progeny tests become available. This

would give an annual genetic improvement ranging from one-sixth to one-fourth above that expected without progeny testing. In small sized herds although progeny testing is seen to have slight advantage over no progeny testing but its use may not be warranted in view of the accompanying high rate of inbreeding. Similar study on rates of genetic gain for herds of indigenous cattle and buffaloes remained in progress during the year.

17.3.16 Estimation of genetic trends in Beetal Goats

The breeding data of about 1,200 Beetal goats spread over a period of 37 years (1931-67) were analysed for six economic characters. Repeatability and heritability of these characters were estimated. Genetic changes in various economic characters were worked out by three methods viz., (i) intra-sire regression on time of sire progeny deviations from population (Smith, 1962), (ii) intra-sire regressions of sire progeny on time adjusted for the effects of age and culling of dams (Everett *et al* 1967) and (iii) pooled intra-sire regression coefficient of the weighted difference between the herd and the individual sire means on time (Narain & Garg, 1972). Although genetic changes in lactation yield were not found to be significant, yield per day of lactation as well as per day of kidding interval were found to have decreased significantly over 37 years.

17.4 Sample Survey Methodology

17.4.1 Sample Surveys for methodological investigations into high yielding varieties programmes.

During the year, the data for 1977-78 was analysed. The salient results embodying the findings of (i) yield estimation survey and (ii) area estimation surveys season-wise and crop-wise are given below :

A. KHARIF

1. Rice

The estimated HYV area expressed as a percentage of the total area under the crop was the highest (99 per cent) in Coimbatore; 84 to 96 per cent in Guntur, Madurai, Amritsar, Patiala and 24-Parganas (Aus); 54 to 71 per cent in Chittoor, Karimnagar, Sibsagar (Autumn), Monghyr, Ambala and Varanasi. In the remaining districts it was below 47 per cent. Jaya was the most important variety grown by the cultivators in Monghyr, Ambala, Shimoga, Moradabad, Varanasi, Amritsar, Patiala and Midnapur (Aus); Mashori in Guntur, Chittoor and Karimnagar; IR-8 in Sibsagar (Autumn), Saran and Gonda; Ratna in

Champan and Bilaspur ; IR-20 in Coimbatore and Madurai ; Pankaj in 24-Parganas and Midnapur (Aus) ; Manohar Sali in Sibsagar (Winter) ; Hamsa in Kolar ; Triveni in Trichur (Autumn) ; Saket-4 in Meerut ; Padma in Bolan-
 gir, Jagannath in Cuttack and RRI in 24-Parganas (Aus). The highest average yield of 33.3 q/ha was recorded for IR-8 variety in Patiala. Pooled over the different HYV of rice the average yield was in the range 26 to 29 q/ha in Chittoor, Sibsagar, Ambala, Shimoga, Kolar, Coimbatore, Madurai and Amritsar. In the remaining districts the average yield of HYV rice was below 25 q/ha. Nitrogen was applied close to the recommended level in Guntur, Chittoor, Coimbatore, Madurai, 24-Parganas and Midnapur. In the remaining districts it was generally between 50 to 80 per cent of the recommended level. The rate of application of phosphatic fertilizer was close to the recommended level in Sibsagar (winter), Coimbatore, Meerut, Moradabad, Amritsar, Patiala, 24-Parganas and Midnapur, 60 to 80 per cent of the recommended level in Guntur, Sibsagar (Autumn), Ambala, Shimoga, Kolar, Trichur (Autumn) and Madurai. In the remaining districts it was 50 percent or below 50 percent of the recommended level. Potash was generally applied close to the recommended level in Karimnagar, Sibsagar, Saran, Monghyr, Shimoga, Kolar, Trichur, Coimbatore, Madurai, Varanasi, Gonda, 24-Parganas and Midnapur. In the remaining districts it was much below the recommended level.

2. Maize

The estimated HYV area expressed as a percentage of the total area under the crop was 99 per cent in Champan, 80 per cent in Monghyr, 60 per cent in Meerut, 55 per cent in Saran and 32 per cent or below in the remaining districts. The important variety grown was Ganga Safed-2 in Saran, Champan, Ambala, Jullundur and Chittorgarh, Canga Safed in Monghyr and T-41 in Gonda and Meerut. Pooled over the different hybrid maize varieties the highest average yield of 21.6 q/ha was recorded in Chittorgarh. This was closely followed by a yield rate of 20 q/ha recorded in the districts of Ambala and Jullundur.

Nitrogenous fertilizers were applied at the rates ranging between 34 to 62 per cent of the recommended level in all the districts. Application of phosphatic and potassic fertilizers was also below the recommended level in all the districts.

3. Jowar

The estimated HYV area expressed as a percentage of the total area under the crop was 96 per cent in Shimoga, 74 Percent in Dharwar, 47 percent in Mandsaur and 33 per cent in Akola. Vidisha-60 was the popular variety grown by the cultivators in Mandsaur while CSH-1 was popular in the other districts. The highest average yield of 27.80 q/ha was recorded for CSH-5 variety in Shimoga. Application of chemical fertilizer was generally below 70 per cent of the recommended level.

4. Bajra

The estimated HYV area expressed as a percentage of the total area under the crop was 98 per cent in Mehsana, nearly 88 per cent in Kaira and Sabarkantha, 61 per cent in Hissar and Madurai, around 42 per cent in Morena and Jaipur and 32 per cent in South Arcot. The important variety grown was CJ-104 in Kaira, HB-3 in Sabarkantha, HB-5 in Mehsana, BJ-104 in Hissar and Jaipur, Vijaya in Morena, BJ-104 in Aurangabad and KM-2 in Madurai and South Arcot. The highest average yield of 19.8 q/ha was recorded for KM-1 in South Arcot. In Kaira, Sabarkantha, Mehsana and Hissar application of K fertilizer to hybrid bajra and in South Arcot application of P and K fertilizers was not recommended. Nitrogenous fertilizer was generally applied in the range of 50 to 70 per cent of recommended level in all the distries.

5. Groundnut

The estimated HYV area expressed as a percentage of the total area under the crop was around 90 to 100 per cent in Chittoor, Karimnagar, Kolar, Aurangabad, Patiala and South Arcot. In the remaining districts this percentage ranged between 48 to 75. The main variety grown was TMV-2 in Guntur, Chittoor, Karimnagar. Dharwar and South Arcot, Spanish in Kolar, SB-11 in Aurangabad, Pb-1 in Jullundur and Patiala and T-28 in Moradabad. Pooled over the different HYV of groundnut the highest average yield of 11.6 q/ha was recorded in Jullundur. Nitrogenous fertilizer was applied at around 50 to 70 per cent of the recommended level in Guntur, Chittoor, Dharwar and Kolar. In Jullundur and Patiala the rate of application of N was double the recommended level. Application of P and K fertilizer was below the recommended level in all the districts.

6. Cotton

The estimated HYV area expressed as a percentage of the total area under the crop was 100 percent in Coimbatore, 97percent in Jalgaon, 92 percent in Sabarkantha, around 60 to 80 per cent in Kaira, Hissar, Amritsar and Chittorgarh

and 37 per cent in Mehsana. The important variety grown was H-4 in Kaira, Sabarkantha, Mehsana and Jalgaon, 320-F in Hissar, J-34 in Amritsar, C Indore-1 in Chittorgarh and Varalaxmi in Coimbatore. The highest average yield of 8.9 q/ha was recorded for Varalaxmi variety in Coimbatore. The rates of application of chemical fertilizer were as per the recommended level in Coimbatore. Nitrogenous fertilizer was applied around 50 to 80 per cent of the recommended level in the remaining districts. Application of P and K fertilizers in the rest of the districts was lower than that recommended.

B. RAB1

1. Wheat

The estimated HYV area expressed as a percentage of the total area under the crop was 90 to 100 per cent in Sibsagar, Champaran, Kaira, Sabarkantha, Morena, Aurangabad, Jalgaon, Amritsar, Jullundur, Patiala, Meerut, Moradabad, Varanasi, 24-Parganas and Midnapur, 60 to 90 per cent in the rest of the districts except for Akola (54 per cent), Jaipur (48 per cent) and Dharwar (20 per cent). Sonalika and Kalyan Sona were the most popularly grown HYV of wheat in almost all the districts. Pooled over the different HYV of wheat the highest average yield of 34.9 q/ha was recorded in Morena district. In 50 per cent of the districts the yield rates of HYV were 24 q/ha or more. The rates of application of N generally ranged between 60 to 90 per cent of the recommended level in a majority of the districts. Rates of application of P and K were lower than those recommended in the districts.

2. Rice

The estimated HYV area expressed as a percentage of the total area under rice was 88 to 100 per cent in Guntur, Shimoga, Kolar, Bolangir, Coimbatore, Madurai, 24-Parganas and Midnapur, 57 to 77 per cent in the remaining districts except for Trichur where this percentage was 32. The important varieties grown were Jaya, IR-20, Triveni, White-Hamsa and RP-4-14. Pooled over the different HYV of rice the highest average yield of 33.8 q/ha was recorded in Shimoga district. Nitrogen was applied close to the recommended level in Guntur, Trichur, Bolangir, Coimbatore, Madurai and Midnapur. In the remaining districts N was applied in the range of 70 to 80 per cent of the recommended level. The rate of application of phosphatic fertilizer generally varied in the range of 40 to 80 per cent of the recommended level in the different districts. The proportion of fields receiving potash was of a low order.

3. Maize

The survey was conducted in Kolar (Karnataka) district only, 100 per cent of the area under maize was covered by HYV of maize. Deccan hybrid was the most extensively grown hybrid variety in the district. The average yield for this variety worked out to 19.7 q/ha. The rate of application of chemical fertilizer was around 50 per cent of the recommended level.

4. Jowar

The survey conducted in Shimoga (Karnataka) district only, 100 per cent of the area under the crop was covered by HYV of jowar. CSH-1 was the popular variety grown by the cultivators in the district and gave an average yield of 27.2 q/ha. The rates of application of chemical fertilizers were higher than those recommended in the district.

5. Bajra

The survey was conducted in Madurai and South Arcot (Tamil Nadu) districts only. Cent per cent of the area under the crop was covered by HYV of bajra in South Arcot while in Madurai this percentage was 65. The popular variety grown was KM-2 in both the districts. The highest average yield of 18.6 q/ha was recorded for KM-2 variety in South Arcot. Application of P and K fertilizer to hybrid bajra was not recommended in South Arcot. Chemical fertilizer was applied around 80 per cent of the recommended level in Madurai.

6. Groundnut

The survey was conducted in South Arcot (Tamil Nadu) district only. 98 per cent of the area under groundnut was covered with HYV groundnut. TMV-2 was the most popular variety grown by the cultivators. The highest average yield of 20.3 q/ha was recorded for TMV-7. For this crop the fertilizer recommendation was in respect of potash only which was applied at nearly 19 per cent of the recommended level.

7. Cotton

The survey was conducted in Dharwar (Karnataka) and Coimbatore (Tamil Nadu) districts only. 100 per cent of the area under cotton in both the districts was covered by HYV of cotton. The popularly grown HYV of cotton was Jayadhar in Dharwar and Varalaxmi in Coimbatore. The highest average yield of 6.7 q/ha was recorded for Varalaxmi variety in Coimbatore. Application of chemical fertilizers was almost as per the recommended level in Coimbatore and at around 25 per cent of the recommended level in Dharwar.

17.4.2 **A study on cost and return for intercrops in apple cultivation in U.P.**

The important findings worked out provisionally were that on an average more than half of the orchardists had grown crops in addition to apple cultivation. In Almora and Tehri districts about one third orchardists had grown potato and maize whereas in case of Tehri district, one third orchardists had also taken bean crops. In Nainital district, half of the orchardists had grown wheat and potato and one third orchardists had also taken bean crops. But in the district Uttarkashi, about half of the orchardists had grown wheat and one third beans also.

17.4.3 **Pilot sample survey for estimation of number of pigs slaughtered and study of attendant swine practices**

The salient results achieved are as follows :

In the districts of Aligarh and Allahabad the number of pigs was estimated at 19.1 and 75.8 thousands with standard errors of 11.0 and 13.0 percent respectively.

The estimate of the number of pigs slaughtered during the year was 8.9 and 33.9 thousands with a standard error of 14.0 and 11.9 percent in the districts of Aligarh and Allahabad respectively. The average price of pork per kg. was Rs. 5.10 and Rs. 4.51 in the districts of Aligarh and Allahabad respectively.

The highest percentage number of farrowing took place during the winter (November to March) in both the districts and the percentages were 66 and 56 in the districts of Aligarh and Allahabad respectively. The average number of piglets born per sow was 4.9 and 4.0 in the districts of Aligarh and Allahabad respectively.

In Aligarh district the average body weight of pigs was 44.5 kg. in the age group of 25 to 36 months whereas in the Allahabad district the corresponding figure was 40.9 kg.

The average family size of pig rearing households was 5 and 6 in the district of Aligarh and Allahabad respectively. Mostly the pigs were kept for a small additional income without much investment. In Aligarh district pig rearing was mostly with the landless farmers but in Allahabad district the same was also popular with the farmers having land. The average family

income of pig rearing farmers in Aligarh district was about Rs. 205/- p.m. whereas in Allahabad district it was about Rs. 185/- p.m. while average income through pig rearing was Rs. 47/- and Rs. 17/- p.m. in the two districts respectively.

17.4.4 Study to find out the causes of land lying idle in the operational holdings during agricultural year 1977-78

The survey was conducted in the six centres of Anantapur, Belgaun, Jabalpur, Ratnagiri, Chittorgarh and Jhansi. The results of the interim report are as follows :—

It was observed that in the three districts of Ratnagiri, Chittorgarh and Jhansi the proportion of cultivators having waste land was very high, being as much as 72 per cent. In the context of spread of land lying idle in a district, Ratnagiri topped the list with nearly 3 lakhs cultivators having waste land followed by chittorgarh where this number was nearly 2 lakhs. The smallest number of such cultivators was in Jabalpur even though their proportion was quite substantial.

The highest proportion of area under waste land was in Ratnagiri district being of the order of 62 per cent. In Chittorgarh and Anantapur it was of the order of 48 and 42 per cent respectively. In the remaining 3 districts it was around 25 per cent.

Some of the main causes of land lying idle were non-availability, lack of irrigation facilities. Unlevelled, uneven or the slopping land, non-availability of resources or adequate finances with the cultivator, low fertility of soil, rocky land, non-availability of crucial inputs including seeds and fertilizers, heavy weed infestation etc.

It was seen that provision of irrigation facilities would be beneficial to a large proportion of farmers having waste land ranging between 25 to 70 per cent in different districts. Levelling of land was considered important by 25 to 40 per cent of the farmers and the need for additional resource availability was felt by 25 to 50 per cent of the farmers. Other remedial measures were also suggested by farmers in different districts.

17.5 ECONOMETRIC ANALYSIS

17.5.1 Identification of socio-economic and other constraints operating in the spread of modern technology on Rice farms in the Operational Research Project (ORP) Areas located in Puri district of Orissa.

The study revealed a significant yield gap of 1.73 tonnes per hectare between the potential farm yield as demonstrated on farmers' fields in the study

area and average farm yield of the area estimated on the basis of the survey data. The behaviour of the yield gap among different categories of farmers indicated that the yield gap decreased as the farmers adopted more and more improved practices. Adoption pattern of improved practices among different holding size groups indicated that the adoption index was highly associated with the holding size groups. As regards intensity of adoption, it was however, revealed that the intensity of adoption was higher in packages of less practices comparatively in all the holding size groups. The analysis further depicted that low level of input use viz., HYV, fertilizers application and plant protection measure (biological), poor economic condition and indebtedness (social) and type of land (Physical) were the main factors contributing to the yield gap.

17.5.2 Identification of the socio-economic and other constraints operating in the spread of modern technology on rice farms in operational research project areas located in Nalgonda district of A.P. and Raipur district of M.P.

The study in the operational area of the ORP on rice cultivation in Nalgonda district of A.P. examined the untapped yield potential at farmers' fields on rice crop and factors responsible for the low-productivity of the crop during kharif season of 1978-79. The study revealed a gap of 1504 kg. per hectare between the potential farm yield as demonstrated on farmer's field in the study area and average farm yield of the area. The main factors contributing to this yield gap were fertilizer application (N,P and K), ZnSo₄ application, plant protection measures and literacy. To probe further into the discriminating characteristics of the farmers applying low and high levels of fertilisers and taking plant protection measures and not taking any measure discriminant function technique was utilised. The results indicated that the average yield and literacy are the major characteristics discriminating the two group of farmers applying low and high levels of fertilizers. The other discriminating characteristics are area under HYV, Zn So₄ application, plant protection measures taken and seed rate. In the case of farmers taking plant protection measures and not taking any measure also, average yield and literacy are the two major discriminating characteristics. The other characteristics in this case are area under HYVs and N, K application.

17.6 TRAINING AND BASIC RESEACH

17.6.1 Training Activities

During the year under report, 17 students of the Institute completed successfully the degree courses of which from M. Sc. Programme and 5 were

from Ph. D. programme. The XVIII convocation of the training courses of IASRI, for the award of Diploma/Certificates to students completing successfully various courses of training in Agriculture and Animal Husbandry Statistics, was held on the morning of September 30, 1980. Dr. M.S. Swaminathan, Member, Planning Commission was the Chief Guest on the occasion. The convocation programme was preceded by a two days programme including an elocution contest. The topic for the contest was, "The role of Agricultural Statistics in Planning for Rural Development".

At this convocation, in all, a total number of 26 candidates were awarded certificate viz. 5 for Junior Certificate Course (JCC), 9 for Senior Certificate Course (SCC), 9 for Professional Statisticians Certificate Course (PSCC) and 3 for Diploma Course. Gold Medals were presented to those who secured highest aggregate of marks in each of the certificate courses, viz. J.C.C., S.C.C. & P.S.C.C. and also to the candidate whose diploma thesis was adjudged as the best from among those considered for the award of Diploma during the year.

During the year under report, eight students were admitted to M. Sc. course and twelve students were also admitted to Ph. D. course. Students of P.S.C., S.C. and J.C. Courses were taken on an educational tour to various research institutes.

Special training programmes were also arranged for the benefit of trainees deputed from other organisations, such as C.S.O., various I.C.A.R. Institutes, Agricultural Universities, and other research organisations. A number of important seminars/lectures were delivered by eminent statisticians during the year under report. Besides these, about 52 seminars by the members of staff and the students of the Institute on various topics of interest were also held.

17.6.2 **Basic Research in Statistics**

During the year under report, significant contributions were made in the application of statistical techniques to the problems on sampling designs of experiments and statistical genetics.

17.7 **COMPUTER SCIENCE AND NUMERICAL ANALYSIS**

The Division of Computer Science and Numerical Analysis continued to utilize the two Computer Systems, the Burroughs B-4700 and IBM-1620 for catering to the Data Processing requirements of Agricultural Scientists, Research Workers and Students from the Institutes under I.C.A.R., Agricultural Universities, Agricultural faculties of other Universities and Directorate of Economics and Statistics.

During the year, about 15000 production jobs were processed on B-4700 and IBM-1620 systems. Besides these, about 4000 testing jobs of students, staff members and programmers of the Division were processed. About 220 Ph. D., 100 M. Sc. and 90 other Research Workers from the Institutes under ICAR and Agricultural Universities were given help in Computer Programming, data processing and Statistical Interpretation of the results.

To meet the data analysis requirements of Research Scholars, about 25 new Computer Programmes were developed apart from these a number of old programmes were modified according to the needs of the Research workers. A few system programmes in BPL were also developed to make better use of the new computer system.

For the benefit of computer users and programmers, a source programme library on tape has been created. At present 216 Source Programmes in FORTRAN, COBOL and BPL reside on the tape in Library Format. Users can directly compile and execute these programmes.

The Computer centre has also acquired a new programme package "SPSS" which contains computer programmes for a number of Statistical Techniques used in Biometrical and Social Sciences Research e.g. Analysis of Variance/ Co-variance in Multiclassification, Regression Analysis, Factor Analysis, Contingency Tables, Cross Tabulation, Frequency Distributions etc. A few handouts for certain programmes from this package have been brought out for the benefit of users.

Updating of the AGRIS Information System on receiving the tapes from Vienna continued to be done every month and the Selective Dissemination of Information Services for Scientists in India was made available from this data base.

Software development for the data base on Bio-data of Agricultural Scientists under ICAR is complete and the data base has become functional.

Courses in Computer Programming for M. Sc. and Ph. D. students of P.G. School, IARI and also for PSCC, SCC and JCC were conducted by Scientists of the Division.

A 6 week training course in FORTRAN-IV programming, sorting and merging of data files and use of PSSG Programming package and a short duration course in Report Program Generator (RPG) were organised for the benefit of staff members of IASRI. Besides a three week intensive training course in Computer Programming was also organised for scientists from different Agricultural Universities.

During the year MT-Unit undertook work of various projects and schemes of IASRI numbering over 40. In addition MT Unit provided facilities of punching and processing of data of projects, of various Agricultural Institutes under I.C.A.R. viz., IARI, NDRI, CSWRI, CSSRI and CAZRI, Jodhpur etc. had also to large number of students of various Agricultural Universities and Institutes in India.

A large number of students, participants of different workshops/seminars and Prof. N.R. Brockington (U.K.) visited the computer centre.

17.8 OTHER UNITS/CELLS AND THEIR ACTIVITIES

17.8.1 Director Cell :

During the year under report, the cell collected the requisite material from various Divisions of the Institute and prepared the consolidated material in respect of this Institute for Annual Report, 1979, the Quarterly Progress Reports of the Institute and Statistical Newsletters falling due during the year. The cell also collected and supplied the consolidated material to ICAR, DARE, CSO, ESCAP, for their respective regular publications. In addition to these regular publication, the cell also supplied the material to such organisations/agencies as ICAR, CSO, DARE, Deptt. of Science & Tech., etc. The cell also organised the 5th Conference of the Agricultural Research Statisticians in collaboration with the 34th Annual Conference of the Indian Society of Agricultural Statistics from 23rd to 26th Dec., 1980 at Directorate of Agriculture Uttar Pradesh, Lucknow (U.P.). Moreover the monthly meetings of the Institute as well as various technical committees and sub-committees of the Institute were also convened and their proceedings were prepared by the Cell.

17.8.2 Field Unit

The field unit of this Institute inspected and supervised the field work of about 12 projects in collaboration with the concerned project leaders as well as rendered technical advices and guidance to the field staff in regard to the collection of basic data of the projects relating to Sample Surveys, Animal Sciences and Crop Sciences. During the year, field training was also imparted to the field staff and the supervisory staff working in ten projects of Crop Sciences, Animal Sciences, Crop Forecasting Methodology and Sample Surveys Methodology with the help of the projects leaders.

17.8.3 Monitoring Cell

During the year 1980, there were three meetings of the Monitoring Cell. The first meeting was held on 3rd March, 1980, the second was held on 7th

August, 1980 and the third meeting was held on 30th Oct., 1980. The Monitoring Cell devised the proformae for the purpose of Monitoring the progress of the research projects of the Institute which were approved in the meeting.

17.9 ADVISORY SERVICES

The Institute continued to play its important role of giving technical advice and guidance in regard to problems in agricultural statistics and sampling techniques, particularly in statistical aspects of the projects financed by the ICAR. Also officers of the Institute attended meetings of the various ICAR Scientific Panels as well as the workshop meetings of the All-India Co-ordinated Projects of the ICAR held during the year and took active part in the discussions on statistical aspects of projects.

Technical advice and guidance was rendered to research workers and students from various Research Institutes/Universities and other research organisations in planning their experimental investigations and statistical analysis of data as well as in processing of their data at the Computer Centre and the Mechanical Data Processing Unit of the Institute.

17.10 PUBLICATIONS

During the year under report, forty seven papers by the officers, other members of the staff and students of the Institute, were published in standard journals, while twenty nine papers were accepted for publication in different journals. Besides, forty three publications including Technical Reports, proceedings, compendia, Annual Report of the Institute for the year, 1979, four issues of IASRI Statistical Newsletter, one Bulletin of Seminars, a series of 3 Technical Reports of Training and Basic Research and other project reports were published as IASRI Publications.

17.11 CONFERENCES ORGANISED BY/AT THE I.A.S.R.I.

17.11.1 Fifth Conference of Agricultural Research Statisticians

The First, Second, Third and Fourth Conferences of Agricultural Research Statisticians were held in 1974, 1976, 1978 and 1979 respectively. The 5th Conference of Agricultural Research Statisticians (ARS) and 34th Conference of Indian Society of Agricultural Statistics (ISAS) were jointly organised by the

IASRI and ISAS during December, 23-26, 1980 at Lucknow (U.P.). About 250 participants, including members of the ISAS and delegates representing Agricultural Universities, ICAR Institutes, State and Central Deptt. of Agriculture, Animal Husbandry, Forestry and Fisheries engaged in research, participated in the joint conference. The host of this conference was the Directorate of Agriculture, U.P., Lucknow.

There were two Technical Sessions and a Plenary Session as detailed below :

On 24th December, 1980, the technical session-1 of Agril. Research Statisticians (ARS) was held. During the session, action taken on the recommendations made in the last four conferences were discussed. The Technical session II on Current Statistical Research in Agriculture, Forestry, Livestock and Fishery with reference to Rural Development was held on 24th and 26th Dec., 1980. The Plenary Session in the after-noon of 26th Dec., 1980 was devoted to the presentation of reports by the Chairman of the various sessions. An Excursion trip to Ayodhya was arranged for the participants.

17.11.2 Training Course on Improvement of Data Base on Livestock Resources

The Training Course on "Improvement of Data Base on Livestock Resources" was organised from 1-6 December, 1980 at IASRI on behalf of FAO Regional Animal Production and Health Commission for Asia, the Far East and the South West Pacific (APHCA). The purpose of the Training Course was to impart training on the development of the basic frame work for research and analytical studies which will be needed in the in-country's training workshop for national statistical personnel and the development of a continuing statistical programme on livestock. 21, participants from 7 APHCA countries (Bangladesh-3 ; Malaysia-3 ; Pakistan-2 ; Phillippines-1 ; Sri Lanka-3 ; Thailand-3 and India-6) attended the Training Course.

17.12 SUMMER INSTITUTE ON "ADVANCED STATISTICAL METHODOLOGY AS APPLIED TO ANIMAL SCIENCES"

The Summer Institute was organised from 6th May to 4th June, 1980 at the Indian Agricultural Statistics Research Institute, New Delhi-12. The objective of the Summer Institute was to provide necessary orientation to research workers and teachers of agricultural statistics working in ICAR Institutes,

Agricultural Universities and Colleges and State Departments of Animal Husbandry/Dairying to update their knowledge of statistical methodology as applied to animal sciences and livestock development. The Summer Institute was attended by 18 participants from various organisations besides 3 departmental candidates from IASRI. Out of these 21 participants, 11 were from agricultural universities, 6 from ICAR Institutes and 4 from State Departments of Animal Husbandry and Veterinary Services.

The course in the Summer Institute consisted of lectures on theoretical as well as practical aspects, group discussion on projects of the Institute and lectures and talks by invited speakers. A Field Trip was organised from 20th to 23rd May, 1980 during which they carried out a livestock survey both in a Ward in Dehradun City and in a village (Sinaula) in Dehradun district. During the course, two tests, one in the middle of the session and second at the end, were conducted to assess the extent of participation and understanding. The lecture notes and papers prepared by different lecturers and invited speakers were found very useful. The overall impression and rating of the participants about the Summer Institute was highly satisfactory.

17.13 OTHER ACTIVITIES

17.13.1 Lab to Land Programme

Under the ICAR Lab to Land Programme implemented during 1979-80, the Institute had adopted 100 families in the village Garhi Randhala located in Kanjhawala block of Delhi. Due to economic and social changes that took place in the village during the last one year, the status of some of the households in the village also changed. The selection of 100 families under this programme was accordingly modified and during the year under report these families comprised 34 small farmers, 26 marginal farmers and 40 landless agricultural labourers. A programme of economic uplift of these families by communicating the latest agricultural technology in crop management and animal husbandry aspects and providing vocational training etc., as a means for regular source of income was taken up. The farmers were supplied free fertilizers, seeds of rabi & kharif crops, feeds for milch animals as well as medicines for animal health. Their relative income were also worked out. The farmers were taken round to the Agricultural Fair at I.A.R.I., New Delhi. They were also shown documentary films, Crops Demonstrations were also conducted to acquaint the farmers with new technologies, in Agriculture seeds, etc.

17.13.2 All-India inter-zone final sports meet

The winners of the four zones along-with teams from IARI, NDRI and IVRI met for the All-India Championship in the Inter-zone Final Sports Meet held at NAARM, Hyderabad from 18th Feb. to 24th Feb., 1980. In all 27 ICAR Institutes participated, in various games like Table Tennis, Badminton, Volley Ball, Kabaddi and Athelatics. The sportsmen of the Institute got I positions in the Table Tennis (Singles), Table Tennis (Doubles), Hammer Throw, III position.

भारतीय कृषि सांख्यिकीय अनुसंधान संस्थान

(भा० क्र० अ० प०)

वार्षिक रिपोर्ट, 1980

18. सारांश

18.1 फसल विज्ञान में सांख्यिकीय अनुसंधान

18.1.1 अखिल भारतीय समन्वित सस्य अनुसंधान परियोजना के अधीन प्रयोगों का नियोजन और उनके सांख्यिकीय विश्लेषण का समन्वय।

परियोजना के अधीन किये गये कार्य और विभिन्न क्षेत्रों में उनसे प्राप्त परिणाम निम्नानुसार हैं।

(मद सं० 18.1.2, 18.1.3, 18.1.4 और 18.1.5)

18.1.2 देश के उत्तर और उत्तर-पश्चिमी क्षेत्रों में अखिल भारतीय समन्वित सस्य अनुसंधान परियोजना के अधीन प्रयोगों का नियोजन, सांख्यिकीय विश्लेषण और आंकड़ों का निर्वचन।

प्रतिवेदनाधीन वर्ष के दौरान वर्ष 1978-79 में कृषकों के खेतों पर आयोजित 1950 प्रयोगों और अनुसंधान केन्द्रों पर 120 जटिल प्रयोगों के आंकड़ों का सांख्यिकीय विश्लेषण किया गया। इनके प्रमुख परिणामों को वर्ष 1979 के वार्षिक प्रतिवेदन में पहले ही संक्षेप में दिया जा चुका है। 1978-79 के कुछ प्रमुख परिणामों को नीचे दिया गया है।

(क) सस्य अनुसंधान केन्द्रों (A.R.C.) पर प्रयोग :—

चने के लिए पुरा फार्म और हनुमानगढ़ में उर्वरकों के स्वीकृत स्तर का 25 प्रतिशत डाला गया जबकि बिचपुरी में यह स्वीकृत स्तर का केवल 75 प्रतिशत तक डाला गया। बिचपुरी में सरसों की फसल में डाले गए उर्वरक के स्तर में स्वीकृत मात्रा में 25 प्रतिशत की कमी ही संभव थी।

बाँसवाड़ा में सिंचाई के निम्नस्तरों के कारण उपज में लगभग 3.0 क्वि/हेक्ट. की कमी हुई। पुराफार्म पर राई फसल में उर्वरक की स्वीकृत मात्रा में से 75 प्रतिशत तक की कमी की जा सकी।

पन्त नगर में आर० आर०-21 और एच० डी०-2204 को सामान्य अवधि से एक माह बाद की देरी से बोने पर उपज में 7-9 क्वि०/हेक्ट० की वृद्धि हुई। लुधियाना में एच० डी०-2204 की बुवाई में एक पखवाड़ा के देरी होने पर उपज में 3.0 क्वि०/हेक्ट० की वृद्धि हुई।

हनुमानगढ़ में 150 कि० ग्रा० N./हेक्ट० लगाने पर डब्लू० एल०-711 किस्म सबसे उपयुक्त पाई गई।

तलाब तिल्लो और लुधियाना में 120 कि० ग्रा० N./हेक्ट० के उर्वरक उपयोग पर क्रमशः के० एस० एम० एल०-3 और डब्लू० एल०-711 किस्मों से अधिकतम उपज प्राप्त की गयी।

खरीफ की फसल में राईजोबियम कृष्ण को हिसार में मूंग की अपेक्षा लोबिया पर अधिक प्रभावी पाया गया जिससे 1.6 क्वि/हेक्ट० की अतिरिक्त अनुक्रिया प्राप्त हुई। रबी की फसल में लोबिया पर लागू राईजोबियम का अवशिष्ट प्रभाव खरीफ के दौरान मूंग की अपेक्षा अधिक प्रमुख था। खरीफ के मौसम में भूमि परती रखने के परिणामस्वरूप सभी उपजों की अपेक्षा गेहूँ के अनाज की उपज में सार्थक वृद्धि हुई।

बाजरे की उच्चतर उपज प्राप्त करने के लिए हनुमानगढ़ में एफ० वाई० एम० (F. Y. M.) से उर्वरक के उपयोग में (N₉₀ P₄₅ K₄₅) 75 प्रतिशत स्तर पर देखी गई। गेहूँ की फसल में उर्वरक के किसी भी स्तर पर ऐसी संभावना नहीं थी।

बाजरे की फसल के लिए दोनों ही जगह बिचपुरी और हनुमानगढ़ में खरपतवार नियंत्रण चैंक की तुलना में रासायनिक खरपतवार नियंत्रण अधिक प्रभावी नहीं पाया गया। दोनों में से किसी भी केन्द्र पर रबी के दौरान गेहूँ की फसल में खरीफ के दौरान किये गये खर-पतवार नियंत्रण उपचारों से कोई अवशिष्ट प्रभाव देखने में नहीं आया।

(ख) कृषकों के खेतों पर प्रयोग (E. C. F.) :—

सिंचित चावल के लिए कुरुक्षेत्र, गुरुदासपुर और कांगड़ा में N₁₂₀ P₆₀ K₆₀ डालने पर 22-29 क्वि०/हेक्ट० की उच्चतम अनुक्रिया मिली। हमीरपुर में केवल N₁₂₀ डालने से 10 क्वि०/हेक्ट० की अनुक्रिया मिली। कुरुक्षेत्र, गुरुदासपुर और कांगड़ा में जिंक सल्फेट के उपयोग से भी सार्थक अनुक्रिया देखी गई। गेहूँ के लिए सभी जिलों में N₁₂₀ P₆₀ K₆₀ पर्याप्त पाई गई। इस

स्तर पर आगरे में (29.2 कि०/हेक्टर) अनुक्रिया उच्चतम थी। इसके बाद बूंदी, फरखाबाद और हिसार में (25.5 कि०/हेक्टर) थी और अन्य जिलों में यह 17 से 22 कि०/हेक्टर में थी।

दिल्ली में बाजरे की नयी किस्म बी० के०-560 ; सवाई माधोपुर में बी० जे०-104 किस्म ; बूंदी में ज्वार की सी० एच० 1 स०-5 किस्म ; चित्तौड़गढ़ में गंगा-2 जैसी नई किस्मों से इन स्थानों पर स्थानीय किस्मों की अपेक्षा अच्छी उपज प्राप्त हुई। इन किस्मों से सभी स्तरों पर डाली गई नाईट्रोजन से उच्च अनुक्रिया प्राप्त हुई। चने की पूर्वनिर्मुक्त किस्म के०-468 ललितपुर, हमीरपुर और आगरा में मानक किस्म टी०-3 से श्रेष्ठ रही। इन जिलों में डाले गये फास्फोरस के स्तर में वृद्धि करने पर उपज में सार्थक सुधार हुआ।

शुष्क भूमि स्थितियों के अन्तर्गत उगाई गई अनाज वाली फसलें गेहूँ, जौ और ज्वार के लिए नाईट्रोजन की अनुक्रिया में सतत रूप से 90 कि० ग्रा० N./हेक्टर तक की उच्चतम वृद्धि हुई। उपज दर की वृद्धि के लिए नाईट्रोजन के साथ 30 कि० ग्रा० P₂O₅/हेक्टर की सामान्य मात्रा पर फास्फोरस डालना उपयोगी था। पोटाशियम और जिंक सल्फेट की अनुक्रिया सामान्यतः नगण्य थी।

बंगाल-चना और उड़द के लिए परिणामों से पता चलता है कि केवल फास्फोरस डालना ही पर्याप्त नहीं है बल्कि इसे नाईट्रोजन की सामान्य मात्रा के साथ मिलाकर डालना आवश्यक है। N₂₀P₄₀ की मात्रा उपयुक्त पाई गई जिससे उड़द की 6-7 कि०/हेक्टर की अनुक्रिया प्राप्त हुई।

फरखाबाद, बूंदी, ललितपुर और हमीरपुर जिलों में (तिलों के लिए) फरखाबाद, दिल्ली, सवाई—माधोपुर, काँगड़ा और हिसार जिलों में (अरण्डी के लिए) और हमीरपुर तथा ललितपुर जिलों में (अलसी के तेल के लिए) फास्फोरस की बढ़ी हुई मात्रा डालने से वर्षा वृष्टि परिस्थितियों के अधीन उगाई गई तेल वाली फसलों की 60 कि० ग्रा० N./हेक्टर की अनुक्रिया प्राप्त हुई। N₆₀P₄₀ डालने पर तिलों के लिए 3-4 कि०/हेक्टर की और सरसों और अलसी के लिए 4-5 कि०/हेक्टर की अनुक्रिया प्राप्त हुई।

18.1.3 शुष्क पश्चिमी मैदानों, आर्द्र बंगाल-आसान और पूर्वी हिमालय के क्षेत्रों में ए० आई० सी० ए० आर० पी० के अधीन आंकड़ों के प्रयोगों का नियोजन, सांख्यिकीय विश्लेषण और निबंधन।

1979-80 के दौरान खरीफ और रबी के मौसम में 10 ए० आर० सी० में सफलता पूर्वक किये गये 94 प्रयोगों और 11 ई० सी० एफ० जिलों में ऋषकों के खेतों पर 1650 प्रयोगों का सांख्यिकीय विश्लेषण किया गया। 1978-79 के लिये परियोजना प्रतिवेदन पहले ही छप चुकी है। मुख्य परिणाम भा० कृ० सां० अ० सं० के वार्षिक प्रतिवेदन, 1979 में प्रस्तुत किये गये।

18.1.4 द० क्षेत्रों में अखिल भारतीय समन्वित सस्य अनुसंधान परियोजना के अधीन आंकड़ों के लिए प्रयोगों का नियोजन, सांख्यिकीय विश्लेषण तथा निर्वचन

प्रतिवेदनाधीन वर्ष 1979-80 के दौरान 6 सस्य अनुसंधान केन्द्रों पर किये 75 प्रयोगों और 18 जिलों में कृषकों के खेतों पर किये गये 3742 प्रयोगों का सांख्यिकीय विश्लेषण किया गया। 1978-79 के लिए आंकड़ों संबंध परियोजना रिपोर्ट प्रकाशित हो चुकी है। मुख्य परिणाम संक्षेप में भा० कृ० सां० अ० सं० की वार्षिक रिपोर्ट 1979 में दिये गये हैं।

1978-79 के कुछ परिणाम नीचे दिये गये हैं।

(क) सस्य अनुसंधान केन्द्रों (A.R.C.) के प्रयोग :—

कराई रूपू में मक्का-चावल—बाजरा चक्र से अनाज का अधिकतम उत्पादन (130.8 कि०/है०) प्राप्त हुआ किन्तु रागी-चावल-कपास चक्र अधिक लाभदायक पाया गया, (अनाज की उपज 90.5 कि०/है० + कपास की 15.8 कि०/है०) उपज प्राप्त हुई। सिरू-गुप्पा में गेहूँ, बंगाल-चना और कुसुम (Safflower) जैसी फसलों के लिए 14 चाई स्तर को 5 से 3 तक घटा देने पर उपज पर कोई प्रशंसनीय प्रभाव नहीं पड़ा और कम सिंचित भू-खण्डों पर बाद में ज्वार की फसल पर अवशिष्ट प्रभाव देखा गया (17 प्रतिशत की वृद्धि)। सिरूगुप्पा में प्याज-गन्ने के साथ अन्तः फसल के रूप में सबसे उपयुक्त पाई गई। कराईरूपू और भवानीसागर में कपास के साथ मूँग अन्तः फसल के रूप में उपयुक्त पाई गई। मंगलूर में संयुक्त रूप से 12 टन/है० पर एफ० बाई० एम० + N₃₀ P₁₅ K₁₅ लाभदायक पाया गया जबकि भवानीसागर में 12 टन/है० पर N₃₀ P₁₅ K₁₅ के समान ही अनुक्रिया पाई गई किन्तु उनका संयुक्त प्रयोग लाभप्रद नहीं था। भवानीसागर में गन्धक चढ़े यूरिया (Sulphur Coated Urea) ने सीधे और संचयी चरण में उच्चतम अनुक्रिया दी। कराईरूपू में अंजोला की 5 टन/है० + 30 कि० ग्रा० N/है० डालने से 60 कि० N/है० उर्वरक के रूप में डालने की अपेक्षा उच्च उपज प्राप्त हुई। मारुतेरू में खरीफ के दौरान मध्य-कालीन चावल की किस्म और बाद में रबी के दौरान मध्यकालीन चावल की किस्म से उच्चतम उत्पादन (12.8 टन/है०) प्राप्त हुआ।

(ख) कृषकों के खेतों पर प्रयोग (E.C.F.) :—

(i) विभिन्न फसलों की उर्वरक आवश्यकता :—

चावल :—

मदुरैय, त्रिचुरापल्ली, उत्तरी आरकोट, खम्माम, कृष्णा, तुमकुर, वेलगांव और भेदक में N₄₀ P₂₀ K₂₀ के हिसाब से उर्वरकों को निम्न मात्रा में सतृलित रूप से डालना लाभदायक

पाया गया। मर्क्यूर, ब्रैचरॉपलॉ, उत्तरी आरकॉट, प्रकाशम और विसुवर में $N^{60}P^{40}K^{80}$ की साम्य मात्रा लाम्बद पाई गई। मर्क्यूर जिन में $N^{120}P^{60}K^{60} + Zn^{25}$ के उपयोग से सर्जिका की उत्पत्ति थी।

गैर:— विदर, बंगाल और खामाम में $N^{40}P^{20}K^{20}$ की संतुलित उपयोग लाम्बदिक या किसी भी जिन में उत्पन्न की मात्रा इससे अधिक वर्तन पर विफायती नहीं थी।

भक्ता:— बंगाल में $N^{40}P^{20}K^{20}$ विफायती मात्रा पाई गई।
 उत्तर:— बंगाल और प्रकाशम में $N^{40}P^{20}K^{20}$ विफायती मात्रा पाया।

बावरी:— प्रकाशम में $N^{80}P^{40}K^{40}$ से विफायती सर्जिका प्राप्त हुई।
 रानी:— प्रकाशम जिन में $N^{40}P^{20}K^{20}$ से अधिक मात्रा विफायती नहीं थी।

काम:— $N^{120}P^{60}K^{60} + Zn^{25}$ से परलक्षणी प्रक्रम से बंगाल में मर्क्यूर विद्यता (6.7 विव/हे०) की तुलना से दुर्गती सर्जिका (13.5 विव/हे०) प्राप्त हुई।

(ii) भावों की पूर्व निर्धारण और मानक क्रमों की संश्लेषण का विवरण:—
 बावल खरीफ के क्षेत्रीय कोष्क बद्ध निर्दिष्ट जिनों में टी० के० एम०-9 (मर्क्यूर), मर्क्यूर (भद्रक), एम० एल० आर० 9672, एम० एल० आर० 9674 (प्रकाशम), एम० टी० एम० 8002, एम० टी० एम० 8089 (खम्म), फलानी, कन्नर 3234 (खामाम), एम० टी० एम० 4569, एम० टी० एम० 9416 (पूर्वी गोलार्ध), इटिन (प्रकाशम), आइ० आर० 36 (कोलकोट और कोल्लियम) प्रक्रम उपयुक्त पाई गई। रवी की ए० बी० टी० 31 (उ० आरकोट) और बी० ए० टी० 125 (पूर्वी गोलार्ध) प्रक्रम श्रवणी पाई गई।

(iii) शुद्ध प्रमाण के अर्थों विभिन्न प्रसलों की उत्पन्न प्रत्यक्षता:—
 विदर और भद्रक में खरीफ की उत्पन्न, प्रकाशम में मर्क्यूर, और प्रकाशम में बावरी (सामान्य उत्तर, बावरी भाद्र) के लिए $N^{30}P^{30}$ की मात्रा उपयुक्त पाई गई। मर्क्यूर और बावरी के लिए प्रकृत प्रकाशक नही थी। विदर और खामाम में मर्क्यूर, विदर में उत्तम और विदर और भद्रक में बंगाल-वने के लिए $N^{20}P^{20}$ प्रयुक्त थी। पूर्वी

शून्य: फसल पर किए गए अध्ययनों से पता चलता है कि शून्य: फसल का मुख्य फसल की उपज पर कोई प्रभाव नहीं पड़ता बल्कि रीट्रो सीडिंग पर भी फसल के रूप में रीट्रो से उपज पर कोई मुख्य फसल की उपज में कोई भी फसल के रूप में रीट्रो से 5.5 फीसदी/हेक्टर

की कमी करती संभव था ।
 बने की फसल में जबलपुर और इंदौर में 75 प्रतिशत तक की और अकोला में 50 प्रतिशत तक उर्वरक की मात्रा में 25 प्रतिशत की और रायपुर में 50 प्रतिशत की कमी की जा सकती है ।
 गेहूँ की फसल के लिए संशोधन व्यवस्थाओं के अधीन उत्पादन क्षमता प्रयोग में अकोला में की उपज प्रदात हुई ।

3.2 फीसदी/हेक्टर की प्रभावी उपज के साथ-साथ मक्के के बारे (बी. एम. 2) की 18.1 फीसदी/हेक्टर प्रभाव में फसल अनुक्रम बिना प्रदात अकोला में गेहूँ-मक्का से एक वर्ष में अकोला की है की परेशानी गयी । नवमारी में चावल—गेहूँ—मूंग से 10.9 टन/हेक्टर की उपज प्रदात हुई और उत्पादन क्षमता प्रयोगों में उच्च फसल बीजता अनुक्रम बिना प्रदात अकोला और दाल सिंधल

(क) सूक्ष्म अनुसंधान केन्द्रों (A.R.C.) पर प्रयोग :—

परिणाम नीचे दिए जा रहे हैं ।
 पी. एं. में वार्षिक परिवर्तन, 1979 में संक्षिप्त रूप से दिये गए थे । 1978-79 के कुछ और 170 फीसदी प्रयोगों के आंकड़ों का सांख्यिकीय विश्लेषण किया गया । प्रमुख परिणाम पी. एं. की शोधन कर्मियों के क्षेत्रों पर किये गये 1920 प्रयोगों और 16 शोधन क्षेत्रों पर आयोजित परिवर्तनशील वर्ष के दौरान दोनों ही निम्न/उच्च रीट्रो और एक ही परिणामों

प्रयोगों से संबंधित आंकड़ों का सांख्यिकीय विश्लेषण और निवेदन :—
 और क्षेत्रीय उत्पन्न मूल्य में ५० शतक से ५०० पी. एं. के शोधन किए गए 18.1.5 उच्च-गुणवत्ती से शून्य-पूर्व और दक्षिण-पूर्व उत्पन्न मूल्य और अर्थ-शून्य लाना पठारी

प्रतिशत की गिरावट हुई ।
 रबी में $N_{120} P_{60} K_{60}$ की रीट्रो प्रभाव मात्रा की 50 प्रतिशत खाने पर फल उत्पादन में 3 से वार्षिक उत्पादन में एक प्रतिशत की गिरावट हुई । कोस्टलियम में दोनों ही मौसमों खरीफ और प्रतिशत की कमी करके रबी के दौरान $N_{120} P_{60} K_{60}$ उर्वरक की पूर्ण मात्रा खाने पूर्ण गिरावट में खरीफ के दौरान $N_{120} P_{60} K_{60}$ उर्वरक में रीट्रो प्रभाव मात्रा में से 25

(iv) संशोधन व्यवस्थाओं के अधीन उर्वरक प्रत्यक्षता :—

शुद्धिकरण प्रदात हुई ।
 गिरावट में गिरी के लिए $N_{60} P_{40}$ और मकक में मूल्यमूल्य के लिए $N_{60} P_{40} K_{60}$ से अच्छी

थी जबकि शुद्ध फसल 4.4 किंव०/हेक्ट० थी। इस पद्धति से मूंगफली की उपज 9.1 से 12.4 किंव०/हेक्ट० की सीमा के बीच बढ़लती-बढ़लती रही।

नबसारी में गेहूँ और सरसों को मिश्रित फसल के रूप में उगाने पर सरसों की उपज में तो सुधार हुआ किन्तु गेहूँ की उपज पर काफी प्रभाव पड़ा। अन्य केन्द्रों में से किसी भी केन्द्र पर एकल फसल से मिश्रित फसल श्रेष्ठ नहीं पायी गयी।

(ख) कृषकों के खेतों पर प्रयोग (B.C.F.)

भड़ोच में $N_{60} P_{60} K_{60}$ डालने पर गेहूँ की उपज दर में 7 किंव०/हेक्ट० से (बिना खाद वाले भूखण्डों के लिए) 21 किंव०/हेक्ट० तक की वृद्धि हुई। सतना में गेहूँ की उपज दर में 9 किंव०/हेक्ट० (नियंत्रण के लिए) से 22 किंव०/हेक्ट० तक की वृद्धि हुई।

सतना और उज्जैन में 40 कि० ग्रा० P_2O_5 /हेक्ट० डालने पर 5 किंव०/हेक्ट० की अच्छी अनुक्रिया प्राप्त हुई। उज्जैन में जे० जी०-404 और सतना में जे०-62 किस्म में 20 कि० ग्रा० N./हेक्ट० डालने पर 6 किंव०/हेक्ट० से अधिक की अनुक्रिया प्राप्त हुई। अधिकांश जिलों में $N_{20} P_{20}$ का उपयोग श्रेष्ठ पाया गया।

भड़ोच और कच्छ में मूंग के लिए 20 कि० ग्रा० N/हेक्ट० के हिसाब से नाइट्रोजन की थोड़ी सी मात्रा लाभप्रद थी। सतना में उड़द और उज्जैन में सोयाबीन के लिए नाइट्रोजन का उतनी ही मात्रा में उपयोग लाभप्रद पाया गया। सतना में उड़द के लिए $N_{20} P_{20}$ का उपयोग भी लाभप्रद पाया गया। अमरावती, नान्देद और अमरोली में $N_{20} P_{60}$ डालने पर मूंगफली में अनुक्रियाएं 3.4 से 5.7 किंव०/हेक्ट० के बीच बढ़लती-बढ़लती रहीं। सांगली में $N_{20} P_{60} K_{60}$ डालने पर 6.2 किंव०/हेक्ट० की उच्चतम अनुक्रिया प्राप्त हुई।

बनासकांठा में $N_{60} P_{60} K_{60}$ का उपयोग काफी लाभदायक रहा जिससे भरंडी की उपज दर 15 किंव०/हेक्ट० से 34 किंव०/हेक्ट० तक हो गई।

18.1.6 कृषि क्षेत्रों के राष्ट्रीय सूचकांक का समन्वय एवं नियोजन एकक

क्षेत्रानुसार (पूर्वी, उत्तर-पश्चिमी, दक्षिणी और उत्तर प्रदेश) समेकित प्रगति रिपोर्ट निम्नानुसार है :—

वर्ष के दौरान क्षेत्रीय स्टाफ ने सूचना दी की 1972 तक आयोजित 2735 प्रयोगों से संबद्ध आंकड़े और इनके अतिरिक्त 1972 से अब तक आयोजित लगभग 17,700 प्रयोगों से संबद्ध आंकड़ों की सूचना संस्थान को दे दी गई है।

सभी राशियाँ में FYM की खाली जाने वाली मात्रा को बढ़ाने के साथ-साथ शोधकर्ताओं:
 सभी किसानों की उपज में वृद्धि हुई। 50 टन/हेक्टर, F.Y.M. खाली पर गूजरान में प्रच. मात्र.

रही।

की उपज स्थिति पर विचारितियों के अधीन 100 फा. ग्रा. K_2O /हेक्टर खाली से शोधकर्ताओं
 6.55 और 3.88 फा. K_2O /हेक्टर थी। शोधकर्ताओं में इन किसानों की शोधकर्ताओं और शोधकर्ताओं की
 रही पत्तियों की उपज में पत्तियों की उपज में वृद्धि हुई। विभिन्न किसानों की उपज में वृद्धि क्रमशः 4.78,
 ग्रा. K_2O /हेक्टर तक प्रतिशत खाली पर खाली, किसानों और विभिन्न राशियों में वृद्धि किसानों की
 शोधकर्ताओं की (के लिए लाभदायक न था। गूजरान में विचारितियों के अधीन 100 फा.
 फा. की फसल के लिए 100 फा. ग्रा. P_2O_5 /हेक्टर तक खाली फसल उपज (रही पत्ती,

हेक्टर खाली पर उपज न थी।

वृद्धि रही है। गूजरान में खाली किसानों के लिए रही पत्ती की उपज 40 फा. ग्रा. N/
 गूजरान की मात्रा बढ़ाने पर विभिन्न किसानों की रही पत्ती और शोधकर्ताओं की उपज में
 कर्नाटक, तमिलनाडु, गूजरान और शोधकर्ताओं में विचारितियों के अधीन

से एकत्रित शोधकर्ताओं के लिए गए। शोधकर्ताओं पर विचारितियों के अधीन 491 पत्तियों

शोधकर्ताओं की फसल पर प्रच. मात्रा में वृद्धि हुई। की शोधकर्ताओं के अधीन 491 पत्तियों

18.1.7. शोधकर्ताओं के उपजान पर विभिन्न शोधकर्ताओं की मात्रा —

गयी।

कोरिया के लिए विभिन्न शोधकर्ताओं के लिए शोधकर्ताओं की शोधकर्ताओं की शोधकर्ताओं की
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1977 के दौरान शोधकर्ताओं में शोधकर्ताओं से शोधकर्ताओं की शोधकर्ताओं की शोधकर्ताओं की
 शोधकर्ताओं की शोधकर्ताओं की शोधकर्ताओं की शोधकर्ताओं की शोधकर्ताओं की शोधकर्ताओं की
 शोधकर्ताओं की शोधकर्ताओं की शोधकर्ताओं की शोधकर्ताओं की शोधकर्ताओं की शोधकर्ताओं की
 शोधकर्ताओं की शोधकर्ताओं की शोधकर्ताओं की शोधकर्ताओं की शोधकर्ताओं की शोधकर्ताओं की
 शोधकर्ताओं की शोधकर्ताओं की शोधकर्ताओं की शोधकर्ताओं की शोधकर्ताओं की शोधकर्ताओं की

62-7 किस्म की हरी पत्ती में 1.52 किंव०/हेक्टर० की अधिकतम वृद्धि प्राप्त हुई। कर्नाटक और आंध्र प्रदेश में सर्वाधिकत परिस्थितियों के अधीन सभी F.C.V. किस्मों के अधिकतम उपयोग से संसाधित और चमकीली पत्तियों की उपज में वृद्धि हुई। विभिन्न किस्मों में चमकीली पत्ती की उपज में वृद्धि 0.24 किंव०/हेक्टर० से 1.88 किंव०/हेक्टर० तक अदलती-बदलती रही। संसाधित पत्ती की उपज 0.29 किंव०/हेक्टर० से 1.09 किंव०/हेक्टर० तक अदलती-बदलती रही।

80 प्रतिशत खेत क्षमता तक सिंचाई प्रयोगों में जब सिंचाई के स्तर को एक, दो और तीन सिंचाई तक बढ़ाने पर कुल पत्ती और चमकीली पत्ती की उपज में लगातार वृद्धि देखी गयी। सर्वाधिकत अवस्था की तुलना में एक, दो और तीन सिंचाई के स्तर सहित कुल पत्ती उपज में वृद्धि 3.57, 4.25 और 4.62 किंव०/हेक्टर० की थी। गुजरात राज्य में उपयोग में लाई गई किस्म आनन्द-2 थी। एफ० बी० सी० (F.V.C.) और बीड़ी, ये दो तम्बाकू की किस्में थीं।

18-1-8. तुंगभद्रा नदी-घाटी परियोजना क्षेत्र में सस्य व्यवरोधों का अध्ययन :—

परियोजना-रिपोर्ट को अन्तिम रूप दिया जा चुका है। प्राप्त प्रमुख परिणाम निम्नानुसार है :—

खाद्यान्न और तेल वाली फसलों के उत्पादन और उत्पादकता में प्रगति का मूल्यांकन करने के लिए एक अध्ययन किया गया और सात हुआ कि आन्ध्र-प्रदेश के भाननपुर, कुडपा और करनूल जिले और कर्नाटक के बेल्तारी और रायचूर जिले जो तुंगभद्रा नदी-घाटी परियोजना के अधीन आते हैं, के कमान क्षेत्रों में सुधार की सम्भावनाएं हैं। दो परियोजनाओं की सिंचाई क्षमता 5.1 लाख हेक्टर० थी जोकि कुल क्षेत्र का जितने उचार, कपास, चना इत्यादि जैसी फसलें उगाने के लिए निर्धारित किया गया था, का 80-90 प्रतिशत था।

फसल पद्धति को अनुकूल बनाने में जो व्यवरोध अनुभव किये गये उन्हें दूर करने और सिंचित कृषि के लिए अनुकूल वातावरण उत्पन्न करने की दृष्टि से हर प्रकार की सिंचित फसल उगाने के लिए प्रोत्साहन दिये गए। ऊपरी भाग के कुछ खण्डों में अनाधिकृत सिंचाई से निम्न क्षेत्रों में पानी की अल्पता/अनुचित समय/आपूर्ति के कारण फसल अनुकूलन की हानि हुई।

मन्द गति और विच्छेदों की वजह से नहरों के पूर्ण क्षमता में काम न करने और वर्षों से नालियों की ओर ध्यान न देने के कारण जल की अल्पता/असमय आपूर्ति ने भूमि प्रबन्ध की समस्याओं को बढ़ाया है। खरीक और रबी बायें किनारे में, बहुवर्षीय, शुष्क एवं नम (दोनों ही) खेती के लिए एक ही निर्गम का आबंटन एक गम्भीर कारण है।

1953 में जब परियोजना चालू हुई थी तो जिन अनाज, दाल और तेल की फसलों का उत्पादन क्रमशः 1.00, 0.04 और 0.09 लाख टन था। 1977-78 में यह बढ़कर क्रमशः 5.33, 0.12 और 1.07 लाख टन हो गया। कर्नाटक में जहाँ 70 प्रतिशत कमान क्षेत्र आता है, अनाजों

श्रीर तेल वाली फसलों के उत्पादन में लक्ष्य की प्राप्ति के लिए कमशः 3.03 और 0.57 लाख टन का श्रान्तर रह गया । गान्ता जो 1953 से पहले कभी नहीं उगाया जाता था, पैदावार 16.32 लाख टन उत्पादन के लक्ष्य तक पहुंच गया । 1977-78 में चावल और गन्ने के लक्षित क्षेत्र को कमशः 116 प्रतिशत और 37 प्रतिशत बढ़ाया गया ।

कमान में उत्पादकता बढ़ाने का कार्यक्षेत्र है । गेहूँ, ज्वार, बाजरा जैसी फसलों को उगाने के लिए, जिसके लिए केवल एक तिहाई पानी की आवश्यकता होती है, सिंचाई सुविधाओं का लाभप्रद उपयोग किया जा सकता है और इसके उगाने से चावल की अपेक्षा अधिक लाभ अधिक है । इन फसलों में उच्च पैदावार वाली किस्मों के प्रसार को प्रोत्साहन दिया जा सकता है । श्रान्तों, दालों और तेल वाली फसलों की उच्च पैदावार वाली/संकर/उन्नत किस्मों उगाकर उत्पादकता को उचित सिंचाई देकर, 40-100 प्रतिशत के बीच तक बढ़ाया जा सकता है । प्रायोगिक श्रांकड़ों से निकलने वाला फसल तीव्रता को 100 से 300 प्रतिशत तक बढ़ाया जा सकता है और 12 टन/हेक्टर श्रान्त उत्पादन दर्शाया गया । दालों और तेल वाली फसलों को फसल क्रम में लाने की संभावनाओं को भी इन्हीं प्रयोगों द्वारा देखा गया । श्रान्तः फसल द्वारा भूमि उपयोग की कार्य-कुशलता बढ़ाने के लिए गन्ने में गेहूँ और लोबिया उगाया जिससे गेहूँ की 1856 कि०ग्रा०/हेक्टर और 1472 कि०ग्रा०/हेक्टर लोबिया की प्रतिरिक्त उपज प्राप्त हुई जबकि गन्ने की उपज लगभग 108 टन/हेक्टर उभों की र्यों रही । कुण्कों के खेतों पर किये गये प्रयोगों से पता चलता है कि सिंचाई करने और 120 कि०ग्रा० N, 60 कि०ग्रा० P₂O₅ और 60 कि० ग्रा० K₂O/हेक्टर के हिसाब से उर्वरक डालने पर चावल की उपज लक्षित उपज 5000 कि०ग्रा०/हेक्टर से अधिक श्रान्त 6800 कि०ग्रा०/हेक्टर तक प्राप्त की जा सकती है और 60 कि०ग्रा० N, 30 कि० ग्रा० P₂O₅ और 30 कि०ग्रा० K₂O/हेक्टर डालने पर मूंगफली की उपज को लक्षित उपज 2500 कि०ग्रा०/हेक्टर से 3200 कि०ग्रा०/हेक्टर तक बढ़ाया जा सकता है ।

18.1.9. बहु सस्य-कर्तन (Multiple Harvesting) वाली फसलों पर पद्धतिबद्ध श्रान्तः—

प्रारम्भिक श्रांकड़ों सहित विस्तृत सूचनाएं पी० ए० यू०, जी० ए० यू० और गो० ब० पन्त विश्वविद्यालय से एकत्रित की गई । श्रांकड़ों पर विस्तृत सांख्यिकीय विश्लेषण किया गया । केंद्रानुसार स्थिति नीचे दी जा रही है :—

(1) पंजाब कृषि विश्वविद्यालय लुधियाना :—

कपास पर कुल 41 प्रयोग उपलब्ध थे । विभिन्न प्रयोगों में चुनने की संख्या 2 से 4 तक श्रदलती बदलती रही । सभी प्रयोग 3 या 4 पुनरावृत्ति (Replication) लेकर R.B.D. में श्रायोगित किये गये । समस्त किस्मों 12 से 30 तक रही । सभी प्रयोगों के लिए कुल उपज के प्रति विभिन्न चुनवों (Pickings) के प्रतिशत योगदान की गणना की गई । सभी चुनवों

(Pickings) और कुल उपज के लिए विचलनों का विश्लेषण अलग से किया गया। सभी प्रयोगों के लिए विभिन्न चुनावों और कुल उपज हेतु विचलन के गुणकों की गणना की गई। सह-विचरण का विश्लेषण करने के लिए पादप आधार के आंकड़ों को उपयोग में लाया गया।

(ii) गुजरात कृषि विश्वविद्यालय, सूरत

कपास पर प्रयोगों (39 स्वतंत्र प्रयोगों) के 12 समूहों के आंकड़े उपलब्ध थे। अनेक चुनाव (Pickings) 2 से 5 तक अदलते बदलते रहे, 39 प्रयोगों में से 9 प्रयोग बिखरे हुए भूखण्ड अभिन्यास (Split-Plot Design) में आयोजित किये गये जबकि शेष 30 प्रयोग R.B.D. में किये गये; सभी प्रयोगों के लिए कुल उपज के प्रति विभिन्न चुनावों (Pickings) के प्रतिशत योगदान की गणना की गई। समस्त चुनावों (Pickings) और कुल उपज के लिए विचरण का विश्लेषण अलग से किया गया। सभी प्रयोगों के विभिन्न चुनावों और कुल उपज के विचरण का गुणांक पता लगाया गया। चूंकि अनेक वर्षों के आंकड़े उपलब्ध थे अतः विभिन्न उपचारों/किस्मों की स्थिरता की जाँच भी स्थिरता सूचकांक द्वारा की गई।

(iii) गो० ब० पंत कृषि एवं प्रौद्योगिकी विश्वविद्यालय, पंत नगर

इस विश्वविद्यालय से टमाटरों पर आयोजित आठ प्रयोगों के लिये आंकड़े एकत्रित किये गये हैं। कुल उपज के प्रति विभिन्न चुनावों (Pickings) का प्रतिशत योगदान, विचरण का विश्लेषण विभिन्न चुनावों (Pickings) के लिए विचरण गुणांक और कुल उपज की गणना पूरी की जा चुकी है।

18.1.10 उ० प्र० राज्य में गेहूँ की फसल पर 1966-71 के दौरान कृषि क्षेत्रों पर आयोजित प्रयोगों का सांख्यिकीय मूल्यांकन :—

परियोजना के अधीन खेतों पर 8,18 प्रयोगों का विश्लेषण किया गया। कुल अनुसंधान सूचकांक 62.42 प्रतिशत बना जिसे देखने से पता चला कि अनुसंधान प्रयास सन्तोषजनक स्थिति में किये गये। कुछ कमियाँ नीचे दी गई हैं :—

- (i) 34 प्रतिशत मामलों में वैज्ञानिकों की ओर से प्रभावी उपचार स्तर के चयन में शलत निर्णय।
- (ii) लगभग 17 प्रतिशत प्रयोगों में बिखरे हुए भूखण्ड अभिन्यासों (Split-plot design) का अनुचित उपयोग।
- (iii) अनेक मामलों में रोग नियंत्रण प्रयोग ऐसे खेतों में भी किये गये जहाँ रोगों का प्रभाव नहीं था।

(iv) ऊपर कथ्य शीघ्रतः 10 प्रतिशत वृद्धि तथा जबकि 80 प्रतिशत प्रयोगों में से C.V. 15 प्रतिशत से अधिक था। बर्तमान: ऐसे मामलों में 6 से अधिक पुनरावृत्तियाँ (Replications) की आवश्यकता थीं किन्तु मामलों पर केवल 4 पुनरावृत्तियाँ की गयीं।

(v) अध्ययन के अधीन खाने खाने की मात्रा निश्चित करने में समग्र प्रयोगों में खाने गये भारी/माथारी खाद की मात्रा का अनेक प्रयोगों में विचार नहीं किया गया।

(vi) भूदा, जलवायु और मृत्तिका की स्थानांतरित की रैंड में रखकर भूखण्ड आकार का कोई स्थाय प्रयोग उपयोग नहीं किया गया। एक ही प्रकार के उपचारों के लिए बारिशपानी और धरत जैसे स्थानों में जो कि एक दूसरे से काफी दूर हैं, उसी प्रकार के भूखण्ड आकारों का उपयोग किया गया।

18.1.11 धान की फसल पर प्रयोगों के समूहों में समय एवं मात्रा घटकों से संबंधित

प्रयोगों की समीक्षा

प्रधान मुख्य पर्यवेक्षण निम्नलिखित हैं:—

समय संबंधी प्रयोगों और मात्रा घटकों का जॉिक समान प्रयोगों में वृत्ति विवरणों की समीक्षा के लिए उपयुक्त है, अध्ययन करने के लिए बावत की फसल पर 445 प्रयोगों की गयीं। विवरणों निम्न प्रकार हैं—

भूदा की फसल, विभिन्न परिसरों, पौधों के भूखण्ड का आकार, प्रतिखण्ड भूखण्डों की संख्या एवं क्षेत्र, प्रयोग का प्रकार और प्रति समूह प्रयोगों की संख्या। 1/2 परीक्षण द्वारा उक्त प्रत्येक घटकों के साथ वृत्ति विवरणों की समीक्षा के प्रयोगों की परीक्षा की गयी। परीक्षण से वृत्ति विवरणों की समीक्षा के साथ कुछ घटकों के प्रयोग का पता चला। कुछ परिणाम नीचे दिये गये हैं:—

(i) वृत्ति विवरणों की समीक्षा का संबंध फसल कार्यों के साथ प्रत्येक क्षेत्र पड़ता है:—

(ii) वृत्ति भूदा समूहों के अधीन खण्ड क्षेत्र ≤ 600 वर्ग मी. किन्तु विविध पर-
 स्थितियों में प्रयोगों के अधीन < 200 वर्ग मी.

(iii) m-टाईप के प्रयोगों या भारी मूदा समूह के श्रवण संचित परिस्थितियों के अधीन प्रति ब्लाक-भूखण्डों की संख्या 6 से अधिक नहीं थी और संचित परिस्थितियों के अधीन प्रत्येक ब्लाक में भूखण्डों की संख्या 5 थी ।

18.2 फसल पूर्वानुमान क्रिया-पद्धति

18.2.1 जीव सांख्यिकीय लक्षणों (Biometrical-characters) पर आधारित फसल की उपज के कटाई से पूर्व पूर्वानुमान पर मार्गदर्शी अध्ययन-गन्ना, उवार और तम्बाकू ।

तीन फसलों से संबद्ध कार्य की प्रगति निम्नानुसार है
(मद संख्या 18.2.2, 18.2.3, 18.2.4 और 18.2.5)

18.2.2 गन्ना—जिला मेरठ (उत्तर प्रदेश)

वर्ष 1978-79 के दौरान मेरठ जिले में गन्ने पर आयोजित मार्गदर्शी सर्वेक्षण पर आधारित श्रांकड़ों का विश्लेषण किया गया । सात विभिन्न मांडलों के साथ समाश्रयण विश्लेषण का कार्य किया गया ; प्रथम में आश्रित विचर (Y) और स्वतंत्र विचर (Xis) प्रारंभिक स्केल में लिए गये । मांडल II, III और IV में Xis को क्रमशः लघुगुणकीय, वर्गमूल और व्युत्क्रम स्केलों में रूपान्तरित किया गया । मांडल V, VI और VII में Y और Xis दोनों ही को क्रमशः लघुगुणकीय, वर्गमूल और व्युत्क्रम स्केलों में रूपान्तरित किया गया । मांडल I श्रान्य मांडलों के समतुल्य और मांडल—VII से श्रेष्ठ पाया गया । अतः मांडल I अभिकलन एवं निर्वाचन के परिणामों की साधारणता के कारण पूर्वानुमान के काम में लाया जा सकता है ।

18.2.3 गन्ना—जिला कोलहापुर (महाराष्ट्र)

1977-78 में जिला कोलहापुर (महाराष्ट्र) में गन्ने की उपज के कटाई से पूर्व पूर्वानुमान पर मार्गदर्शी अध्ययनों में गन्ने की उपज और विभिन्न जीवसांख्यिकीय लक्षणों जैसे—गन्नों की संख्या, ऊंचाई, मोटाई और तृतीय पर्ण की लम्बाई और चौड़ाई के बीच सार्थक घनात्मक सहसम्बन्ध देखने में आया । समाश्रयण विश्लेषण के अध्ययन से पता चला कि इन लक्षणों द्वारा लगभग 70-75 प्रतिशत विचलन की व्याख्या की जा सकती है और कटाई से 3-4 माह पूर्व उपज का पूर्वानुमान संभव है ।

प्रतिवेदनाधीन वर्ष 1978-79 के दौरान एकत्रित श्रांकड़ों का विश्लेषण किया गया । परिणामों से ज्ञात हुआ कि सर्वेक्षण के प्रथम चक्र की तरह उपज और इन लक्षणों के बीच घनात्मक सह-संबंध देखा गया । समाश्रयण विश्लेषण के परिणामों में देखा गया कि जब फसल लगभग 7 माह पुरानी थी तो जीवसांख्यिकीय लक्षणों द्वारा उपज में विचलन की लगभग 75

गया कि प्रारम्भिक स्केल में विचरणों सहित रेखीय मॉडल उपज के प्राग्भक्ति (Prediction) के लिए उपयुक्त है।

18.2.6 (i) जिला दक्षिणी आरकोट (तामिलनाडु) में धान और

(ii) जिला गोरखपुर (उ० प्र०) में गेहूँ की उच्च पैदावार वाली किस्मों पर फसल में कीटाणुओं और बीमारियों तथा संगत हानि के प्रभाव के आंकलन हेतु मांगदर्शी प्रतिदर्श सर्वेक्षण

इन दो फसलों से सम्बद्ध कार्य की प्रगति निम्नानुसार है। (मद 18.2.7 और 18.2.8)

18.2.7 धान—जिला द० आरकोट (तमिलनाडु)

सम्बन्ध 1976 के प्रतिवेदन को अन्तिम रूप दिया जा चुका है। नवराई, 1977 के आंकड़ों पर आधारित, बहुसमाश्रयण विश्लेषण में समाश्रय चरो जैसे मुख्य घटकों के प्रभाव को उपयोग में शामिल करने की तकनीक द्वारा परिणाम प्राप्त किये गये।

18.2.8 गेहूँ—गोरखपुर (उ० प्र०)

वर्ष 1978-79 में रबी मौसम से संबद्ध आंशिक आंकड़ों का विश्लेषण पूरा किया गया और उपर्युक्त पादप सुरक्षा उपायों द्वारा रोकी जा सकने वाली फसल की उपज की हानि के क्षेत्रानुसार आंकलन और जिले की ऐसी हानि का संयोजित आंकलन भी प्राप्त किया गया जिले में फसल की उपज में रोकी जा सकने वाली हानि 6 प्रतिशत की मानक त्रुटि सहित, 3.23 कि०ग्रा/हेक्ट० आंकी गई। प्रतिशत के आधार पर सम्भवतः उपयुक्त पादप सुरक्षा रासायनिकों के उपयोग से फसल की उपज में हानि 9.69 प्रतिशत थी। क्षेत्रानुसार हानि की सीमा 206 कि०ग्रा/हेक्ट० से 384 कि०ग्रा/हेक्ट० और प्रतिशत में यह 6 से 14 प्रतिशत के बीच थी।

18.2.9 मौसम प्रचालों पर आधारित फसल की उपज के पूर्वानुमान पर अध्ययन।

वर्ष 1947 से 1973 तक 25 वर्षों के रायपुर जिले के आंकड़ों का संग्रह और विश्लेषण किया गया। अधिकतम तापक्रम और सापेक्ष आर्द्रता (14 घण्टे) के संयुक्त प्रभावों पर अध्ययन से पता चला कि अधिकतम तापक्रम में वृद्धि होने पर उपज पर उपर्युक्त औसत सापेक्ष आर्द्रता के हितकारी और अपचायक (Detrimental) प्रभाव में वृद्धि हुई। सापेक्ष आर्द्रता में वृद्धि होने से उपज पर उपयुक्त औसत तापक्रम के लाभकारी प्रभावों में वृद्धि हुई जबकि अपचायक प्रभावों में कमी हुई।

अधिकतम ताप, सापेक्ष आर्द्रता, कुल वर्षा वृष्टि, बरसात के दिनों की संख्या जैसे

सांख्यिक मास वरी की मदद से, उर्वरक खपत जैसे कृषि निवेष्टी उ० ष० कि० के अधीन प्रतिशत क्षेत्र एवं सिंचाई के अधीन प्रतिशत क्षेत्र और उर्वरक-फल मूल्य के अनुपात रीत्युर विज्ञ की बावत की उपज के पूर्वानुमान के लिए संयुक्त मंडल की अध्ययन किया गया। फरमागों से प्राप्त हुआ कि कृषि निवेष्टी का प्रवृत्ति पर प्रतिरक्षत योगदान नगण्य था, दक्षिण है कि मास वरी और प्रवृत्ति का उपयोग करने वाला मंडल पूर्वानुमान लगाने के काम में बाधा जा सकता है, जिसमें बावत की उपज में 70 प्रतिशत से ऊपर के विचलन की व्याख्या की जा सकती है।

18.3 पशु विज्ञान में सांख्यिकीय अनुसंधान

18.3.1 (क) आई० सी० डी० क्षेत्र, भीपाल (म० प्र०) ;

(ख) आई० सी० डी० क्षेत्र, बीकानेर (राजस्थान) में दूध की उपलब्धता और उत्पादन की जागत का आंकलन और दूधका सूचकांक :

दोनों ही क्षेत्रों से संतुल्य गणित दूध प्रकार है :—

(क) आई० सी० डी० क्षेत्र, भीपाल (म० प्र०) में दूध उत्पादन की जागत एवं उपलब्धता का आंकलन :

फिराई प्रमुख फरमागों सहित प्रतिवयन अभियोग्य, कार्य योजना, आंकलन पद्धति प्रस्तुत करती है। आई० सी० डी० क्षेत्र, भीपाल में प्रति गांव फरमागों की आसत संख्या 69 थी, जिसमें से 78 प्रतिशत फरमागों में गौवृक्षीय पशु पाले जाते हैं। गौवृक्षीय पशु पालने वाले वरी में से अधिक से अधिक 85 प्रतिशत वरी में दूधालू पशु थे। प्रति गांव आसतन 281 पशु और 77 में से रखी जाती थी। लगभग 52 प्रतिशत वरी में केवल दूधालू गायें, 38 प्रतिशत वरी में दोनों ही गाय एवं भैंसे और 10 प्रतिशत वरी में केवल भैंसे रखी जाती थी। उत्पादकों का कुल वय प्रदान था और कुल दूध उत्पादकों में से उसकी संख्या तीन चौथाई आंकी गयी है। प्रत्येक 10 फरमागों में आसतन 17 दूधालू गाय और 8 दूधालू भैंसे रखी जाती थी। प्रजनन योग्य गायों का 99 प्रतिशत आसत वंशी (N.D.) था। प्रजनन योग्य भैंसों में से 95 प्रतिशत आसत वंशी (N.D.) थी और शेष मुर्तिह थी। भीपाल के आसतन आई० सी० डी० क्षेत्र में कुल दैनिक दूध उत्पादन 70 टन के लगभग था, जिसमें से 44 प्रतिशत गाय का और 56 प्रतिशत भैंस का दूध आंकी गया। दूध दे रही एक गाय का आसत दैनिक दूध उत्पादन लगभग 0.79 कि० ग्रा० था, दूधकी कुलता में दूध दे रही प्रति भैंस का दैनिक दूध उत्पादन 1.80 कि० ग्रा० था। दूधालू गाय और दूधालू भैंस के जागत आंकलन क्रमशः 0.40 और 1.07 कि० ग्रा० था।

सर्वेक्षण की अवधि के दौरान गाय के दूध की प्रति कि० ग्रा० कुल लागत परिवारिक श्रम शामिल करने पर 212 ± 10.4 पैसे थी और इस श्रम को निकाल देने पर यह लागत 146.7 ± 7.7 पैसे थी। इसी अवधि में इस क्षेत्र में गाय के दुग्ध का सनातन बाजार भाव 1.80 रु० प्रति कि० ग्रा० था। परिवारिक श्रम सहित भैंस के दूध की प्रति कि० ग्रा० कुल लागत 169 ± 4.7 पैसे थी और इसे निकालने पर यह 113 ± 3.1 पैसे थी। भैंस के दूध का सनातन बाजार भाव 1.97 रु० प्रति कि० ग्रा० था।

गाय के दूध की स्थिति में चारे की लागत, पेंसा लेकर काम करने वाले श्रमिक, परिवारिक श्रमिक, पशुओं की हानि, पूंजी पर ब्याज, पूंजी और उपकरणों पर हानि तथा फुटकर खर्च, कुल लागत का क्रमशः 46, 6, 28, 5, 8, 5 और 2 प्रतिशत आंका गया। भैंस के दूध के लिए यह आंकलन क्रमशः 42, 7, 23, 10, 12, 4 और 2 प्रतिशत था।

व्यावसायिक घरों में प्रत्येक मौसम में उत्पादित गाय के कुल दुग्ध की अधिक से अधिक 71 से 81 प्रतिशत खपत तरल रूप में होती थी, 9 से 11 प्रतिशत को दुग्ध उत्पादों में बदल दिया जाता था और शेष को बेच दिया जाता था। किन्तु भैंस के कुल दुग्ध का 42 से 50 प्रतिशत बेच दिया जाता था, शेष का उपयोग या तो तरल दुग्ध के रूप में या दुग्ध उत्पादों के रूप में होता था।

क्षेत्र में दुधारू भैंसों में मृत्यु का अनुपात 6.5 प्रतिशत था, जबकि इसकी तुलना में गायों में मृत्यु अनुपात 4 से 7 प्रतिशत था।

(ख) आई० सी० डी० क्षेत्र, बीकानेर, (राजस्थान) में दुग्ध उत्पादन की लागत का सूचकांक :—

रिपोर्ट दुग्ध उत्पादन की लागत का सूचकांक बनाने की विधि प्रस्तुत करती है। इस विधि में प्रथम लासपेयर की विधि की सहायता से लागत के प्रमुख घटकों अर्थात् चारे और श्रमिक की सूची बनाते हैं और तब अपेक्षित सूचकांक प्राप्त करने के लिए इन सूचियों को समुचित भारों से मिला देते हैं।

1975-77 में आई० सी० डी० क्षेत्र, बीकानेर में गाय के दूध की उत्पादन लागत 98 पैसे प्रति कि० ग्रा० थी। 1975-77 के दौरान लागत की तुलना में 1977-78 के दौरान इसमें 12 प्रतिशत की ; 1978-79 में 19 प्रतिशत की वृद्धि हुई। 1975-77 के दौरान गाय के दुग्ध का बाजार मूल्य 113 पैसे प्रति कि० ग्रा० था।

1975-77 आधार वर्ष की अपेक्षा 1977-78 में गाय के दूध के बाजार भाव में एक प्रतिशत की और 1978-79 में 6 प्रतिशत की वृद्धि हुई।

प्रतिवेदन में, वर्ष 1977-78 और 1978-79 के लिये, वर्ष 1975-77 को आधार मान कर प्रमुख भोज्यों के बाजार भाव और पशुओं को खिलाये गये चारों के साथ-साथ विभिन्न वर्गों के श्रमिक की मजदूरी की दरों की भी सूची प्रस्तुत की गयी ।

18.3.2 पशु प्रयोगों का राष्ट्रीय सूचकांक :—

(क) दक्षिणी एवं पूर्वी अनुसंधान केन्द्र :

प्रतिवेदनाधीन वर्ष के दौरान जी० ए०शू० कृषि संस्थान, आनन्द (गुजरात) में 1960-74 के दौरान आयोजित, संख्या में 67 पशु पोषण प्रयोगों से सम्बद्ध एक सार संग्रह अर्थात् "पशु प्रयोगों का राष्ट्रीय सूचकांक" खण्ड-1, भाग-VI, प्रकाशित किया गया । लगभग 37 प्रतिशत सी० आर० डी० के प्रयोग, आर० वी० डी० के 5 प्रतिशत 3 प्रतिशत, व्यर्थस्त अभिकल्पना (Switch over designs), एक प्रतिशत बटु-उपादाना अभिकल्पना, 6 प्रतिशत लेटिन अभिन्यास के प्रयोग और लगभग 48 प्रतिशत प्रयोग किसी भी मानक अभिन्यास के अधीन नहीं थे ।

(ख) उत्तरी और पश्चिमी अनुसंधान केन्द्र :

आर० वी० एस० कान्नेत्र, बिचपुरी, आगरा द्वारा (1962-76) में आयोजित संख्या में 73 पशु-पोषण प्रयोगों पर एक सार संग्रह अर्थात् "पशु प्रयोगों का राष्ट्रीय सूचकांक" खण्ड-1; भाग-V प्रकाशित किया गया । लगभग 12 प्रतिशत सी० आर० डी० के प्रयोग, आर० वी० डी० के 5 प्रतिशत, 2 प्रतिशत व्यर्थस्त अभिकल्पना (Switch over designs) और शेष विना किसी मानकीकृत अभिन्यास के थे, अधिकांश शैक्षणिक अनुसंधान से सम्बद्ध थे ।

18.3.3 पशुओं (bovines) से जन्म एवं मृत्यु दरों के प्रांकलन हेतु मार्गदर्शी अध्ययन :

पंजाब और गुजरात केन्द्रों से सम्बद्ध प्रगति निम्नानुसार है :

(क) पंजाब केन्द्र :

यह रिपोर्ट, चयनित गावों के घरों में पाली गई जाती, नस्ल, लिंग और आयु के साथ-साथ घरों के एक प्रतिवर्ष से प्राप्त विशिष्ट आयु उर्वरता और मृत्यु दरों की विस्तृत जान-कारी के लिए प्रांकलित पशुओं की जनसंख्या की पूर्ण गणना के ढांचे से सम्बद्ध है । सर्वेक्षण के अधीन क्षेत्र में गावों की अपेक्षा भैसे अधिक थी । गौवंशीय पशुओं में देखी गयी नस्ल हरियाणा और साहिवाल और भैंसों में मुराह और नीली थीं । इनके अतिरिक्त प्रत्येक जाति में अज्ञातवंशी [N. D.] थी और कुछ संकर नस्ल की तथा श्रेणीगत (Graded) भैसे देखी गयी । 3 से 9 वर्ष की आयु समूह में प्रत्येक लिंग और प्रत्येक क्षेत्र में गौवंशीय पशुओं का प्रतिशत कुल पशुओं की संख्या का 51 से 66 था और इसी आयु सीमा के लिए भैंसों का प्रतिशत 51

से 62 था। शीघ्र पशु जनसंख्या फैल और प्रभावी उद्धारण पद्धति (Fractional Exposure Method) द्वारा फास्टेड शय्य उद्धारण और मृत्यु दर निकाली गई। उद्धारण की सीमा में शय्य पर उद्धारण दर में सामान्यतः वृद्धि की प्रवृत्ति देखी गई। बच्चों में मृत्यु दर अधिकतम थी। पशुओं में बर्ली शय्य के साथ शय्य मृत्यु दर कम होती बनी और ग्रीड पशुओं में निम्न थी यद्यपि अधिक शय्य वाले पशुओं में यह देखाया अधिक हो गया।

(ख) गुणवत्ता क्रम:—

इस क्षेत्र में ग्रीबलीय पशुओं में ककरेज और पशुओं में घूरती थी, इनकी अधिकतम केवल शी. डी. ए. क्षेत्र (कैरु जिले) में थी। ग्रीबलीय शी. डी. ए. क्षेत्र में घूरती पशु प्रजातिका [N. D.] का काम संख्या में देखी गयी अन्य तर्ज, ग्रीबलीय में गिर और अधिकतम पशु प्रजातिका थी। इसके साथ-साथ शी. डी. ए. क्षेत्र में बर्लीय पशु और शी. डी. ए. क्षेत्र में घूरती पशु (Graded) पशु थी। 5 से 10 वर्ष तक के शय्य मृत्यु में देर की क्षेत्रों में पशुओं का प्रतिशत कमतः मारो ग्रीबलीय पशुओं के लिए 47 और 42, तर ग्रीबलीय पशुओं के लिए 59 और 52 और मारो पशुओं के लिए 45 और 40 था। देरी शय्य मृत्यु में तर पशुओं का प्रतिशत 5 से कम था, इस वर्ग में अधिकतम पशु एक वर्ष की शय्य से कम के बर्लीय थे। फास्टेड उद्धारण, शय्य दर के आकलनों से प्राप्त किया गया। ग्रीबलीय पशुओं में ये दरें 3 से 6; 6 से 9; 9 से 12 और 12 वर्ष और अधिक शय्य मृत्युओं के लिए ग्रीबलीय पशुओं में ये दरें शी. डी. ए. क्षेत्र में 17.40 से 40.18 प्रतिशत और ग्रीबलीय शी. डी. ए. क्षेत्र में 19.10 से 26.50 प्रतिशत की सीमा में थी जबकि शी. डी. ए. क्षेत्र की पशुओं में यह 27.96 से 33.77 और ग्रीबलीय शी. डी. ए. क्षेत्र में यह 14.89 से 28.99 प्रतिशत की सीमा में थी।

शी. डी. ए. क्षेत्र में विभिन्न शय्य मृत्यु के मारो ग्रीबलीय पशुओं में मृत्यु दर का प्रतिशत 0.28 से 17.43 तक की सीमा में था। जबकि तर पशुओं में यह प्रतिशत 1.04 से 19.02 की सीमा में था। मारो पशुओं में मृत्यु दर का प्रतिशत 0.51 से 20.22 था। तर पशुओं में मृत्यु दर की शय्य मृत्यु 0 से 1 वर्ष और 1 से 3 वर्ष तक के लिए अधिकतम किया जा सकता है और ये अधिकतम कमतः 61.55 और 29.94 प्रतिशत थे। ग्रीबलीय शी. डी. ए. क्षेत्रों में मारो ग्रीबलीय पशुओं के लिए इस दर की सीमा 1.92 से 10.72 प्रतिशत और तर ग्रीबलीय पशुओं में यह 2.39 से 16.43 प्रतिशत थी, जबकि मारो पशुओं में उद्धारण प्रतिशत 2.21 और 15.41 के बीच और तर 7.85 और 63.85 के बीच था।

18.3.4 बछड़ों पालने की लागत का सूचकांक और हरियाणा के ग्रामीण क्षेत्रों में पालन कार्यों में परिवर्तनों का अध्ययन ।

रिपोर्ट में, 1977-78 के दौरान भोज्य पदार्थों और चारे के मूल्यों एवं मजदूरी की दरों पर एकत्रित आंकड़ों और 1963-66 में आयोजित विस्तृत सर्वेक्षणों में आंकलित निवेशों की मदद से पशुओं (गाय और भैंसों) के रख रखाव/पालने की लागत का सूचकांक तैयार करने की विधि उपलब्ध हुई । इस विधि में सर्वप्रथम लासपेयर विधि (Laspeyres Method) के उपयोग से लागत के विभिन्न घटकों की सूचियाँ बनाई जाती हैं और तब इन सूचियों को भार की प्रणाली के साथ संयोजित कर दिया जाता है । भार, लागत के घटकों के कुल लागत के समानुपात में थे ।

अध्ययन से ज्ञात हुआ कि 1977-78 के दौरान पशुओं को खिलाये गये चारे की मात्रा और दुग्धाह पशुओं के दुग्ध उत्पादन में 1963-66 की तुलना में पर्याप्त परिवर्तन आया । इस-लिए इस क्षेत्र में पशुओं के रख-रखाव और पालन-पोषण के सही आंकलन प्राप्त करने के लिए विस्तृत सर्वेक्षण को शीघ्र दोहराने की आवश्यकता है ।

18.3.5 सुभार उत्पादन के अर्थशास्त्र पर सांख्यिकीय अन्वेषण : —

कार्य सर्वेक्षण : —

वर्ष के अधीन पांच फार्मों अर्थात् आई. वी. आर. आई. इज्जत नगर; संयोजित पशुधन फार्म, हैसरघट्टा; पशुधन फार्म, जबलपुर; मनोथी और तिरुपति के पशुचिकित्सा विज्ञान महाविद्यालय से एकत्रित आंकड़ों के सांख्यिकीय विश्लेषण का कार्य पूरा हो चुका था । अलीगढ़ (उ० प्र०) जिले का कोइल और सिन्दराराव तहसीलों के 28 गांवों से एकत्रित आंकड़ों का भी विश्लेषण किया गया ।

एक "लार्ज व्हाईट यार्कशायर" नस्ल के प्रौढ़ सुभार के रख-रखाव में औसत दैनिक लागत हैसरघट्टा में 3.60 रु० और तिरुपति में 7.20 रु०, युवा सुभार के लिए हैसरघट्टा में 1.2) रु० से जबलपुर में 4.0 रु० की सीमा में और शिशु सुभार के लिए हैसरघट्टा में 22 पैसे से तिरुपति में 71 पैसे की सीमा में थी । इज्जत नगर में 'लेण्ड रेस' नस्ल के प्रति सुभार के रख-रखाव की औसत दैनिक लागत एक प्रौढ़ सुभार के लिए 66) रु०, युवा सुभार के लिए लगभग 4.50 रु० और शिशु सुभार के लिए लगभग 6) पैसे थी । क्षेत्रीय सर्वेक्षण में यह लागत बहुत कम थी जो कि प्रौढ़, युवा और शिशु के लिए क्रमशः 90, 45 और 12 पैसे थी । फार्म आंकड़ों में प्रौढ़ पशुओं के लिए चारे की लागत कुल लागत में से लगभग 45 से 80 प्रतिशत है और क्षेत्रीय आंकड़ों में यह केवल लगभग 6 प्रतिशत है । क्षेत्रीय आंकड़ों में मजदूरी की लागत,

के समिश्रण, जिसने उत्पादनों को अधिकतम किया, को हरियाणा गांधी और सूरती भैंसों से सम्बद्ध केवल दो प्रयोगों से प्राप्त किया जा सका है। उत्पादनों ने नियत स्तर के लिए समोत्पादों, निवेश घटकों के सीमांत उत्पादों, प्रतिस्थापना और उत्पादन प्रत्यास्थता की सीमांत दरों का पता लगाया गया।

18.3.9 मुर्गीपालन का अर्थशास्त्र : उत्पादन और निवेश घटकों के मध्य फलनात्मक सम्बन्धों का अध्ययन।

अध्ययन से देखा गया कि अण्डे देने के दिनों और प्रति अण्डे देने पर चारे की लागत से अण्डा उत्पादन और फार्म की आय में विचलन का एक प्रमुख भाग देखने में आया। आंकड़ों के विभिन्न समुच्चयों में द्विघात और काब-डगलस (Cobb-Douglas) प्रकार्यों को उचित पाया गया इससे R^2 का मान 50 और 97 प्रतिशत की सीमा में प्राप्त हुआ।

ऐसा देखा गया कि विभिन्न मौसमों के लिए अन्य निवेशों के साथ अण्डा उत्पादन हेतु एकल उत्पादन प्रकार्यों को चुना जा सकता है, पंजाब के आंकड़ों के लिए यह सम्बन्ध, एक वर्ष में वर्गमूल प्रकार्य और दो वर्ष में काब-डगलस प्रकार्य होगा। दिल्ली सर्वेक्षण से 2 वर्ष के आंकड़ों में फार्म आय और अन्य निवेश चरों के बीच सम्बन्ध के प्रतिनिधित्व के लिए 3 मौसमों हेतु सामान्य द्विघात प्रकार्य को चुना जा सकता है।

18.3.10 मुर्गी पालन अर्थशास्त्र से सम्बद्ध कुछ आगामी सांख्यिकीय अध्ययन — अण्डा उत्पादन की निश्चित एवं कार्यकारी पूंजी के बीच सम्बन्ध का अध्ययन।

इस अध्ययन में, दिल्ली और आसपास के क्षेत्रों में आयोजित परियोजना "मुर्गी पालन और अण्डा उत्पादन की लागत" में लगभग 130 व्यवसायिक मुर्गी पालन फार्मों से पहले ही से एकत्रित आंकड़ों का उपयोग किया गया। दो वर्षों में व्यवसायिक फार्मों की कुल लागत रु० 1,052 से रु० 1,76,056 प्रति फार्म थी। लगभग 55 प्रतिशत फार्मों की कार्यकारी पूंजी रु० 5,000 से रु० 30,000 तक की सीमा में थी और 64 प्रतिशत फार्मों की, दोनों वर्षों की निश्चित पूंजी भी रु० 5,000 से रु० 30,000 तक की सीमा में थी। दोनों ही वर्षों में 66 प्रतिशत फार्मों में अण्डा उत्पादन की सीमा 1000 से 12000 तक थी और 22.6 प्रतिशत में यह 12000 अण्डों से अधिक थी। निश्चित एवं कार्यकारी पूंजी के साथ अण्डा उत्पादन का सहसम्बन्ध गुणांक (Correlation Coefficient) क्रमशः 0.48 और 0.46 था। विचलन के अधिकतम प्रतिशत के लिए काब-डगलस प्रकार्य लिया गया और इसे समोत्पादों और समानविधियों की पहचान के लिए किया गया। पाँच प्रतिस्थापना की दर के साथ 9000 अण्डों के औसत उत्पादन के लिए 29,644 रुपये कार्यकारी पूंजी और 14,680 रु० निश्चित पूंजी सहित 44,324 रुपये की लागत की आवश्यकता थी।

18.3.11 ब्रह्म कलकत्ता द्रष्टा आर्पित योजना - कलकत्ता (पश्चिमी बंगाल) के द्रष्टा वाले क्षेत्र में कृषि जमीनों के विभाजन जमीनों के अधीन द्रष्टा उत्पादन, श्रावण और रीजानार पर सॉलियेकॉम अध्ययन ।

अध्ययन से पता चला कि कुल 63 परिवारों के पास एक हेक्टेयर तक कृषि जमीन थी, 26 परिवारों के पास 1 से 2 हेक्टेयर के बीच, 9 परिवारों के पास 2 से 4 हेक्टेयर के बीच और शेष 2 परिवारों के पास 4 हेक्टेयर से अधिक भूमि थी। जिन द्रष्टा उत्पादक वर्गों के पास 1 से 2 हेक्टेयर के बीच भूमि थी उनका प्रतिदिन द्रष्टा उत्पादन सबसे अधिक था और जिनके पास 4 हेक्टेयर से अधिक जमीन थी उनका द्रष्टा उत्पादकता सबसे कम थी। बर्तमान में श्रावण परिवारों के पास उच्चतम देखा गया। परिवारों में कम अनुपात में श्रमिकों की श्रमिकता में लगता है। श्रमिकता में जमीन वाले विभाजन जमीनों के समूह में काम चल रहा है। एक बड़े बड़ा अनुपात, मुख्य व्यवसाय की श्रमिकता और व्यवसाय के रूप में द्रष्टा उत्पादन के व्यवसाय में संलग्न था। श्रावण के विवेक, जैसे-जैसे जमीन में ब्रह्म द्रष्टा कृषि श्रावण में संलग्न थी। द्रष्टा के पास जमीन की श्रावण करने वाले क्षेत्रों के व्यवसायिक परिवारों में जिनके पास जमीन 4 हेक्टेयर से अधिक थी और उन क्षेत्रों में बर्तमान में श्रावण नही होती थी और जमीन 2 से 4 हेक्टेयर थी, की कुल वार्षिक श्रावण श्रमिकता में श्रावण प्रथम की कुल वार्षिक श्रावण ०.7863 और श्रावण वाले की ०.8987 थी। ऐसे परिवार, जो न तो व्यवसायिक हेक्टेयर न ही द्रष्टा का उत्पादन करते हैं, की श्रावण व्यवसायिक परिवारों की श्रमिकता कम थी।

18.3.12 द्रष्टा क्षेत्र में श्रमिकता की दृष्टिकोण से

वाणिज्य, मूल्य और मूल्य पर श्रमिकता के विवेक से द्रष्टाओं की मूल्यपूर्ण बात-वार्ता मूल्य, मूल्य और क्षेत्र, वार्षिक और क्षेत्रों की मूल्यपूर्ण मूल्यों पर श्रमिकता का गहरा दृष्टि देना में श्रावण किया भी जमीन के मूल्य द्रष्टाओं पर एक भी श्रावण नही किया गया। वर्तमान अध्ययन के आधार पर यह पता चला कि देना में द्रष्टाओं में द्रष्टाओं के श्रावण में द्रष्टाओं की श्रावण करने की श्रावण करने से दृष्टिकोण में द्रष्टाओं के लिए श्रावण में लगभग 2143 श्रावणों की श्रावण करने

18.3.13. व्यवसायिक श्रमिकता में श्रमिकता का उत्पादन ।

प्रायः सर्वप्रथम श्रमिकता से यह देखा गया कि 130 फार्मों पर केवल द्रष्टा श्रमिकता का उत्पादन किया गया, 2 फार्मों पर केवल श्रावण श्रमिकता का और 14 फार्मों पर दोनों ही प्रकार के श्रमिकता (जो केवल श्रावण में ही श्रावण करते हैं), का उत्पादन किया गया। कुल, मूल्य और श्रावण वाले श्रमिकता का प्रतिशत क्रमशः 72,26 और 2 था। ऐसे कुल फार्मों पर बर्तमान द्रष्टा श्रमिकता

$$y=20.14+1.60x$$

क्षतिज पेरीकार्डीटिस का अधिकतम योग था, जो सभी श्रेणियों में कुल मृत्यु दर का एक चौथाई था। विभिन्न श्रेणियों की मृत्यु दर में उच्चतम सार्थक विचरण देखा गया। मृत्यु दर सबसे कम 7/16 थी और अर्द्ध-नस्ल में यह 7 प्रतिशत थी, जो कि विदेशी खून की मात्रा बढ़ने के साथ बढ़ती थी और इस से विपरीत भी यही ठीक पाया गया।

लगभग आधी गायें चार दुग्ध स्रवण (Lactation) पूरा होने से पूर्व ही शेषक (Culled) हो गयीं। असामान्य बछड़े देने की समग्र दर 8 प्रतिशत थी। विभिन्न गायों की दरों में कोई सार्थक भिन्नता नहीं देखी गयी। नरों का जन्म मादाओं के जन्म की अपेक्षा अधिक था, विभिन्न श्रेणियों के पशुओं के लिये नर से मादा का अनुपात .78 से 1.75 तक विचरित होता रहा।

18.2.15 विभिन्न आकारों के भुण्डों में अनुकूलतम संतती परीक्षण की योजनाएं :—

300 से 600 गायों के भुण्डों के आकारों के लिए, प्रति चक्र 2 परीक्षित एवं 10 युवा बैलों का उपयोग करना और संतती परीक्षण उपलब्ध हो जाने के बाद 10 युवा बैलों में से उत्तम दो बैलों को बचा लेना इष्टतम नीति होगी। इससे बिना संतती परीक्षण के वार्षिक अनुवांशिक में सुधार 1/6 से 1/4 की सीमा में सम्भावना से अधिक प्राप्त हुआ। छोटे आकार के भुण्डों में यद्यपि संतती परीक्षण न होने की अपेक्षा संतती परीक्षण कुछ लाभदायक पाया गया किन्तु अंतः प्रजनन की उच्च दर होने की दृष्टि से इसके उपयोग की आवश्यकता उचित नहीं थी। वर्ष के दौरान, देशी पशु और भैसों के भुण्डों के लिए अनुवांशिक प्राप्ति की दरों पर अध्ययन प्रगति पर रहा।

18.3.16 बोटल-बकरियों में अनुवांशिक प्रवृत्ति का आंकलन :—

छः आर्थिक लक्षणों के लिए लगभग 1,200 बोटल बकरियों पर 37 वर्षों (1931-67) प्रजनन आंकड़ों को विश्लेषित किया गया। इन लक्षणों की पुनरावृत्ति वंशागतित्व का आंकलन किया गया। विभिन्न आर्थिक लक्षणों में अनुवांशिक परिवर्तनों का तीन पद्धतियों द्वारा पता लगाया गया। तीनों पद्धतियों द्वारा अर्थात्, पशु संख्या से प्रजनक सांड संतती विचलनों के समय अन्तः प्रजनक सांड समाश्रयण (स्मिथ, 1962), (ii) आयु के प्रभावों के लिए निर्धारित समय में प्रजनक-सांड संतती और मादाओं के चुनने का अन्तः प्रजनक सांड समाश्रयण (एवरेट एवं सहयोगी, 1967) और (iii) समय पर, भुण्ड एवं व्यवितगत प्रजनक सांड के माध्यों के बीच भारित भिन्नताओं का वर्गीकृत अन्तः प्रजनक सांड समाश्रयण गुणांक। यद्यपि दोहन उत्पादन में अनुवांशिक परिवर्तन सार्थक नहीं पाया गया फिर भी 37 वर्षों में प्रति दिन दोहन उत्पादन और प्रति दिन बच्चे देने के अन्तराल में सार्थक कमी देखी गयी।

स्वीकृत स्तर के करीब ही डाली गयी। शेष जिलों में इसकी मात्रा स्वीकृत स्तर से काफी कम थी।

(2) मक्का

मजल के शर्बत कुल क्षेत्र का शिकलिन उच्च प्रदावार फसल (H.V.V.) क्षेत्र का प्रतिघन वृत्तफल में 99, मूंगेर में 80, मरठ में 60, मरठ में 55 और शेष जिलों में 32 प्रतिघन क्षेत्रों के समान है। मरठ, बरगन, खासगाँव, जालंधर और बिस्फीखंड में गीना मरठ-2, मूंगेर में गीना मरठ, गीना और मरठ में टी-41 उगाई गई मंडलपूर्ण फसलें थीं। बिस्फीखंड में मकर मक्का फसलों की उच्चतम शीघ्रता उपाय 21.6 फव./हेक्टर. एवं की गई। खासगाँव और जालंधर जिलों में एवं की गई 20 फव./हेक्टर. की उपाय दर इससे लगभग बराबर रही।

शर्बत जिलों में डाले गये वाइडरॉजेशन स्तर उर्वरकों की दर, स्वीकृत स्तर के 34 से 62 प्रतिघन की मात्रा में थी। शर्बत जिलों में डाले गये फासफोरी और पोटाशी उर्वरकों की दर स्वीकृत स्तर से कम थी।

3. उदर :

मजल के शर्बत कुल क्षेत्र का शिकलिन उच्च प्रदावार फसल क्षेत्र का प्रतिघन क्षेत्र में 96 वृत्तफल में 74, मंडली में 47 और मकौला में 33 था। मंडली में क्षेत्रों द्वारा उगाई गई वाइडरॉज फसलें 60 थीं वाइडरॉज क्षेत्रों में थीं। उपाय 0.1 वाइडरॉज थी। बिस्फीखंड में उपाय 0.5 के लिए 27.80 फव./हेक्टर. की उच्चतम शीघ्रता प्रदावार दर की गयी। डाले गये वाइडरॉज उर्वरकों की मात्रा सामान्यतः स्वीकृत स्तर का 70 प्रतिघन से कम थी।

4. बाजरा :

मजल के शर्बत कुल क्षेत्र में से शिकलिन उच्च प्रदावार फसल (H.V.V.) का क्षेत्र प्रतिघन में 98 प्रतिघन, कूटा और साबरकण्डा में लगभग 88 प्रतिघन, बिस्फीखंड, मंडली में 61 प्रतिघन, मंडली और बरगुन में 42 प्रतिघन के साथ-साथ और बिस्फीखंड में 32 प्रतिघन था। कूटा में सी.जे. 104, साबरकण्डा में एच.बी. 0-3, मंडली में एच.बी. 0-5, बिस्फीखंड और बरगुन में बी.जे. 0-104, मंडली में बिस्फीखंड, मंडली और मंडली में एच.बी. 0-2 उगायी जाने वाली मंडलपूर्ण फसलें थीं। उ. मंडली में के.एम. 1 के लिए एवं की गयी उच्चतम शीघ्रता उपाय 19.8 फव./हेक्टर. थी। कूटा, साबरकण्डा,

सहस्रगना और हिसार में सकर बाजरी में पटोला उबरक और द० शारकोट में फरफोट और पटोला डालने की सिफारिश गही की गयी। यही जिलों में पाईटैजिन ग्राम उबरकी की माया स्कीम तार तार का 50 से 70 प्रतिशत की सीमा में डाली गयी।

5. यूपकी :

फसल के यूपीन कुल क्षेत्र में से अधिकतम उच्च प्रकार के फसल क्षेत्र, कयीम-

नगर, कोलार, श्रीरंगबाद, पट्टय्याल और द० शारकोट में 90 से 100 प्रतिशत के लगभग था। क्षेत्र जिलों में ग्रह प्रतिशत 48 से 75 की सीमा में था। गदर, बिन्नूर, कयीमनगर, शारबाड और द० शारकोट में एम० पी०-2, कोलार में स्फिशा, श्रीरंगबाद में एम० पी०-11, बालनगर और पट्टय्याल में पी० बी०-1 और मुत्तारबाद में पी०-28 मुख्य किस्में उगाई गई। बालनगर में यूपकी की फसल-फसल उ० पी० फ० की उच्चतम यूपीन प्रकार 11.6 फीव०/हेक्टर। रब की गई। गदर, बिन्नूर, शारबाड, कोलार में डालने में पाईटैजिनग्राम उबरक का प्रतिशत स्कीम तार से 50 से 70 प्रतिशत के लगभग था। बालनगर और पट्टय्याल में डालने में पाईटैजिन की माया स्कीम तार से ठीक यूपकी थी। यही जिलों में P और K की माया स्कीम तार से

6. कपास :

फसल के यूपीन कुल क्षेत्र, में से अधिकतम उच्च प्रकार के फसल (H.V.V.) का क्षेत्र, कोयंबटूर में 100, बलगाव में 97, शारकोट में 92, कयी, हिसार, शर्मनगर और बिनींगर में लगभग 60 से 80 और सहस्रगना में 37 प्रतिशत था। कयी, शारकोट, सहस्रगना और बलगाव में एम-4, हिसार में 320-एफ, शर्मनगर में बी०-34, इंदौर और बिनींगर में पी-1 और कोयंबटूर में बरलडमी उगाई गई महत्वपूर्ण किस्में थी। कोयंबटूर में बरलडमी के लिए उच्चतम यूपीन उच्च 8.9 फीव०/हेक्टर। रब की गयी। कोयंबटूर में डालने में रीयोजिनिक उबरकी की माया स्कीम तार के यूपीन थी। क्षेत्र जिलों में पाईटैजिन उबरकी की डाली गई माया स्कीम तार का 50 से 80 प्रतिशत था। क्षेत्र जिलों में P और K उबरक की माया स्कीम तार से फसल थी।

(ख) रबी :

1 गदर :

फसल के यूपीन कुल क्षेत्र में से अधिकतम उ० पी० फ० (H.V.V.) का क्षेत्र बिबनगर, शारकोट, कयी, शारकोट, गदर, श्रीरंगबाड, बलगाव, शर्मनगर, बालनगर, पट्टय्याल, शरड,

मुरादाबाद, वाराणसी, 24-परगना और मिदनापुर में 90 से 100, अकोला (54 प्रतिशत), जयपुर (48 प्रतिशत) और धारवाड़ (20 प्रतिशत) को छोड़कर शेष सभी जिलों में 60 से 50 प्रतिशत था। जनगण सभी जिलों में उगाई गई गोहूँ की उ० पू० क्रि० (H.Y.V.) सोनालिका और कल्याण सोना सर्वाधिक लोकप्रिय रही। मुरैना जिले में गोहूँ की विभिन्न उ० पू० क्रि० (H.Y.V.) की उच्चतम औसत उपज 34.9 कि०/हेक्टर दर्ज की गई। 50 प्रतिशत जिलों में उ० पू० क्रि० की उपज दर 24 कि०/हेक्टर या उससे अधिक थी। अधिकांश जिलों में डाली गई नाईट्रोजन की मात्रा सामान्यतः स्वीकृत स्तर की 60 से 90 प्रतिशत के बीच में थी। जिलों में P और K की दरें स्वीकृत स्तर से कम थी।

2. चावल :

चावल के प्राचीन कुल क्षेत्र में से प्रांकीलित उ० पू० क्रि० (H.Y.V.) का क्षेत्र, गण्डूर, शिमोगा, कोलार, बोलंगीर, कोयम्बटूर, मडुरैय, 24-परगना और मिदनापुर में 88 से 100, त्रिचूर को छोड़कर जहाँ यह प्रतिशत 32 था, शेष जिलों में 57 से 77 प्रतिशत था। उगाई गई महत्त्वपूर्ण किस्में, जया, ग्राईं, ग्रा०-20, त्रिवेणी, सफेद हम्सा और ग्रा० पी०-4-14 थी। शिमोगा जिले में चावल की भिन्न-भिन्न उ० पू० क्रि० (H.Y.V.) की उच्चतम औसत उपज 31.8 कि०/हेक्टर दर्ज की गई। गण्डूर, त्रिचूर, बोलंगीर, कोयम्बटूर, मडुरैय और मिदनापुर में डाली गई नाईट्रोजन की मात्रा स्वीकृत स्तर के करीब थी। शेष जिलों में डाली गई N की मात्रा स्वीकृत स्तर का 70 से 80 प्रतिशत थी। फासफेटी उर्वरक की मात्रा भिन्न-भिन्न जिलों में स्वीकृत स्तर में से 40 से 80 प्रतिशत तक अदलती बदलती रही। पोटाश प्राप्त कर रहे खेतों के अनुपात का क्रम निम्न स्तर का था।

3. मक्का :

केवल कोलार (कर्नाटक) में सर्वेक्षण किया गया। मक्का की फसल का 100 प्रतिशत क्षेत्र मक्का की उ० पू० क्रि० (H.Y.V.) के प्राचीन घाता है। जिले में डिक्केन संकर व्यापक रूप से उगाई जाने वाली संकर किस्म है। इस किस्म की औसत उपज 19.7 कि०/हेक्टर प्राप्त की गई। डाले गये रासायनिक उर्वरक की दर स्वीकृत स्तर का 50 प्रतिशत थी।

4. ज्वार :

केवल शिमोगा (कर्नाटक) में सर्वेक्षण किया गया। फसल के क्षेत्र का 100 प्रतिशत क्षेत्र ज्वार की उ० पू० क्रि० (H.Y.V.) के प्राचीन घाता है। जिले के किसानों द्वारा उगाई गई किस्म सी० एस० एच०-1 लोकप्रिय रही और इससे 27.2 कि०/हेक्टर की औसत उपज प्राप्त हुई। जिले में डाले गये रासायनिक उर्वरकों की दरें स्वीकृत स्तर से अधिक थीं।

5. बाजरी

कबल मडूरुय और द० शारकोट (विमलगाडू) जिलों में ही सर्वप्रथम किया गया। द० शारकोट में फसल के क्षेत्र का शत-प्रतिशत क्षेत्र बाजरे की उ० पू० फा० (H.Y.V.) के अधीन था। जबकि मडूरुय में यह 65 प्रतिशत था। दोनों जिलों में उगाई गई लोकप्रिय किस्म के० एम०-2 थी। द० शारकोट में के० एम०-2 के लिए उच्चतम शीघ्रत उपज 18.6 त्रिब०/हेक्टर। दूब की गई। द० शारकोट में संकर बाजरी के लिए P और K उर्वरकों के उपयोग की स्वीकृति नहीं की गई। मडूरुय में स्वीकृत स्तर का लगभग 80 प्रतिशत रसायनिक उर्वरक खाला गया।

6. मूंगफली:

कबल द० शारकोट (विमलगाडू) में ही सर्वप्रथम किया गया। मूंगफली की फसल के कुल क्षेत्र का 98 प्रतिशत क्षेत्र मूंगफली की उ० पू० फा० (H.Y.V.) के अधीन आता था। कुल क्षेत्रों द्वारा उगाई गई टी० एम० बी०-2 किस्म सर्वाधिक लोकप्रिय रही। टी० एम० बी०-7 के लिए उच्चतम शीघ्रत उपज 23.3 त्रिब०/हेक्टर। दूब की गई। दूब फसल के लिए कबल पट्टाशा उर्वरक स्वीकृत किया गया जिसे स्वीकृत स्तर में से लगभग 19 प्रतिशत खाला गया।

7. कपास:

कबल धारवाड़ (कान्हाक) और कोयंबटूर (विमलगाडू) में सर्वप्रथम किया गया दोनों ही जिलों में शतप्रतिशत क्षेत्र कपास की उ० पू० फा० के अधीन था। धारवाड़ में जयधर और कोयंबटूर में बरलक्ष्मी किस्म के लिए 6.7 त्रिब०/हेक्टर की उच्चतम शीघ्रत उपज दूब की गई। कोयंबटूर में रसायनिक उर्वरक की मात्रा स्वीकृत स्तर के अनुसार और धारवाड़ में स्वीकृत स्तर का 25 प्रतिशत खाला गई।

18.4.2 उन्नत प्रजनन में सेब फलोद्यान में प्रजनन: फसल करने की लागत और श्राप पर अध्ययन।

प्रदशाही रूप से किया गया कार्य के महत्वपूर्ण निष्कर्ष थे कि शीघ्रतन श्राप से अधिक फलोद्यानियों ने सेब की खेती के प्रतिरूपत फसल भी उगाई। श्रवमांडा और टीहरी जिलों में लगभग एक तिहाई फलोद्यानियों ने शालू और मक्का उगाये जबकि टीहरी जिले में एक तिहाई फलोद्यानियों ने सेम की फसल भी उगाई। नैनीताल जिले में श्राप फलोद्यानियों ने गहूँ और शालू उगाए और एक तिहाई ने सेम की फसल भी उगाई किन्तु उत्तरकाशी जिले में लगभग श्राप फलोद्यानियों ने गहूँ उगाया और एक तिहाई ने सेम भी उगाई।

18.4.3 सूकर बध की संख्या और सूकर पालन के आंकलन के लिए मार्गदर्शी प्रतिदर्श सर्वेक्षण से प्राप्त प्रमुख परिणाम इस प्रकार हैं :—

अलीगढ़ और इलाहाबाद जिलों में सूअरों की संख्या क्रमशः 19.1 और 75.8 हजार आंकी गई, मानक त्रुटि क्रमशः 11.0 और 13.0 प्रतिशत थी।

वर्ष के दौरान अलीगढ़ और इलाहाबाद में काटे गये सूअरों की संख्या मानक त्रुटि क्रमशः 14.0 और 11.9 प्रतिशत सहित 8.9 और 33.9 हजार आंकी गई। अलीगढ़ और इलाहाबाद में सूकर मांस का औसत मूल्य क्रमशः 5.10 और 4.15 रुपये प्रति कि० ग्रा० था।

दोनों ही जिलों अलीगढ़ और इलाहाबाद में सर्दियों (नवम्बर से मार्च) में सूअर द्वारा दिये गये बच्चों की संख्या का प्रतिशत उच्चतम था जो क्रमशः 66 और 56 था।

अलीगढ़ जिले में 25 से 36 माह के आयु समूह में सूकरों के शरीर का वजन 44.5 कि० ग्रा० था जबकि इलाहाबाद जिले में यह अंक 40.9 कि० ग्रा० था।

अलीगढ़ और इलाहाबाद जिले में सूअर पालने वाले परिवार का औसत परिवार आकार क्रमशः 5 और 6 था। अधिकतर सूअर कम अतिरिक्त आय के लिए पाले जाते हैं क्योंकि इनके पालने में लागत नहीं लगती। अलीगढ़ जिले में सूअरों का पालन अधिकतर भूमिहीन कृषकों द्वारा किया जाता है किन्तु इलाहाबाद में यह भूमि वाले कृषकों में भी लोकप्रिय था। अलीगढ़ जिले में सूअर पालने वाले कृषकों के परिवार की औसत आय 205 रुपये प्रति माह थी जबकि इलाहाबाद जिले में यह लगभग 185 रुपये प्रति माह थी जबकि दोनों जिलों में सूअर पालन से होने वाली आय क्रमशः 47 रुपये और 17 रुपये प्रतिमाह थी।

18.3.4 कृषि वर्ष 1977-78 के दौरान सक्रियात्मक जोतों (Operational Holdings) में बेकार पड़ी भूमि के कारणों का पता लगाने के लिए अध्ययन

छ: केन्द्रों—अनन्तपुर, बेलगाँव, जबलपुर, रतनगिरि, चित्तौड़गढ़ और झाँसी में सर्वेक्षण किये गये। अन्तरिम प्रतिवेदन के परिणाम नीचे दिए गए हैं :—

देखा गया कि रतनगिरि, चित्तौड़गढ़ और झाँसी इन तीन जिलों में बंजर भूमि रखने वालों का अनुपात काफी ऊँचा था जो 72 प्रतिशत था। बंजर भूमि के प्रसार के प्रसंग में रतनगिरि जिला सूची में सबसे ऊपर है जहाँ बंजर भूमि रखने वाले कृषकों की संख्या लगभग 3 लाख थी। इसके बाद चित्तौड़गढ़ आता है जहाँ यह संख्या लगभग 2 लाख थी। ऐसे कृषकों की सबसे कम संख्या जबलपुर में थी हालांकि उनका अनुपात पर्याप्त था।

बजर भूमि के अधीन क्षेत्र का उच्चतम समानुपात रतनगिरि जिले में था जो 62 प्रतिशत के क्रम में था। चित्तौडगढ़ और अन्ननपुर में यह क्रम क्रमशः 48 व 42 प्रतिशत था। शेष तीन जिलों में यह लगभग 25 प्रतिशत था।

भूमि के अप्रयुक्त पड़े रहने के कुछ मुख्य कारण सिचाई की अनुपलब्धता या सिचाई सुविधाओं की कमी, ऊबड़खाबड़, असमतल या ढलान वाली भूमि, संसाधनों अथवा कुपकों के पास पर्याप्त धन की अनुपलब्धता, मृदा की कम उर्वरता, चट्टानी भूमि, निर्णायक निवेशों जिनमें बीज एवं उर्वरक शामिल हैं, की अनुपलब्धता और खर-पतवार का भारी प्रसन इत्यादि थे।

यह देखा गया कि विभिन्न जिलों में 25 से 70 प्रतिशत के बीच व्यर्थ भूमि रखने वाले अनेक कुपकों के लिए सिचाई सुविधाओं का प्रावधान लाभप्रद होगा। 25 से 40 प्रतिशत कुपकों के लिए भूमि को समतल करना महत्वपूर्ण होगा और 25 से 50 प्रतिशत कुपकों के लिए अतिरिक्त संसाधनों की उपलब्धता महसूस की गई। विभिन्न जिलों में कुपकों द्वारा अन्य उपचारी उपाय भी सुझाए गये।

18.5 अर्थमितीय विश्लेषण :—

18.5.1 उड़ीसा के पुरी जिले में प्रचालन अनुसंधान परियोजना (O.R.P.) क्षेत्रों के चार्ल फार्मों पर प्राधुनिक तकनीक के विस्तार में सामाजिक, आर्थिक और अन्य व्यवरोधों का विवरण :—

अध्ययन के दौरान, अध्ययन क्षेत्र में कुपकों के खेतों पर निर्दिशत रिश्तितज (Potential) फार्म उपज और सर्वेक्षण फार्मों पर आधारित फार्मकलित क्षेत्र की श्रौसत फार्म उपज के बीच 1.73 टन प्रति हैक्टेयर का सार्बक उपज अन्तर देखने में आया। कुपकों के विभिन्न वर्गों के बीच उपज अन्तर के व्यवहार से देखने में आया है कि जब कुपकों ने अधिकार्थिक विकसित प्रणालियां अपनानी तो उपज के अन्तर में कमी आई। भिन्न-भिन्न जोत आकार के समूहों में विकसित कार्य पद्धति को व्यवहार में लाने पर देखा गया कि व्यवहार सूचकांक बहुत कुछ जोत आकार के समूहों से सम्बन्धित था। अपनाने की तीव्रता के सम्बन्ध में पता चलता है कि सभी जोत आकार समूहों की तुलना में कम प्रचालनों के समूह में अपनाने की तीव्रता उच्चतम थी। आगे का विश्लेषण दर्शाता है कि निम्न स्तर के निवेश के उपयोग, अर्थात् उ० पं० क्रि० (H.V.V.), उर्वरक डालना, पादप सुरक्षा के उपाय (जैविक), बिगड़ी हुई आर्थिक दशा एवं ऋण का बोझ (सामाजिक) और भूमि की किरम (प्राकृतिक) उपज में अन्तर लाने वाले मुख्य घटक थे।

इस दृष्टान्त में कुल मिलकर 26 प्रयोगों की प्रमाण-पत्र प्रदान किये गये
 अर्थात् 5 की रूबिडियम सल्फाइड काँस (बे.सी.सी., J.C.C.), 9 की सीसियम सल्फाइड काँस
 (ए.सी.सी., P.S.C.C.), 9 की स्वयंप्रतिक्रमणिक सिलिकॉन काँस (ए.सी.सी., P.S.C.C.), 9 की
 सी.सी.सी. और 3 की लिथीम काँस। उन छकों की जाँचें प्रत्येक प्रमाण-पत्र पाठ्यक्रमों
 अर्थात् बे.सी.सी., ए.सी.सी., सी.सी.सी. में उच्चतम अंक प्राप्त किये, की
 प्रमाण पत्र दिये गये और प्रतीक्षितियों की भी प्रदान किये गये जिनकी लिखीमा
 शीघ्र प्रतक की प्रकृति के लिये सर्वसिद्ध माना गया।

प्रतिवेदनार्थीन वर्ष के दौरान 8 छात्रों की प्रतिक्रियाएँ पाठ्यक्रम और 12 की शीघ्र
 पाठ्यक्रम के लिये प्रेषित किये गये। ए.सी.सी., ए.सी.सी. और बे.सी.सी. पाठ्यक्रमों के छात्रों
 की लिखित अर्थप्रदान प्रत्येक प्रमाण के लिए ले जाया गया।

केंद्रीय सिलिकॉन संगठन (ए.सी.सी.), ए.सी.सी. के लिखित संस्थाओं,
 केंद्रिय सिलिकॉन संगठनों जैसे अर्थ संगठनों द्वारा प्रतिनिधित्व प्रेषितियों के
 लाभ हेतु विशेष प्रविष्टि पाठ्यक्रमों की भी व्यवस्था की गयी। प्रतिवेदनार्थीन वर्ष के दौरान
 अनेक महत्त्वपूर्ण सेमीनार हुए और सिलिकॉन सिलिकॉन विद्यार्थी द्वारा आयोजित भी किये गये।
 इनके साथ-साथ प्रत्येक के वैज्ञानिकों और छात्रों द्वारा लिखित विषयों पर लगभग 52 सेमीनार
 भी आयोजित किये गये।

18.6.2 सिलिकॉन में मौलिक अर्थप्रदान

प्रतिवेदनार्थीन वर्ष के दौरान, प्रयोगों के प्रतिबन्धन अर्थप्रदानों और सिलिकॉन अर्थप्रदानों
 काँसों की समस्तियों में सिलिकॉन तकनीकों की लागू करने में महत्त्वपूर्ण योगदान दिया गया।

18.7 सहायक विज्ञान एवं सहायक विज्ञान :—

केंद्रिय वैज्ञानिकों, ए.सी.सी. के अर्थप्रदानकर्ताओं और छात्रों, केंद्रिय सिलिकॉन विद्यार्थी,
 अर्थ प्रविष्टि विद्यार्थियों के केंद्रिय संकायों और सहायक एवं सिलिकॉन विज्ञान की छात्रापीठों-
 सिलिकॉन विद्यार्थियों की पूर्ण सहायक विज्ञान एवं सहायक विज्ञान विज्ञान प्रमाण दी
 काउंसिल प्रणालियों—बरीट्टे बी.—4700 और ए.सी.सी.—1620 की उपयोग में लाया
 जाता है।

वर्ष के दौरान, बी.—4700 और ए.सी.सी.—1620 पर लगभग 15000 प्रमाणित
 कार्य की संशोधित किये गये। इनके साथ-साथ छात्रों और प्रमाण के वैज्ञानिकों और प्रयोगों

के लगभग 4000 परीक्षण कार्यों की भी संश्लेषण (संश्लेषण) किया गया। यह सं. शं. पं. 0 के अर्धन संरचनाओं और श्लेष संरचनाओं के लगभग 220 शोध कार्यों, 100 रसायनोत्पन्न और 90 अन्य अनुसंधान कार्यों की संश्लेषण कायंकरणी, उदा. प्रोसेसिंग और संश्लेषण विवेचन के परीक्षणों में भी मदद की।

अनुसंधान विभागों की शक्तों के विरूपण की आवश्यकताओं को पूरा करने के लिए लगभग 25 नये संश्लेषण कार्यों को संश्लेषण किया गया, इन सबके अतिरिक्त अनुसंधान कार्यों की आवश्यकताओं के लिए अनेक पुराने कार्य-क्रमों की संश्लेषण किया गया। नवीन संश्लेषण कार्यों के अतिरिक्त उपयोग के लिए बी. 0. पी. 0 सं. श्लेषण कायंकरणी प्रणालियों की भी विकसित किया गया।

संश्लेषण उपयोग कार्यों और प्रणालियों के लाभ हेतु देहां पर एक मूल कायंकरणी (COBOL) और बी. 0. पी. 0 सं. 216 मूल कायंकरणी संकलित है। उपयोगकर्ता भी वही इसका उपयोग और विवरण कर सकते हैं।

विद्यार्थी से देहां पर प्रकाश देती रहती श्लेष संश्लेषण (AGRI) की संश्लेषण वातां का कार्य प्रत्येक माह संकलित रहता है और उपरिक्त संश्लेषण में देहां संश्लेषणों के लिए संश्लेषण संश्लेषणों का संश्लेषण प्रकीर्ण उपकरण किया गया।

यह सं. शं. पं. 0 के अर्धन कायंकरणी श्लेष संश्लेषणों के वायुशुद्धि पर उपरिक्त संश्लेषण की अनुसंधान-सामग्री के विकास का कार्य पूरा हो गया है और उपरिक्त संश्लेषण वातां है।
 प्रयोग के संश्लेषणों द्वारा, पी. 0. पी. 0. श्लेषण, पी. 0. पी. 0. श्लेषण के श्लेषणों के लिए भी संश्लेषण कायंकरणी सं. पं. 0 सं. 129 परीक्षण संश्लेषण किया गया।

कार्यक्रम-IV प्रणालियां, उदा. कार्यों की उद्योगी एवं प्रशासन और पं. शं. 0 सं. 0 सं. 0 प्रणालियां कायंकरणी के उपयोग में एक 6 संश्लेषण का प्रणालियां परीक्षण और यह सं. शं. 0 सं. 0 सं. 0 के संश्लेषणों के लिए वायुशुद्धि, प्रणालियां वातां सं. श्लेषणों के लिए वायुशुद्धि परीक्षण का गठन किया गया। साथ ही विभिन्न श्लेष संरचनाओं के संश्लेषणों के लिए संश्लेषण प्रणालियां में एक नवीन संश्लेषण कायंकरणी परीक्षण का भी अनुसंधान किया गया।

वर्ष के दौरान, पं. शं. 0 सं. 0 सं. 0 के अर्धन 40 संश्लेषण यह सं. शं. 0 सं. 0 सं. 0 की विभिन्न परीक्षणों और प्रणालियों के कार्य को श्लेषण में किया। इसके अतिरिक्त पं. शं. 0 सं. 0 सं. 0

18.8.3 मॉनीटरिंग कक्ष :—

वर्ष 1980 के दौरान मॉनीटरिंग कक्ष की 3 बैठकें हुईं। प्रथम बैठक 3 मार्च, 1980, दूसरी 7 अगस्त, 1980 और तीसरी 30 अक्टूबर, 1980 को हुई। मॉनीटरिंग कक्ष ने संस्थान की अनुसंधान परियोजनाओं की प्रगति के नियन्त्रण के लिए प्रपत्रों को तैयार किया जिसका बैठक में अनुमोदन किया गया।

18.9 परामर्श सेवाएं

संस्थान कृषिय सांख्यिकी और प्रतिव्ययन तकनीकियों, विशेषकर भा० कु० श्र० प० द्वारा वित्तीय सहायता प्राप्त परियोजनाओं के सांख्यिकीय पहलुओं की समस्याओं में तकनीकी सलाह और मार्गदर्शन करने की महत्वपूर्ण भूमिका निभा रहा है। वर्ष के दौरान आयोजित संस्थान के भविकारियों ने भा० कु० श्र० प० की विभिन्न वैज्ञानिक पैनलों (Panels) और अखिल भारतीय समन्वित परियोजनाओं की कार्यशालाओं की बैठकों में भी भाग लिया और परियोजनाओं के सांख्यिकीय पहलुओं पर विचार-विमर्श में सक्रिय रूप से भाग लिया।

विभिन्न अनुसंधान संस्थानों/विश्वविद्यालयों और अन्य अनुसंधान संगठनों के अनुसंधान-कर्मियों और छात्रों को उनके प्रायोगिक अनुभवों के नियोजन, आंकड़ों के सांख्यिकीय विश्लेषण तथा उनके आंकड़ों को संगणक केन्द्र एवं यांत्रिकी उपात संसाधन एकक (Mechanical Data Processing Unit) में संसाधित करने में भी तकनीकी सलाह दी और उनका मार्ग दर्शन किया।

18.10 प्रकाशन

प्रतिवेदनाधीन वर्ष के दौरान संस्थान के भविकारियों, स्टाफ के अन्य सदस्यों और छात्रों द्वारा रचित 47 लेख मानक पत्रिकाओं में प्रकाशित हुए जबकि 29 लेखों को विभिन्न पत्रिकाओं में प्रकाशनार्थ स्वीकृति मिली। साथ ही 43 प्रकाशन जिनमें तकनीकी प्रतिवेदन, कार्यवृत्त, सार-संग्रह, वर्ष 1979 की वार्षिक रिपोर्ट, भा० कु० सा० श्र० सं० के सूचना पत्रों के 4 अंक, सेमीनारों का एक बुशेदिन, प्रशिक्षण और मौलिक अनुसंधान की 3 तकनीकी रिपोर्टों की एक शृंखला और अन्य परियोजना रिपोर्टें शामिल हैं, भा० कु० सा० श्र० सं० के प्रकाशनों के रूप में प्रकाशित की गयी।

18.11 भा० कृ० साँ० भ्र० सं० द्वारा आयोजित सम्मेलन

18.11.1 कृषि भ्रनुसंधान सांख्यकीविदों का पांचवां सम्मेलन :—

कृषि भ्रनुसंधान सांख्यकीविदों का प्रथम, द्वितीय, तृतीय और चतुर्थ सम्मेलनों का आयोजन क्रमशः 1974, 1976, 1978 और 1979 में हुआ। कृषि भ्रनुसंधान सांख्यकीविदों का पांचवां सम्मेलन और भारतीय कृषि सांख्यकी संस्था का चौंतीसवां सम्मेलन संयुक्त रूप से भा० कृ० साँ० भ्र० सं० और भा० कृ० साँ० सं० द्वारा 23-26 दिसम्बर, 1980 के दौरान लखनऊ (उ० प्र०) में आयोजित किया गया। लगभग 250 सदस्यों जिनमें भा० कृ० साँ० सं० के सदस्य तथा भ्रनुसंधान में लगे कृषि विरुवविद्यालयों, भा० कृ० भ्र० प० के संस्थानों, कृषि के केंद्रीय और राज्य विभागों, पशु-पालन, ज्ञानकी मात्स्यकी के प्रतिनिधियों ने, इस संयुक्त सम्मेलन में भाग लिया। इस सम्मेलन में सदस्यों के रहन-सहन व खानपान की व्यवस्था कृषि निदेशालय, उ० प्र० (लखनऊ) के निदेशक ने की।

निम्नलिखित दो तकनीकी सत्र और सभासत्र थे :

24 दिसम्बर, 1980 को कृ० भ्र० सांख्यकीविदों का तकनीकी सत्र-1 हुआ। इस के दौरान गत चार सम्मेलनों में की गयी सिफारिशों पर हुई कार्यवाही पर विचार-विमर्श हुआ। तकनीकी सत्र-1I में ग्रामीण विकास के संदर्भ में कृषि, जानकी, पशुधन और मात्स्यकी में चालू सांख्यकीय भ्रनुसंधान पर 24 और 26 दिसम्बर, 1980 को विचार-विमर्श हुआ। 26 दिसम्बर, 1980 को भ्रपरान्ह में सभा सत्र के दौरान अध्यक्ष महोदय ने विभिन्न सत्रों की रिपोर्ट प्रस्तुत की। भाग लेने वालों के लिए भ्रयोध्या के भ्रमण की भी व्यवस्था की गयी।

18.11.2 पशुधन संसाधनों में प्राकड़ों के आघार पर सुधार के लिए प्रशिक्षण पाठ्यक्रम :—

खाद्य एवं कृषि संगठन (F.A.O.) क्षेत्रीय पशु उत्पादन और एशिया में स्वास्थ्य आयोग, सूदुर पूर्व और दक्षिण-पश्चिम प्रशान्त की ओर से भा० कृ० साँ० भ्र० सं० में 1-6 दिसम्बर, 1980 में "पशुधन संसाधनों पर उपात आघार का सुधार" प्रशिक्षण पाठ्यक्रम का आयोजन किया गया। इस प्रशिक्षण पाठ्यक्रम का उद्देश्य देश में राष्ट्रीय सांख्यकीय कर्मियों के लिए प्रशिक्षण कार्यशाला और पशुधन पर चल रहे सांख्यकीय कार्यक्रम के विकास के लिए आबश्यक भ्रनुसंधान के मूल खाकों के विकास और विश्लेषणात्मक अध्ययनों में प्रशिक्षण देना था। 7 ए० पी० एच० सी० ए० देशों (बर्मा देश-3, मलेशिया-3, पाकिस्तान-2, फिलीपीन-1, श्रीलंका-3 थाईलैंड-3 और भारत-6) से आये 21 प्रशिक्षुओं ने प्रशिक्षण पाठ्यक्रम में भाग लिया।

18.12 पशु चिन्तन के लिए लागू उन्नत सांख्यिकीय क्रिया पद्धति पर ग्रीष्मकालीन संस्थान :—

भारतीय कृषि सांख्यिकीय अनुसंधान संस्थान में 6 मई से 4 जून, 1980 तक ग्रीष्मकालीन संस्थान का गठन किया गया। ग्रीष्मकालीन संस्थान का उद्देश्य, भा० कृ० भ्रा० प० के संस्थानों, कृषि विश्वविद्यालयों और महाविद्यालयों के अनुसंधानकर्त्तियों और श्रध्यापकों के लिए भावहरयक दिग्विन्ध्यास प्रदान करना और राज्य के पशुपालन विभागों/डेपरी में पशुविज्ञान एवं पशुधन विकास के लिए लागू सांख्यिकीय क्रिया-पद्धति से उनके ज्ञान में वृद्धि करना था। ग्रीष्मकालीन संस्थान में भा० कृ० सां० भ्रा० सं० के 3 विभागीय प्रत्याशियों के साथ-साथ विभिन्न संगठनों से 18 प्रत्याशियों ने भाग लिया। इन 21 भागीदारों में से 11 कृषि विश्व-विद्यालयों, 6 भा० कृ० भ्रा० प० के संस्थानों और 4 राज्य विभागों के पशु पालन और पशु-विक्रिस्ता सेवाओं से थे।

ग्रीष्मकालीन संस्थान के पाठ्यक्रम में सैद्धांतिक एवं प्रायोगिक पहलुओं पर व्याख्यान, संस्थान की परियोजनाओं पर विचार-विमर्श, ग्रामन्वित वक्ताओं द्वारा व्याख्यान एवं वातर्पिण्णामिल थीं। 20 से 23 मई, 1980 तक एक क्षेत्रीय दौरा किया गया जिसके दौरान दोनों, देहरादून बहर के एक बार्ड में और देहरादून जिले के (सिमौला) ग्राम में एक पशुधन सर्वेक्षण क्रिया गया। पाठ्यक्रम के दौरान दो परीक्षाएं, जिनमें से एक सत्र के मध्य में और एक श्रन्त में ली गयीं। परीक्षा लेने का उद्देश्य हिस्सा लेने के परिमाण और समझ का सुल्यांकन करना था। विभिन्न व्याख्यानदाताओं और वक्ताओं द्वारा तैयार किये गये नोट्स और लेख काफी उपयोगी पाये गये। कुल मिलाकर ग्रीष्मकालीन संस्थान का प्रभाव भागीदारों पर सन्तोषजनक रहा।

18.13 श्रन्त क्रिया कलाप

18.13.1 “प्रयोगशाला से भूमि तक” कार्यक्रम :—

भा० कृ० भ्रा० प० के “प्रयोगशाला से भूमि तक” कार्यक्रम के श्रधीन, 1979-80 के दौरान कार्यक्रमित दिल्ली के कंभातला खण्ड में स्थित गढ़ी रन्धाला गाँव में संस्थान द्वारा 100 परिवारों को श्रपनाया गया। गत एक वर्ष के दौरान गाँव में हुए श्राथिक एवं सामाजिक परिवर्तनों के कारण गाँव के कुछ परिवारों के स्तर में भी परिवर्तन हुए। इस कार्यक्रम के श्रधीन 10) परिवारों के चयन में यशानुसार संशोधन क्रिया गया और प्रतिवेदनाधीन वर्ष के दौरान इन परिवारों के श्रन्तर्गत 34 छोटे किसान, 26 सीमान्त किसान और 40 भूमिहीन कृषि श्रमिक थे।

APPENDIX—I**List of scientists, technical and Administrative Officers in
position as on 31.12.1980**

Dr. Daroga Singh, Director

Dr. Prem Narain, Jt. Director (Training & Research)

Dr. S. S. Pillai, Jt. Director (C. S. & N.A.)

Division of Training & Basic Research

Dr. Aloke Dey, Scientist (S-3), Head

- | | | |
|-----|--------------------------|-------------------|
| 1. | Dr. A. K. Nigam | Scientist (S-3) |
| 2. | Dr. G. Sadasivan | Scientist (S-2) |
| 3. | Sh. S. C. Rai | „ |
| 4. | Dr. Randhir Singh | Scientist (S-1) |
| 5. | Sh. P. P. Rao | „ |
| 6. | Sh. V. K. Gupta | „ |
| 7. | Sh. V. K. Bhatia | „ |
| 8. | Dr. M. Singh | „ (On deputation) |
| 9. | Sh. R. K. Rajagopalachar | „ |
| 10. | Sh. R. K. Bohra | „ (On deputation) |

Division of Statistical Research in Crop Sciences

Shri P. N. Bhargava, Scientist (S-3), Head

- | | | |
|-----|-----------------------|-----------------|
| 1. | Shri K. S. Krishnan | Scientist (S-3) |
| 2. | Miss C. R. Leelavathi | Scientist (S-2) |
| 3. | Sh. P. N. Soni | „ |
| 4. | Sh. V. N. Iyer | Scientist (S-1) |
| 5. | Sh. H. C. Jain | „ |
| 6. | Sh. H.V.L. Bathla | „ |
| 7. | Dr. Basant Lal | „ |
| 8. | Sh. K. C. Bhatnagar | „ |
| 9. | Sh. R. K. Ghai | „ |
| 10. | Sh. J. K. Kapoor | „ |
| 11. | Miss N. K. Chaudhary | „ |
| 12. | Mrs. Asha Saksena | „ |
| 13. | Sh. P. K. Batra | „ |
| 14. | Sh. Prabhat Kumar | „ |
| 15. | Mrs. Suman Gupta | „ |

Division of Crop Forecasting Methodology

Shri M. P. Jha, Scientist (S-3), Head

- | | | |
|----|----------------------|-----------------|
| 1. | Sh. S. R. Bapat | Scientist (S-2) |
| 2. | Dr. K. G. Aneja | „ |
| 3. | Sh. G. N. Bahuguna | Scientist (S-1) |
| 4. | „ R. C. Jain | „ |
| 5. | Mrs. Ranjana Agarwal | „ |
| 6. | Sh. Chandrahas | „ |

Division of Statistical Research in Animal Sciences

Dr. K. C. Raut, Scientist (S-3), Head

- | | | |
|-----|-----------------------|-----------------|
| 1. | Dr. H. P. Singh | Scientist (S-2) |
| 2. | Sh. U. G. Nadkarni | „ |
| 3. | „ Shivtar Singh | Scientist (S-1) |
| 4. | „ B. C. Saxena | „ |
| 5. | „ V. T. Prabhakaran | „ |
| 6. | Dr. L.B.S. Somayazulu | „ |
| 7. | Sh. K.P.S Nirman | „ |
| 8. | „ R. P. Singh | „ |
| 9. | „ T. B. Jain | „ |
| 10. | „ S. N. Arya | „ |
| 11. | „ R. L. Rustogi | „ |
| 12. | „ S.R.S. Arya | „ |
| 13. | „ G. C. Chawla | „ |
| 14. | „ Jose Abraham | „ |
| 15. | „ H.C. Gupta | „ |
| 16. | „ S. P. Verma | „ |

Division of Sample Survey Methodology

Sh. S. D. Bokil, Scientist (S-3), Head

- | | | |
|----|--------------------|---------------------------------|
| 1. | Sh. S. K. Raheja | Scientist (S-3) |
| 2. | Dr. B.B.P.S. Goel | „ |
| 3. | „ O. P. Kathuria | „ |
| 4. | Sh. J. N. Garg | Scientist (S-2) (On deputation) |
| 5. | Dr. A. K. Banerjee | „ |

6.	Sh. P. C. Mehrotra	Scientist (S-2)
7.	„ J. S. Maini	„
8.	„ V. S. Rustogi	„
9.	Dr. A. K. Srivastava	„
10.	„ M. G. Mittal	„
11.	Sh. Anand Prakash	Scientist (S-1)
12.	„ S. S. Gupta	„
13.	„ A. S. Gupta	„
14.	Dr. N. K. Ohri	„
15.	Sh. Satyendra Kumar	„
16.	Dr. D. V. Subba Rao	„
17.	Sh. Pranesh Kumar	„
18.	„ K. K. Tyagi	„
19.	„ S. S. Sastri	„
20.	„ J. P. Goyal	„
21.	„ K. B. Singh	„
22.	„ Satya Pal	„
23.	„ M. S. Batra	„
24.	Sh. G. S. Bassi	„
25.	„ D. L. Ahuja	„
26.	„ Khubi Singh	„
27.	„ D. P. Malhotra	„
28.	„ Jagmohan Singh	„
29.	„ R. S. Khatri	„

Division of Econometric Analysis

Dr. R. K. Pandey, Scientist (S-3), Head

1.	Sh. B. L. Kaul	Scientist (S-1)
2.	„ H. B. Chaudhary	„
3.	„ U. N. Dixit	„
4.	„ Shanti Saroop	„
5.	„ S. C. Gupta	„
6.	Miss Geeta Bisaria	„
7.	Dr. Bhagat Singh	„

Division of Computer Science and Numerical Analysis

Sh. S. N. Mathur, Scientist (S-2), Head

1.	Sh. K. V. Sathe	Scientist (S-2)
2.	„ R. Gopalan	„
3.	„ A. C. Kaistha	„
4.	„ Ram Kumar	Scientist (S-1)
5.	„ S. P. Doshi	„
6.	„ Mahesh Kumar	„

7.	Sh. O. P. Dutta	Scientist (S-1)
8.	„ Sh. M. L. Chaudhary	„
9.	„ S. L. Garg	„
10.	„ M. L. Sahni	„
11.	„ D. K. Agarwal	„
12.	„ V. K. Mahajan	„
13.	„ R. C. Goel	„
14.	„ R. P. Jain	„
15.	„ K. C. Gupta	„
16.	„ Bharat Singh	„ (On deputation)

Other Units/Cells

(a) Director Cell

1.	Shri R. K. Khosla	Scientist (S-2) In-charge
2.	„ D. P. Singh	Scientist (S-1)

(b) Statistical Genetics Cell

1.	Dr. J. P. Jain	Scientist (S-3)
2.	Sh. J. C. Malhotra	Scientist (S-2)
3.	„ L. K. Garg	„
4.	„ P. K. Malhotra	Scientist (S-1)
5.	„ Lal Chand	„
6.	„ P. S. Rana	„

(c) Field Unit

1.	Sh. Rajinder Singh	Field Officer (T-7)
2.	„ S. K. Suri	„ (T-6)

(d) Library

Sh. S. S. Srivastava	Librarian (T-6)
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Administration

1.	Sh. R. N. Bakshi	Chief Administrative Officer
2.	Sh. T. C. Sachdeva	Senior Administrative Officer

APPENDIX—II

List of Sanctioned and filled up posts as on 31.12.1980

Sl. No.	Post	Scale of Pay (Rupees)	No. of posts sanctioned.	No. of posts filled	No. of S/C, S/T employees
1	2	3	4	5	6
Class-I					
1.	Director	2000-2500	1	1	—
2.	Jt. Director	1800-2250	2	2	—
3.	Scientist (S-3)	1500-2000	18	12	—
4.	Scientist (S-2)	1100-1600	29	22	—
5.	C.A.O.	1300-1700	1	1	—
6.	Sr. A.O.	1100-1600	1	1	—
7.	Scientist (S-1)	700-1300	35	81	1 S/C
8.	M.T.O.	700-1300	1	1	1 S/C
9.	Jr. Tech. Officer	700-1300	1	—	—
10.	Field Officer	700-1300	2	2	—
11.	Librarian	700-1300	1	1	—
Class-II					
12.	Accounts Officer	840-1200	1	1	—
13.	Asstt. F.O.	650-1200	1	1	—
14.	Section Officer	650-1200	1	1	—
15.	A.A.O.	650-1200	1	1	—
16.	Scientists 'S'	550-900	53	19	1
17.	E.C.O.	550-900	8	8	—
18.	Artist	550-900	1	1	—
Class-III					
19.	Superintendent	550-900	4	4	2 S/C
20.	Jr. Accounts Officer	550-900	1	—	—
21.	Jr. Accountant	425-750	1	1	—
22.	Hindi Translator	425-700	1	1	—

23.	Assistant	425-700	20	19	5 S/C, 1 S/T
24.	Sr. Stenographer	550-900	1	—	—
25.	Stenographer	425-700	9	9	—
26.	Jr. Stenographer	330-560	13	13	1 S/C
27.	Tech. Asstt. (Stat.)	425-700	144	116	7 S/C
28.	Tech. Asstt. (Library)	425-700	2	2	—
29.	Asstt. (E.C.O.)	425-700	6	—	1 S/C
30.	Inspector	425-700	2	2	—
31.	Supervisor	330-560	6	6	—
32.	Card Librarian	330-560	1	1	—
33.	Senior Clerk	330-560	16	15	2 S/C
34.	Punch Supervisor	330-560	8	5	1 S/C
35.	K.P.O.	260-430	79	50	3 S/C, 1 S/T
36.	Field Investigator	260-430	30	30	5 S/C
37.	Jr. Clerk	260-430	32	32	5 S/C, 1 S/T
38.	Telephone Operator	260-430	3	3	—
39.	Staff Car Driver	260-430	3	3	3 S/C
40.	Tube-well Operator	260-430	2	1	—
41.	Carpenter	260-430	1	1	—
42.	Sr. Gestetner Operator	260-430	1	1	—

Class-IV

43.	Supporting Staff Grade IV	225-308	5	2	—
44.	Supporting Staff Grade III	210-290	11	11	3 S/C
45.	Supporting Staff Grade II	200-250	22	20	9 S/C, 1 S/T
46.	Supporting Staff Grade I	196-232	43	48*	12 S/C, 1 S/T

* Five excess posts in S. S. Grade I have been shown against the vacant posts of S. S. Grade II and IV.

APPENDIX-III**List of dissertations with (abstracts) approved during the year, 1980
for award of Ph. D. Diploma and M. Sc. Degree in
Agricultural Statistics.****Ph D. Degree****Maini, J.S.—Effect of Measurement errors on the efficiency of various
sampling designs**

The dissertation deals with some aspects of measurement errors with special reference to enumerator's effect. In chapter-I, the problem has been introduced with a broad and upto-date review of the literature. While dealing with the problem of estimating the enumerator's contribution towards total variability the available literature on the subject broadly deals with the method of simple random sampling.

In chapter-II apart from simple random sampling (i) pps with replacement sampling (ii) RHC scheme for pps sampling and (iii) multistage sampling designs are considered.

In chapter-III the method of interpenetrating sub sampling has been applied in conjunction with the above sampling designs which provide control over the travel cost and also enables the estimation of contribution of enumerator's effect to the variance along with the usual estimation procedure of estimating the mean/total for the character under study.

In chapter-IV an unbiased estimate of enumerator's effect on the response error in the presence of non-response as well as on the response rate has been obtained for simple random sampling. Among many techniques of dealing with the problem of non-response one commonly adopted is that through imputation. In many cases the imputations are based on the values of available units.

In chapter-V the values of non responding units have been imputed through the duplication method in which the non-responding values are imputed by selecting units randomly from the responding units and estimate of enumerator's contribution towards variance has been obtained due to (i) enumerator's effect on the response errors and (ii) the enumerator's effect on the response rate.

(Guide : Dr. D. Singh)

Bora, A.C.—Some contributions to the Design and Analysis of Switch over trials

The thesis deals with the problems of estimation and testing the significance of various parametric functions of treatment effect in Switch over trials in the presence of auto correlated errors. Two types of structures for the auto correlation, namely first order and second order processes have been assumed. The study has been extended to the case when residual effects of first order are present. The property of robustness of the Switch over design is also studied and some of the well known switch over designs have been shown to be robust.

(Guide : Dr. A.K. Nigam)

Muruga Boopathy, G.—Some contributions to Design and Analysis of Bio-Assays

This thesis deals with design and analysis of experiments on Bio-Assays. Some systematic procedures of construction of incomplete block designs for various Bio-Assay situations have been presented. Through these designs, contrast of major importance can be estimated orthogonally to block contrast. Some further series of designs have been proposed for multiple symmetrical parallel line assays.

(Guide : Dr. A.K. Nigam)

Sing, Gulab.—Designs for two-way estimation of heterogeneity and related problems

The thesis deals with certain problems in design and analysis of experiments for eliminating heterogeneity in two directions. The necessary and sufficient condition for a design eliminating heterogeneity in two directions to be balanced is derived. Partially balanced row-columns designs are studied and methods of construction of such designs are discussed.

The robustness of a design to the presence of an outlier is studied with reference to designs eliminating heterogeneity in two directions. Some robust designs are characterised.

Methods of construction of designs called block designs with rested rows and columns are studied and several new series of designs are reported. Finally, a method of inter-block analysis for such designs is suggested.

(Guide : Dr. Aloke Dey)

Tyagi, K.K.—Some contribution to the theory of multi-auxiliary characters

In this dissertation, multivariate ratio, regression, product, two-variate ratio-product estimators for estimating the population mean of the character study, have been developed alongwith their biases and variances respectively. A comparison among the estimators has also been made. Empirical Studies have also been made.

A suitable cost function for the proposed sampling scheme has also been developed and the optimum values of the sample sizes corresponding to different auxiliary characters as well as for their study character have been determined.

(Guide : Dr. D. Singh)

Diploma

Basu, Gopa—Some contribution to cluster sampling

In this Thesis some Sampling strategies in Cluster Sampling have been suggested. These are imperically shown to be more efficient than some of the existing schems.

(Guide : Dr. Padam Singh)

Mitra, R.K.—Some contribution to second order response Surface Designs

The Thesis contains four chapters including the one on Introduction and Review of Literature. Chapter 2 presents the G-efficiencies of Second Order rotatable designs obtained through central composite and BIB designs. In Chapter 3 an attempt has been made to fit simultaneously a set of polynomial functions for multi-response data. The test procedures involved in the analysis are described. In Chapter 4, robustness of response surface designs is studied.

(Guide : Dr. M. Singh)

Wahi, S.D.—Some aspects of combined selection in poultry

On the basis of the data collected under the Project entitled "Statistical methodology for developing efficient selection procedure in poultry breeding" from Regional Poultry Farm at Bhopal during the laying period 1970.

In this dissertation the efficiency of different selection indices with one and more auxiliary traits (modified Osborne's index) over the Osborne's index has been sudied.

(Guide : Dr. Prem Narain)

M. Sc. Degree**1. AGARWAL, S.C. Some Statistical Aspects of the Effect of Transactions in Birds on Poultry Keeping.**

Purchases and sales of poultry birds of different age groups do play an important role in the economic running of the poultry farm. The purpose of these transactions in birds is to replenish the stock in such a way as to have a required number of layers to meet the seasonal demand of eggs and also of birds.

To find out to what extent the total egg production and total income are dependent on transaction in poultry birds, the data collected by I.A.S.R.I. from about 130 commercial poultry farms in the Union Territory of Delhi in the project 'Estimation of cost of production of poultry and eggs' for the year 1969-71 was utilised for this purpose. The birds of different categories were converted into standard birds by using ratio of feed intake of other birds to that of a layer. The farms were divided into two groups (i) farms having purchases more than sales (Group I) and (ii) farms having purchases less than sales (Group II). As purchases and sales of birds play a relative role among themselves and also in accordance with flock strength, it was felt convenient to reduce them to some transaction factor such as (i) ratio of purchased standard birds to total number of standard birds maintained (T_1), (ii) ratio of sold standard birds to total number of standard birds maintained (T_2) and (iii) ratio of total of purchased and sold standard birds to the total standard birds maintained (T_3). The transaction factors showed in some cases higher correlation coefficients with egg production and income than feed and labour.

Different production functions with egg production or total income as output factor and total layers (X_1), feed cost per bird (X_2), labour cost per birds (X_3), and transaction factor (X_4) as input factors were fitted for the two groups of farms in each year. The values of R^2 showed that in general, quadratic functions accounted for larger variation. It was also observed that incremental contributions to R^2 value made by transaction factors was more than that made by either feed or labour or both. Also the relative contribution due to transaction factor (T_2) to R^2 was more than that due to transaction factor T_1 or T_3 . Optimum age at disposal of young birds was obtained by fitting Mitscherlich curve and maximising the profit. The optimum age was found to be 12.84 Weeks.

(Guide : Sh. U. G. Nadkarni)

2. CHOUBEY, ANJANI KUMAR. **A critical appraisal of the methodological investigations into High Yielding Varieties Programmes in selected districts of the Punjab State**

In this dissertation, data collected under the scheme "Sample surveys for methodological investigations into high yielding varieties Programme" in the selected districts of Jullundur, Amritsar and Patiala of the Punjab State for rabi season of 1977-78 for wheat crop have been utilized with a view to study the various input practices influencing the yield.

The results of the study revealed that majority of the cultivators in the three districts had medium (2-4 hectares of cultivated area) or large (more than 4 hectares of cultivated area) holdings. WG 357, the high yielding variety of wheat was the most popular variety grown by the cultivators. Although the highest average yield recorded was for WL 711 which was of the order of 38 q/ha, the highest yield for WG 357 variety worked out to be 28 q/ha. The two yields differ from one another. The number of experiments on local variety of wheat was small for any valid conclusion. The yield rates of HYV of wheat was independent of holding size classes. The percentage number of fields benefitted by the application of chemical fertilizers as well as their rate of application was more or less of the same order over the three districts. The overall dose of chemical fertilizers (N+P+K) was close to that recommended in the districts. The yield rates generally depicted an increasing trend with increased input of fertilizers. More than 90 per cent of the fields are reported to be well drained and fairly levelled. In Jullundur and Amritsar the soil type for a majority of the fields was reported to be alluvial. In a majority of the fields, pre-sowing irrigation was carried out. A large majority of the cultivators reported that the seed was procured either from own source or through local body. The practice of sowing the fields with pre-treated seed was not very prevalent in the districts. A majority of the fields were sown at normal time (mid-November). The average rate of sowing varied marginally around 86 kg/ha of seed. Pre-sowing irrigation as well as drainage of soil was independent of yield level. The weather in Amritsar and Jullundur was free from causes likely to damage the crop. The regression analysis of yield and chemical fertilizers did not give any significant result. The results of group of experiments revealed that the treatment effects do not differ significantly from district to district.

(Guide : Dr. A.K. Banerjee)

3. CHOKKALINGAM, G. **Estimation of milk production utilising partial milk recording data**

The methodology was developed by the I.A.S.R.I. For the estimation of milk production in an area requires the weighment of milk yield for the ultimate unit both in the morning as well as in the evening. The character under study which is the day's production is the aggregate of the yield in the morning and evening and is obtained for each of the ultimate stage unit (by weighment of milk on both occasions) and estimates of average annual/daily milk production are obtained following the sampling design adopted in the investigation.

It has been observed that the correlation between morning and evening milk yield of animals in all the three seasons ranges from 0.60 to 0.96. Utilising this, the functional relationship between the yield at two occasions has been established. It is concluded that for obtaining the estimates of milk production in a day, it is enough to record milk yield either in the morning or in the evening taking adequate samples. When the milk is to be recorded both in the evening and morning, it is better to have independent samples on each occasion. The first stage units i.e. villages accounts for 90% variation and the second stage units i.e. households contribute only about 3% of the variation. The operationally feasible plan of work which minimises most of the difficulties encountered in the present plan of work has been suggested. Utilising the theory of successive sampling the improved estimates are obtained more precisely on the basis of revised plan of work.

(Guide : Dr. K.C. Raut)

4. CHUGH, KANWAL. **Some methodological investigations for the estimation of vegetable production**

IASRI conducted various pilot sample surveys to develop a suitable sampling methodology for the estimation of acreage, average yield and production of vegetable crops. These surveys were conducted at each Centre for three years in independent rounds of one year's duration each. The sampling design adopted in these surveys may be broadly described as stratified multistage random sampling, design, however, different sampling designs i.e. with some modifications were tried in different rounds of these surveys.

Although these pilot investigations indicated the feasibility of obtaining these statistics but the precision of the estimates of area and production were very low. These surveys also highlighted various problems which were associ-

ated with the conduct of these surveys. It has been found that a sort of double sampling technique, selecting a larger sample for area enumeration and a suitable fraction of this sample for estimating the average yield, improved the estimates of area. The estimates of production would be suitably modified through another method of estimation. It has been, thus, found that efficiency of the estimates of area and production of vegetable crops could be suitably improved in this manner. Some other methodological investigations have also been carried out for the conduct of these surveys with better efficiency.

(Guide : Sh. S.D. Bokil)

5. **KHER, K.K. On the procedures of estimation of egg production**

The dissertation deals with the comparison of efficiency of the three procedures of estimation of egg production. Three methods used for estimating season-wise egg production are as follows :

- (i) Simple estimator i.e. without using information from other seasons.
- (ii) Regression type estimator using information from the previous seasons.
- (iii) Regression type estimator using all the information available.

These three types of estimates are pooled over the seasons to get three annual estimates of total egg production and third method of estimation of egg production was found to be the most efficient. The design adopted for the present study was one of the multi-stage stratified random sampling with partial matching of units over the seasons. The procedures were illustrated with the help of data collected from integrated pilot sample survey conducted in the Northern region during 1970-71.

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

6. **KUMAR, RAMESH. Some Statistical aspects of cost accounting in poultry farming**

Management of poultry in economic manner is important for improvement of commercial poultry farming. In this study, data of 134 commercial farms of Delhi area, an attempt is made through statistical-cum-cost accounting technique to determine the break even points which determine the volume of sale, so that revenue equals costs and to determine ratio of profit with volume of sale. Break even points is obtained for each farm under study and a regression of break even level on average number of layers maintained at the farm is also obtained. The optimum number of layers to be maintained at the farm is also found from the quadratic equation which explained about 98 percent of variation in break even volumes.

(Guide : Sh. U.G. Nadkarni)

7. **NARASIMHAN, B. N. On a simulation approach to study of bias in ratio estimates.**

Simulation is a process that employs a computerized model of certain significant features of some physical or logical systems. Providing an experimental model for the accumulation of data on the target system is the main objective of this process. The Simulation technique is due to Jon Von Neumann.

In this study, using the technique of Simulation, we generated populations of different sizes. These populations were following either Bi-variate Normal distribution or Bi-variate Exponential distribution. For each of the generated population all the possible samples of specific sizes were drawn and the "true bias" was calculated over these samples. Also, the bias in the ratio estimator of the population total of the variable by Sukhatme's first order and second order approximations were calculated and a comparison was made between these biases.

The comparisons showed that the first approximation due to Sukhatme is always better than the second approximation. Hence we conclude that there is no point in going for the second approximation and that the first approximation will itself serve as a guideline to the extent of bias in the ratio estimate. This fact was also varified with the help of two real world populations, data on which were taken from published records.

(Guide : Dr. S. S. Pillai)

8. **RAMESAN, P. M. Some studies on age-specific mortality of bovines under village conditions**

An attempt has been made to work out age-specific mortality rates of bovines by mid-year through exposure methods and to fit them into a probability distribution. Animals existed in the selected households at the start of the survey and at the end of the survey were taken as beginners and enders respectively. Frequency distribution of both these categories of animals according to age were smoothened separately by polynomials. A mid-year estimate was also derived from the above two polynomials. Age-specific deaths were also smoothened by an other polynomial. Estimates of mortality rates were taken as the ratio of the value of the function of death polynomial to the polynomial of mid-year estimate for specific age denominations. The total exposure failing in each age group by fraction exposure

method was computed after screening each animal for the period in which they were exposed to the risk of death. Another polynomial was fitted to the exposure also. Mortality rates were computed, as earlier as the ratio of the polynomial of deaths to the polynomial fitted for exposures. Mortality rates estimated by both the methods followed a probability distribution, Pearsonian (Type-1).

Data utilised for the above study were taken from the scheme "Pilot studies for estimation of birth and death rates in bovines"-Andhra Pradesh, 1972-73.

(Guide : Dr. K. C. Raut)

9. **RABINDRAN, C. D. Some statistical studies of poultry keeping in relation to poultry shed area**

To investigate the effect of floor-area on production of eggs and income from poultry, the data collected by the IASRI during 1969-71 for the project "Estimation of cost of production of poultry and eggs" around the Union Territory of Delhi were utilised. The method of regression analysis was used to study the effect of floor-area on egg production and income by taking the later as dependent variables and number of layers, feed cost per layer, labour cost per layer and floor area for layers as independent variables. Various functional forms, viz. linear, quadratic, square root and Cobb-Douglas functions were fitted to the data of two years. Examination of the production functions showed that the input-factor-number of layers, was a dominant variable in the regression and on deleting this factor it was found that floor-area accounted for much larger percentage of variation than feed and labour and that the Cobb-Douglas function was the best fit.

On the basis of the Cobb-Douglas function, optimum floor area along with optimum egg production was worked out. It was estimated that the optimum floor area per layer was within the range prescribed by the Indian Standards Institution in the case of data combined overall farms in rural and urban area and was slightly more in rural farms than the standard prescribed by the ISI. Further comparisons of the optimum floor area per layer with the existing practice in commercial farms under study showed that on an average, based on data combined for rural and urban areas, farmers were allowing more floor area than the optimum and the farmers in the rural area alone were providing less floor area than the optimum.

(Guide : Sh. U.G. Nadkarni)

10. SHARMA, ROOP KISHORE. **Studies on the efficiency of Designs for Cotton (*Gossypium hirsutum*) in relation to shape and size of plot and block**

An uniformity trial on cotton was conducted at Indian Agricultural Research Institute, New Delhi, with the objects to determine optimum plot size and shape of plot and blocks, number of replications and relative efficiency of different designs. Results of the present investigation indicated that the coefficient of variation decreased with the increase in size of plot. Optimum plot size was worked out using different methods. Fairfield Smith's Variance law was fitted and found satisfactory. Values of 'b' obtained was of the order of 0.50 indicating that the neighbouring plots were poorly correlated. The number of replications required decreased with increase in plot size. Using area into consideration the smallest plot size of 8 units was found optimum. Considering cost function, it was observed that optimum plot size increased with the increase in cost ratio. Convenient plot size was worked out using Hatheway method and it was observed that differences in treatments which were 5% or less required very large plot size which was not practically feasible. The convenient plot size decreased with the increase in number of replications when number of treatments were fixed. When the differences between treatments to be detected was increased, the plot size for a given number of replications and for a given level of probability, decreased sharply. In case of split plot design, it was observed that with the increase in size of sub-plot the efficiency of main plot comparisons was increased while that of sub-plot decreased. Latin square had been found to be efficient in controlling two way heterogeneity of experimental material.

(Guide : Sh. P.N. Soni)

11. SINGH MAHENDER **On the efficiency of designs adopted for irrigational experiments**

The objective of the present study is to examine the efficiency of design adopted for irrigational experiments, where various factors are contributing to experimental error variations. The sensitiveness of experimentation can be increased by reducing the error variation. Different techniques have been suggested by research workers to reduce such error variations. The data pertaining to 400 irrigational experiments laid out in RBD or split-plot design was analysed and the relative efficiencies of alternative designs were calculated. such relative efficiency was found to be influenced by various factors viz. : soil type, the ultimate plot sizes, number of treatments per block, number of

replications and the value of intra-class correlation coefficient (r) between contiguous plots. The effects of some of these factors were inter related and hence needed to be studied conjointly. After critical study it was observed that RBD is more efficient than CRD for purely irrigational experiments and split plot design in respect of sub-plot contrasts has an edge over RBD for experiments having irrigational treatments along with other sets of treatments. The reverse trend of relative efficiencies of alternative designs was also observed in some of the cases which could have been avoided by adopting appropriate statistical principles of designs at the time of laying out of experiments.

(Guide : Sh. K. S. Krishnan)

12. VERMA, DEVENDRA. **Estimation of Heritability of threshold characters.**

Most of the applications of the concept of heritability have been made with respect to characters showing continuous or graded types of variation. The importance of this parameter, however, extends equality to threshold traits which, while possibly based on a continuous or normal distribution of genotypic values, are expressed phenotypically on an one-or-the-other kind, or generally speaking of discontinuous basis. The various techniques for the estimation of heritability for characters showing continuous variation are well known. These methods, however, are not immediately applicable to threshold characters because the underlying continuous distribution can not be observed. Special techniques are used to deal with threshold characters. The purpose of this dissertation is firstly to present a critical review of all the available methods for estimation of heritability of threshold characters and secondly to obtain the estimates of heritability of three important characters in poultry viz. fertility, hatchability of all eggs set and hatchability of fertile eggs by different methods and compare their efficiencies. For the empirical investigation the data came from Regional Poultry Farm, Bhopal and pertained to 541 first generation birds raised during 1972.

The different methods of estimation of heritability for threshold characters reviewed included those suggested by Wright (1934), Lush (1948), Robertson and Lerner (1949), Bogyo and Becker (1965), Lush (1950) and Falconer (1955). All these methods are artifices for converting the information contained in the incidences into an estimate of the degree of resemblance between relatives, expressed as a correlation or regression coefficient. The first four methods of estimation of heritability viz. of Wright, Lush,

Robertson and Lerner and Bogyo and Becker provide estimates in terms of correlation while the remaining two methods provide estimates in terms of regressions. The choice depends on the type of data obtainable, design of the experiment, sampling error and environmental sources of covariance. Generally, the estimates based on regression are to be preferred to those based on correlations since the latter are subject to larger bias due to selection of parents. When the data obtainable are generated either by single-parent design or by nested design and the information is recorded only on progeny all the methods based on correlations are applicable but the one suggested by Bogyo and Becker (1965) is more appropriate to adopt. And when the data on incidences are available for both the parents and offspring generations or for the general population and among relatives of affected individuals, the regression methods of Lush (1950) and Falconer (1965) can be used with advantage, but the method of Falconer is more suited to human data.

The estimates of heritability of eggs fertility (x) hatchability of all eggs set (y) and hatchability fertile eggs (z) were obtained using half-sib correlation method as well as full-sib correlation method and also both on the observed scale and on the underlying continuous scale. The estimates based on half-sib correlation for the three traits X, Y and Z on the observed scale were $0.54 \pm .020$, $0.23 \pm .054$ and $0.39 \pm .018$ respectively which were seen to be more precise than the estimates based on full-sib correlation. The corresponding estimates on the continuous scale were $0.89 \pm .191$, $0.46 \pm .100$ and $0.40 \pm .086$ respectively which were higher than the estimates on the observed scale. Thus, all the three traits are considerably heritable with fertility of eggs being more heritable than hatchability of all egg set and much more than hatchability of fertile eggs. This study, therefore, reveals that there is quite a good scope of improvement of these traits through selection.

(Guide : J. P. Jain)

APPENDIX IV

Computer Programmes on Source Programme Library Tape

Sl. No.	Library file name	Programme name	Author	Objective of Program
1	2	3	4	5
1.	LIB 189	DSP 99	S.P. Doshi	Gen. Program. for selective Diallel Analysis by Griffings Method-II approach and Hayman's. (1954/58) approach.
2.	LIB 190	DSP 97	„	Gen. Program. for VAR/Cov. in split-plot design.
3.	LIB 191	DSPPOL	„	Gen. Program. for Polynomial Fitting (up to 4th degree)
4.	LIB 192	DSPLGC	„	Gen. Program. for fitting of logistic curve of the type $Y=K/(1+ae^{bt})$.
5.	LIB 193	DSPASC	„	Gen. Program. for fitting of Asymptotic curve of the type $Y=a-be^{-kt}$
6.	LIB 194	DSPLGF	„	Gen. Program. for growth curves of different types involving Log terms.
7.	LIB 195	DSPFRC	„	Gen. Program. for Fisher's Technique of Response Curve for Meteorological variables.
8.	LIB 196	DSP 39	„	Gen. Program. for Analysis of WR and VR pooled over years (Diallel data).
9.	LIB 197	DSP 40	„	Program. Package for different types of Analysis of Diallel data of $P+F_1+F_2$: (Blockwise and Pooled Analysis).
10.	LIB 198	DSP 45	„	Program. Package for Diallel data of $P+F_1$ and $P+F_2$ Analysis by

1	2	3	4	5
				(i) Morley-Jones Model (1965)
				(ii) Walter-Morton Model (1978)
				(iii) Gardener and Eberthart (1966) Analysis III
				(iv) Hayman's (1957) Test for Epistasis.
11.	LIB 199	DSP 42	„	Program. Package for Line X Tester data (with parents) analysis for individual locations as well as pooled over locations and Heterosis & per Se analysis.
12.	LIB 200	DSP 51	„	Gen. Program. for Regression analysis of multi-collinear data by the method of principal components.
13.	LIB 201	VKM 201	V.K. Mahajan	Program. for pooled analysis of NC-I design under different locations.
14.	LIB 202	VKMA 01	„	Gen. Program. to construct a polynomial when roots are given.
15.	LIB 203	VKMA 02	„	Program. to calculate Double Integral value by Simpson's rule.
16.	LIB 204	VKMA 03	„	Program. to calculate the roots of a polynomial by Newton's method when coefficients of polynomial are complex.
17.	LIB 205	VKMA 04	„	Program. to calculate first and second derivatives by Romberg-Central difference rule.
18.	LIB 206	VKMA 05	„	Program. to obtain the real roots and points of discontinuity of any real function $F(x)$ in given interval (A,B).
19.	LIB 207	VKMA 06	„	Program. to compute the Integral value of a function $F(x)$ in the given interval (A,B)., by Romberg Trapezoidal rule.

1	2	3	4	5
20.	LIB 208	VKM 202	„	Program. to obtain all possible SRSWR of size NS from a population of size N.
21.	LIB 209	DKANOR	D.K. Agarwal	A sub-routine to generate normal variates.
22.	LIB 210	DKAUNI	„	A sub-routine to generate uniform variates.
23.	LIB 211	DKAPAS	„	A sub-routine to generate Pascal variates.
24.	LIB 212	DKAGAM	„	A sub-routine to generate Gamma variates.
25.	LIB 213	DKAPOS	„	A sub-routine to generate Poisson variates.
26.	LIB 214	DKAEXP	„	A sub-routine to generate Exponential variates.
27.	LIB 215	DKAHYP	„	A sub-routine to generate Hypergeometric variates.
28.	LIB 216	DKABIN	„	A sub-routine to generate Binomial variates.

APPENDIX V

List of Papers (with abstracts) Published during the year, 1980

1. AGARWAL, RANJANA, JAIN, R.C., JHA, M.P. and SINGH, D.—Forecasting of rice yield using climatic variables—*Ind. Jour. Agri. Sci. Vol. 50, No. 9, Sept., 1980.*

An attempt has been made to develop a suitable statistical methodology for forecasting rice yield of Raipur district using 25 year data on yield and weekly weather variables namely, maximum temperature, relative humidity, total rainfall and number of rainy days. Out of several yield prediction models tried, two models were found suitable. In the first one, weighted averages of weekly weather variables using powers of week number as weights were used while respective correlation coefficients with yield in place of week number were taken in the second model stepwise regression technique was followed for obtaining the prediction equations.

Results of studies showed that 11th week after sowing (3rd week of August) is suitable period for forecasting as about 70 per cent variation in rice yield could be explained by weather variables including time trend. This indicates that a reliable forecast of rice yield is possible two and a half months after sowing for a crop of about 5 months duration.

Two weighted weather indices using correlation and standardised partial regression coefficients as weights were constructed which can be used in prediction equation in place of weather variables. Principal components were obtained which can also be used as composite variables of weather.

2. AGARWAL, S.B., GOEL, B.B.P.S. and PILLAI, S.S.—Comparison of estimators of number of cashew trees—*Jour. Ind. Soc. Agri. Stat. Vol. XXXII, No. 2, Aug., 1980., pp. 70-78*

Utilising the data collected from a pilot sample survey conducted by Indian Agricultural Statistics Research Institute in important cashewnut growing areas of Andhra Pradesh in 1966-68, the following estimates of number of cashew trees in the area were obtained (i) simple estimate, (ii) separate and combined ratio estimate based on either geographical or garden area as auxiliary variate and (iii) two-variate ratio estimate using geographical and garden areas as two auxiliary variates.

It was found that the simple estimate was the most efficient. The two variate ratio estimate was also more or less equally efficient. However, since the ratios \bar{X}_h/\bar{U}_h and \bar{Z}_h/\bar{V}_h varied considerably from stratum to stratum. The

combined ratio estimate, based on either auxiliary variate was much less efficient. Separate ratio estimate was also much less efficient than simple estimate, possibly on account of a low correlation between number of trees and the auxiliary characters. The gain in efficiency due to pps. sampling overall the strata was 202 per cent. It was found that pps sampling in strata 1,3 and 5 was more efficient than srs and converse was true in strata 2 and 4.

3. AGGARWAL, S.K. AND SRIVASTAVA, A.K.—On probability limits in Snowball sampling—*Biometrical Jour.*, Vol. 22., No. 1, 1980., pp. 87-88.

The limits on probability under which usual sampling model is to be prepared over binomial sampling model have been worked out.

4. AGGARWAL, S.K. AND KUMAR, PRANESH—Combination of Ratio and pps estimators—*Jour. Ind. Soc. Agri. Stat.* Vol. XXXII., No 1, April, 1980, pp. 81-88.

An estimator, combining ratio and pps estimators has been proposed, which is found to be always more efficient than usual pps estimator or ratio estimator under pps sampling. Further, it is shown that the proposed estimator will be superior to the ratio estimator under pps sampling and to the usual pps estimator, if the difference between weights taken and optimum weights is less than.

$$\left| 1 - \frac{P_{uv}C_u}{C_v} \right| \text{ and } \left| \frac{P_{uv} C_u}{C_v} \right| \text{ respectively.}$$

5. AGGARWAL, S.K. AND GOEL, B.B.P.S.—Use of certain type of multi-auxiliary information for increasing the efficiency of cluster sampling with ratio and regression estimators—*Jour. Ind. Soc. Agri. Stat.*, Vol. XXXII, No. 2, Aug. 80. pp, 13-28.

In this paper the use of multi-auxiliary information has been suggested for building up ratio and regression estimators for increasing the efficiency of cluster sampling.

6. BAJPAI, S.N. AND NIGAM, A.K.—Statistical Evaluation of Agricultural Field Experiments—*Jour. Ind. Soc. Agri. Stat.* Vol. XXXII, No. 2, August, 1980.

In this paper a procedure for statistical evaluation of Agricultural Field Experiments is proposed. The procedure consists of evaluating a composite index as a measure of performance of the experiments.

7. GOEL, B.B.P.S, AND GARG, SAVITA—Use of auxiliary information in cluster formation-unequal cluster,—*Jour. Ind. Soc. Agri. Stat.*, Vol. XXXII., No. 1., 1980, pp. 73-80.

In this paper, a method of forming clusters before sampling (CBS) has been suggested which takes into account the twin requirements of nearness of the units within a cluster as also the homogeneity of cluster totals, by using some auxiliary information. The method will, in general result in unequal number of units in different clusters. But for the clusters so formed the unbiased estimate of the population means is very efficient which is not so when we consider natural clusters without using auxiliary information. The method has been illustrated with the help of an actual example.

8. GUPTA, A.S.—Some contribution to the theory of multi-auxiliary variate double sample.

Use of auxiliary information in probability sampling either at the designing stage or at the estimation stage is a commonly used device for improving the precision of the estimate of the population mean or total obtained from a sample. Double sampling regression method of estimation is one such device used at the estimation stage. When auxiliary information is available on more than one character, the theory of multi-auxiliary variate double sampling has been developed by various authors. However, the efficiency of such procedures is heavily dependent on the correlation co-efficient between the character under study and the auxiliary characters on the one hand and the cost structure of the survey on the other. It has been seen that often the use of multi-auxiliary variate double sampling procedure is suggested ignoring these two aspects. In this paper, conditions have been studied under which multi-auxiliary variate double sampling procedures would be more efficient by assuming two types of cost structures. Optimum values of size of preliminary large sample 'n' and size of sub-sample, n have been obtained in terms of cost components considered and correlation coefficients.

9. GUPTA, S.C. AND RAI, S.C.—Rank analysis in paired comparison design—*Jour. Ind. Soc. Agri. Stat.*, Vol. XXXII., No. 1., April 80.

A method of analysis of experiments has been developed involving paired comparison which can easily be extended to the case in which only a fraction of the pairs are retained. This model for paired comparisons permits test of hypothesis of a general class and the estimation of treatment ratings or preferences. It is simple and easy to interpret and apply. The method of maximum likelihood is employed and the tests depend upon the likelihood ratio statistic.

Two special tests are considered to test the null hypothesis that true treatment ratings are equal. The alternative hypothesis (i) makes no assumptions of equality of treatment ratings, and (ii) makes the assumption there are only two groups of treatments where-in within group treatments do not differ in ratings but the groups themselves may have different ratings. The method of pooling and of combining the results of several judges is given which permits an overall test of significance. The utility and application of the model are explained by a numerical example.

10. JAIN, J.P. AND MALHOTRA, J.C.—Note on the computation of variances of two different contemporary daughter average sire indices—*Jour. Ind. Anim. Sci. Vol. 50 (10), 1980, pp. 911-914.*

Numerous enquiries were received for the computation of variances of two sire indices viz. indices I_6 and I_8 , proposed earlier by the authors (*Indian J. Animal Science, 41 ; 1101-1114*). The procedures for the computation of variances of these two indices have been delineated and are illustrated with the help of data on Red Sindhi bulls used during 1946-50 at the Livestock Research Station, Hosur.

11. JAIN, R.C., AGARWAL, RANJANA and JHA, M.P.—Effect of climatic variables on rice yield and its forecast—*'Mausam' Vol. 31, No. 4. Oct., 1980.*

An attempt has been made in this paper to understand the effects of climatic variables on rice yield at different stages of crop growth. Attempt has also been made to forecast rice yield using climatic variables.

The results show that the crop reacts differently to climatic parameters during different stages of development. Above average maximum daily temperature is beneficial during active vegetative and ripening stages and detrimental during lag vegetative stage of the crop. The rise in relative humidity (7 hrs) above average is beneficial during tillering and early part of productive stage. Adverse effects are observed during ripening stage. Above average relative humidity (14) hrs. is beneficial during early part of lag vegetative stage and later part of reproductive stage. The effects of increase in total weekly rainfall are in general beneficial throughout the crop season. Above average daily sunshine hour is beneficial during active vegetative and ripening stages. Adverse effects are obtained in lag vegetative and reproductive stages of the crop.

The study on yield forecast shows that a reliable forecast is possible at about 2 months after sowing, assuming weather to be normal after that. Revised forecasts may be issued periodically in case weather departs from normal.

KHOSLA, R.K.—Methodology of assessing losses due to pests and diseases of rice in India. *Assessment of crop losses due to pests & diseases. UAS, Tech. Series. No. 33. 1980, p.p. 240-48.*

The methodology indicating survey design, measurement technique and statistical analysis, adopted by the Indian Agricultural Statistics Research Institute (ICAR) for estimation of incidence of pests and diseases and its relationship with the yield of rice crop in India has been given in brief. The salient results obtained on the basis of the pilot surveys carried out in the districts of Cuttack (1959-62), Thanjavur (1962-66), and West Godavari (1963-67), have also been presented.

13. KHOSLA, R.K.—Regression analysis and their application in crop loss appraisal programmes. *Assessment of crop losses due to pests & diseases. UAS, Tech, Series. No. 33, 1980, pp. 133-40.*

Regression may be linear or curvi-linear and further in linear as well as curvi-linear there could be a simple or multiple regression equations. Simple and multiple linear regressions which are commonly used for assessing the crop loss due to pests and diseases have been explained in brief. Their application in crop loss appraisal programmes have been discussed and an illustration by using the data collected on the basis of the pilot sample survey carried out in West Godavari district of Andhra Pradesh during rainy season in 1964-65 on rice crop has also been given.

14. KHOSLA, R.K.—Field experiments and survey techniques for the estimation of crop loss. *Assessment of crop losses due to Pests & Diseases. UAS Tech. Series No. 33, 1980. pp. 67-72.*

In this paper the techniques such as mechanical, chemical comparison of the yield in different fields having different degrees of incidences of pests/diseases, comparison of the average yield of individual plant free from pests/diseases, incidence with those of the infested plants, average amount of damage caused by individual insect and biological, adopted by various research workers for the purpose of estimating the incidence of pests and diseases and assessment of crop losses due to them have been presented in brief. The problem for assessing the crop loss when several pests and diseases attack on the crop simultaneously has been discussed and suitable technique has been suggested for adoption for future work in this line.

15. KHOSLA, R.K.—Sampling and survey design. *Assessment of crop losses due to pests & diseases, UAS. Tech. Series. No. 33, 1980 pp 119-26.*

Sampling versus complete enumeration has been defined. The need of sampling, its advantages and requirements of a good sample has been given in brief. Sampling techniques applied by some of the research workers in the incidence of pests and diseases of crops in India have been discussed. On the basis of the work done and keeping in view of the current problem, suitable sampling procedure for estimating the crop loss has also been recommended.

16. KUMAR, DHARMENDRA AND NARAIN, P.—Estimation of Genetic changes in Sahiwal herd—*Ind. Vety. Jour. 56, Oct., 1979, pp. 844-848.*

The breeding data relating to Sahiwal herd spread over 20 years were analysed to estimate actual genetic changes in characters of economic importance which might have taken place during the several years of selective breeding practised in the herd. Average genetic change in given character was estimated as twice the pooled intra-sire intra-generation regression co-efficient of the weighted difference between the herd and the individual sire means on the years.

The estimates of percentage genetic changes per year in respect of lactation yield, yield per day of lactation, yield per day of calving interval, lactation period, calving interval and age at first calving were found to be -3.3, -0.42, -8.2, 4.7, -1.2 and -6.2 respectively. However, none of these changes was found to be significant. Hence it may be concluded that the Sahiwal herd at Chak-Ganjaria Farm, Lucknow did not deteriorate genetically in so far as these economic characters were concerned.

17. MAHAJAN, R.K. AND AGARWAL, D.K.—Indices and growth rates of irrigated acreage under principal crops in Punjab. *Agricultural Situation in India, December, 1979.*

In Punjab, the irrigated acreage under all principal crops has been growing since the beginning of first five year plan. The present study of growth rates crop-wise has shown that the food crops like rice, wheat and maize have been benefited in a much more conspicuous degree than other food and cash crops discussed in this paper.

18. MALHOTRA, P.K. AND NARAIN, PREM—A study on the distributions of breeding values for rate of lay. *Poultry Ind. Jour. Poultry Sci.* (1980), 15, pp. 37-42.

The distribution of the scores of birds based on three selection indices viz. (a) individual's performance and full sib family averages, (b) individual's performance and half-sib family averages and (c) individual's performance, full-sib family averages, and half-sib family averages, was studied. It was observed that for the scores based on methods 'a' and 'b', Personian Type I was the appropriate distribution whereas for the selection scores based on method 'c', a normal distribution was observed to be appropriate. It was also observed that the distribution of selection scores tended to be normal as the information from more than two sources was combined. The variability in the scores also increased when the information from both half-sib as well as full sib families was combined with individual's performance. This shows that prediction of response to selection based on method 'c' would be more accurate because scores obtained by this method are normally distributed.

19. MALHOTRA, P.K. AND SINGH, R.P.—Estimation of life time production in Red Sindhi Cattle using ridge-trace criterion—*Ind. Jour. Anim. Sci.* 50 (3), pp. 215-218, March, 1980.

The breeding data relating to Red Sindhi herd at the Southern Regional Station of the National Dairy Research Institute, Bangalore, spread over about 20 years and available at the Indian Agricultural Statistics Research Institute, were analysed for predicting the life-time production on the basis of characters available in the early life of an animal. Prediction based on ridge-regression method using non-orthogonal prediction vectors could improve the accuracy of prediction by about 20% over the ordinary least-square techniques for estimating the regression coefficients using only orthogonal prediction vectors.

20. MARUTIRAM, B., NADKARNI, U.G., SOMAYAZULU, L.B.S. AND JAIN, T.B.—Productivity of Commercial Poultry farms in relation to capital. *Ind. Jour. of Animal Sci.* Vol. 49, December 1979, pp. 1074 to 1082.

The data collected from about 120 commercial poultry farms in Tanda-Dasuya area of Punjab for estimating the cost of poultry rearing and egg production were utilized to study the relationship between egg production, working capital and fixed capital. Different functional forms were fitted to the data. The square-root function accounted for about 70% of variation. Using the square-root function, isoquants were plotted and levels of capitals for constant production obtained. Optimum combinations of working and fixed capitals

were determined for varying levels of egg production and for different rates of change of the two capitals. For an average production of 5000 eggs and with a rate of substitution 0.32 for working capital with fixed capital, total investment required was Rs. 8383 with Rs. 4225 as working capital and Rs. 4158 as fixed capital.

21. MURTHY, T.A.V., SAXENA, R.P. AND AGARWAL, D.K.—Data base for small Industries—A net work approach—*Journal SEDME Vol. VI, No 4, December 1979.*

This paper deals with the structure of the data files with reference to a data base of the items reserved for manufacture in the small scale sector. The proposed model data base system is designed to cater to the increasing information needs of the entrepreneurs and extension agencies.

22. NARAIN, P.—Certain generalisations in response to genetic selection—*Prof. S.C. Das Memorial Volume, Utkal Univ., Bhubaneswar, 1980. pp. 71-79.*

The concepts of heritability and expected response due to selection for a single character have been generalised for a multi-character case when selection is by the method of independent culling levels. A new concept of 'generalised heritability' has been introduced. Theoretical derivations have been presented for the components of dispersion, correlation between the two vectors and for the vector of the expected response to selection by independent culling levels.

23. NARAIN, P.—The state of agricultural statistics. *Commerce (Annual number 1979 and Agriculture in 1980) Vol. 139, 3577. pp. 131-136.*

The article reviews the status of agricultural statistics with particular reference to India and indicate the developments in the field of official agricultural statistics as well as in the field of agricultural statistics research. In the former case, after describing the early history and development, it is noted that during the last five plans the coverage of the reporting statistics has been considerably enlarged and area enumeration is now better and more rationally supervised. During this period, crop estimation surveys have been extended to almost all major crops for providing objective and reliable estimates of yield. The current status of official agricultural statistics is then discussed in terms (i) land use statistics, acreage and yield statistics, (ii) other agricultural statistics relating to irrigation, fisheries, forestry and prices of agricultural commodities as well as wages of agricultural labour, (iii) agricultural census and (iv) the statistics on livestock number and products.

The development of agricultural statistics research in the country is described in terms of the development of the Indian Agricultural Statistics Research Institute right from its inception in 1930 as Statistical Section of the Indian Council of Agricultural Research which was established in 1929 on the recommendations of the Royal Commission on Agriculture. The current activities of the Institute in the fields of (a) crop sciences (b) crop forecasting methodology (c) animal sciences (d) statistical genetics and (e) sample survey methodology are described.

24. NARAIN, P., JAIN, J.P., GARG, L.K., JAIN, R.K. AND RANA, P.S.—Herd strengths at periodic intervals and annual genetic gain in alternative progeny testing programmes—*Indian Military Farms Jour.* 11, 1979 pp. 9 to 16.

It is well known that the optimum plan of using sires varies with the change in the distribution of the initial female stock. Accordingly, a systematic study of the female and male herd strengths at periodic intervals using three schemes of sire selection and the corresponding annual genetic gain for different initial distributions of the breeding unit starting with 900 females has been attempted in this paper. The important findings of this investigation are (i) a combination of tested and untested sires which is optimum for one initial distribution of female foundation stock is also optimum for others; (ii) of the three alternative schemes of using the males the scheme in which two tested and 10 untested bulls are used, was found to give maximum genetic progress per year.

25. PRABHAKARAN, V.T. AND RAUT, K.C.—Labour utilization in bovine keeping under mixed farming system in a rural area—*Ind. Jour. Anim. Sci.*, Vol. 50, No. 12, December, 1980.

The utilization of labour in bovine keeping has been studied using survey data pertaining to Bikaner area of Rajasthan. A method for determining the optimum size of bovines in a household, based on the net labour available in the household for animal husbandry operations is suggested. Labour utilization has been observed to be at the rate of 2.7 and 3.0 standard man-hours per standard animal (cow in milk), per day during Summer (March to June) and agricultural season (July to February) respectively. Under the conditions prevailing in the rural area, for every unit standard strength of a household, one standard animal could be maintained. The system of mixed farming developed in the area had not been able to provide sufficient employment to the members of rural families, especially to women, about 40% of whose time went idle even during agricultural season.

26. PRASAD, RAJENDRA, MAHAPATRA, I.C. AND JAIN, H.C.—Relative efficiencies of fertilizers for rice—*Fertilizer News, New Delhi, Sept., 1980.*

The management of input such as fertilizer is not only related to soils, physical, chemical, biological and pedological properties in which rice crop grows but also the actual forms of N,P and K, the three major nutrients, the experimental results of which are presented in this paper. Major findings of different N,P and K carriers have been reviewed and more recent data from the All India Co-ordinated Agronomic Research Project (ICAR), and those conducted at IARI, New Delhi have been presented and discussed.

In general, under waterlogged conditions, ammonia containing fertilizers are similar in effectiveness but superior to nitrate sources. The results of experiments conducted, under AICARP to indicate the superiority of 'lac' coated 'neem' cake and 'Mahua' cake coated urea to fertilizer urea. The response of rice to applied phosphorus is lower than that of upland crops. Rice crop is able to utilize phosphate even from those fertilizers which contain little or no water soluble phosphate particularly in acid soils. Because of increase in the solubility of phosphorus in flooded soil, the form of fertilizer is not important, except on strongly acid soils where super-phosphate is not as good as other and on alkaline soils the rock phosphate is inferior to other forms.

In so far as sources of potassium are concerned, there was no significant difference between potassium chloride and potassium sulphate.

27. RAHEJA, S.K. AND MEHROTRA, P.C.—A study of foodgrains storage facilities—practices and problems in Delhi State. *Agricultural Situation in India Jan., 1980.*

Of the total production of kharif and rabi foodgrains, nearly 26 and 60 percent respectively, were stored by farmers for various purposes like self consumption, seed and later disposal. The proportion of grain production kept for storage showed a declining trend with increase in the holding size, although the absolute quantity stored was positively associated with the size of holding. Storage structure like Pucca room or Kotha were available mainly with large holdings of eight hectares & above. Use of metallic containers was reported by only about 25 per-cent of the holdings. Most of the cultivators in the small and medium holding size categories stored their grain by the conventional method like gunny bags etc.

As many as 80 percent of the cultivators canvassed, were not satisfied with their existing storage facilities and were keen to change over to improve methods of storage. The main problems with existing storage were susceptibility to rodent attack, insect infestation on account of moisture and short life or temporary nature of the storage as in the case of bags or Thekka. A sizable number of cultivators were in favour of having metallic containers and Pucca storage shed. However, the main difficulty against the change was lack of funds, non-availability of desired type of container and in some cases, unawareness about improved facilities of storage. Protective measures during storage were adopted by a majority of medium and large holding while in the small holdings the frequency of such cultivators was relatively small. The main reasons for not adopting protective measures were high cost of chemicals as also lack of knowledge in the use of such measures. There is, thus, a need to augment the production machinery to ensure that appropriate and improved storage facilities like metallic bins, pusa bins, etc., are available to meet the storage needs of farmers in different holding size classes. Also the extension effort would have to be strengthened to educate the farmers in proper storage as well as in adopting suitable protective measures to minimise grain losses in storage.

28. RAHEJA, S. K. MEHROTRA, P. C., BANERJEE, A.K., RUSTOGI, V. S. AND GUPTA, S.S.—Factors contributing to regional variation in productivity and adoption of HYV of major cereals in India—*Jour. Ind. Soc. Agri. Stat., Vol. XXXII, Dec., 1980.*

The regional variations in adoption of high yielding varieties and their productivity were studied with the help of data collected under the scheme 'Sample surveys for assessment of high yielding varieties programme' during 1973-74 covering 88 districts spreads over 15 States of the country. Four aspects were considered (a) yield, area and main varieties in different agro-climatic zones, (b) area benefitted by fertilizers and average rates of their application, (c) use of irrigation and plant production chemical and (d) credit availability and its utilization. The study was undertaken for the two major cereals viz , rice and wheat.

29. RAI, S. C. - A note on the ties in standard pairs in fractional paired comparisons—*Jour., Ind. Soc. Agri. Stat., Vol. XXXII pp. 122-128.*

In this paper a model for analysis of paired comparisons when only fractional pairs are considered have been developed. The model accommodates presence of ties in ranking. The procedures for estimating the treatment

parametres and 'threshold' have been given. A test for testing the goodness of fit of the model has been developed. The procedures have been demonstrated by a numerical example.

30. RAI, S. C. AND RAO, P.P.-Use of Ranks in groups of experiments. *Jour. Ind. Soc. Agri. Stat., Vol. XXXII., pp. 25-32.*

In the analysis of variance method in pooling the results of groups of experiments, certain assumptions are made about the nature of the underlying universe which may not hold good. As an alternative to this, the use of ranks is suggested which does not make any assumptions about the distribution. The main step in the application of this method is to rank the individual observations and calculate the test statistic K the sampling distribution of which approaches the χ^2 chi-square distribution as the number of sets of ranks increases. The efficiency of this method as compared to the analysis of variance method is estimated to be about 64 percent when the no. of treatments and the loss of information decreases as the number of treatments increases.

31. RAI, S. C. AND SARUP, SHANTI-Economic Analysis-Rice and Wheat yield trends—*Eastern Economist, Vol. 75, pages 1132-1134.*

This paper evaluates the impact of the plan efforts on the productivity of rice and wheat crops in India during the last two plan periods and compares the growth rates of these crops achieved in the different states of the country. The results indicate that while developmental activities for increasing the productivity of rice have not made any impact in about three-fourth of the area in the country, the progress achieved in respect of wheat crops was quite satisfactory.

32. RAO, D.V.S. AND KATHURIA, O.P.—An appraisal of survey for estimating the production of lac—*Survey Statisticians, No. 4, Dec., 1980.*

In order to develop a suitable sampling technique for the estimation of lac production, the Indian Agricultural Statistics Research Institute, New Delhi, conducted a pilot sample survey during the year, 1975-77 in Bihar. The results from the survey revealed that the estimates of number of lac host and average yield per lac host could be estimated with reasonable precision.

In the present survey, information on number of lac hosts in the village and geographical area of the villages is utilized for making homogeneous strata and in the estimation of number of hosts and number of cultivated hosts respectively. It was observed in some cases that villages were misclassified as the

information provided by 'patwari' on number of hosts was doubtful. Further, the correlation between geographical area and the number of hosts reported by patwari was poor. Thus there is a need for further research in this direction.

It was also observed that while the estimates on number of hosts and average yield per lac host could be obtained with reasonable precision the estimate of number of cultivated hosts had high standard error. Further, there is a large variation in the extent of cultivation which may be attributed to the fact that the hosts which were harvested will not be available immediately for cultivation in the following season, but available only for cultivation in the alternate season. This pattern of cultivation has to be profitably exploited by use of successive sampling technique.

33. RAO, M.G. AND JAIN, J.P.—Effect of non-normality on response to selection in large populations—*Jour. Ind. Soc. Agri. Stat., Vol. XXXII, 1980, pp. 82-94.*

The expressions for intensity of selection appropriate for large population have been derived for Pearson's Type I, beta, Pearson's Type III, gamma, exponential and log-normal distributions and compared with the corresponding expression for Normal distribution to investigate the effect of using normal approximation in predicting response to selection when the criterion of selection follows one of these non-normal distributions. Excepting the exponential and log-normal, other distributions can be approximated to normal distribution for moderately heavy and low culling without any serious discrepancy in response to selection.

34. RAUT, K.C., SINGH, SHIVAR AND RUSTOGI, R.L.—Comparative economics of rearing cross-bred and non-descript calves under village conditions—*Jour. Ind. Agril. Eco., Vol. XXXV, No. 4 (conference Number), Oct.-Dec., 1980.*

A study has been made to compare the cost of rearing cross-bred calves with those of non-descript ones under village conditions utilising data collected in a sample survey in Krishnanagar area of West Bengal. The net rearing cost including family labour upto three years of age was estimated to be Rs. 1764 and Rs. 1327 for a female and male crossbred calf respectively. The corresponding costs for non-descript calves were Rs. 1163 and Rs. 1065 respectively. The rearing cost at different age groups was also worked out. The average age at first calving of a cross-bred female calf was 39 months and that of a non-descript one 51 months. The estimates of cost from birth upto age at first calving were Rs. 1974 and Rs. 2058 for a cross-bred and non-descript animal. The estimates

of cost upto maturity and during gestation period have been worked out. The components of rearing cost and their contribution to gross cost have been shown. Feed cost accounted for 63 to 65% and labour 27 to 30% of the gross cost. About 1.6 man-hours are utilised per animal per day excluding the time spent for taking animals for grazing. Additional cost due to calf mortality and amount of milk sucked by calves have been indicated.

35. SARUP, SHANTI AND GUPTA, S.C.—Modern technology and rice growers of Puri district—*Yojna*, No. 1., XXIV/11, 16th June, 1980.

The study examines the extent and intensity of adoption of selected improved techniques and the reasons for their non-partial adoption among rice growers in the four villages of Puri district. The analysis reveals that the adoption of complete package of practices is not satisfactory in these villages indicating that efforts are needed not only in persuading farmers to adopt packages of mere practices but also in their application in larger areas. Adoption pattern among different holding size groups indicated that the adoption index is highly associated with the holding size group. The intensity of adoption is however observed to be higher in packages of less practices comparatively in all the holding size groups. The reasons for non-partial adoption of these improved practices as explained by the farmers are uncertainty about the performance of the crop due to unfavourable weather and soil water condition, pest and diseases susceptibility, poor economic resources and high cost of inputs.

36. SARUP, SHANTI AND GUPTA, S.C.—Regional Variation in Productivity of Rice and Wheat in India—*Yojna*, Vol. XXIV, No. 20, 1-15 Nov., 1980.

This paper examines the variation in yield per hectare of two important cereal crops namely rice and wheat in India during the period 1967-68 to 1976-77. The main feature is a comparative study of regional disparities. The study revealed that largest increase in the rice productivity were obtained in the northern States of Punjab and Haryana and to a smaller extent in generally high yielding southern States, while in the eastern States there was practically no progress. In respect of wheat crop it was observed that the rate of increase in low productivity region was much higher compared to those States where the productivity was already high. In West Bengal, however, the rate of increase in productivity was around 76 percent during this decade.

37. SATHE, K.V. AND MATHUR, S.N. Computers applications for development. *Proceedings of the Annual Convention of Pune chapter of Computer Society of India.*

The continuous and rapid technological advances in electronic data processing are being exploited in almost all research and development activities. The agricultural research which has achieved its present status owes much of its growth to the use of electronic computers and a stage is coming at which any research work has to be backed up by a computer system. In Indian Agriculture the problem oriented research and realistic development programme have been made possible due to the availability of a computer system exclusively devoted to Agricultural Research. This computer system installed at the Indian Agricultural Statistics Research Institute, New Delhi-12 has been in use for nearly fifteen years. The facilities available at this computer centre for the electronic data processing of data of Agricultural Research workers are discussed in this paper.

38. SAXENA, ASHA, BHARGAVA, P.N. AND NARAIN, P.—Rainfall pattern and crop planning. *Ind. Jour. Agri. Res., Dec., 1979, Vol. 13, No. 4, pp. 208 to 214.*

It has been observed that the information about the important weather factors in short intervals like a week or a ten days period is very helpful in crop-planning. Therefore, an attempt has been made to study the distribution of dry and wet spells and pattern of occurrence rainfall in short intervals like 5, 10 or 15 days period. It is found that the truncated geometric distribution suitably defines the distribution of dry and wet spells in short intervals. Expected lengths of spells for various levels of conditional probabilities have been obtained through empirical relations. Use of these expected lengths in crop planning has been illustrated through an example for Jowar crop in Jalgaon district.

39. SAXENA, B.C. AND ANEJA, K.G.—A comparative study of the impact of dairies under alternative managements of rural economy. *Ind. Jour. Dairy Sci. Vol. 33, No. 2, 1980. pp. 210-218.*

The paper gives the study of the impact on the rural economy of two dairies namely Delhi Milk Scheme (DMS) and Mehsana Dudhsagar Dairy (DSD) which operate under alternative management systems differing mainly in regard to their manner of milk procurement. Various response indicators studied for the purpose were milk production, employment and income. The

main finding is that the DSD in which the milk producers have a direct interest as its co-operative members, was instrumental to a greater extent in improving the socio-economic conditions of rural milk producers in comparison to the public sector dairy DMS whose unfavourable impact can be attributed to its consumers orientation bias without any regard to the interests of rural milkproducers. These findings suggest the desirability of giving an orientations in the functioning of urban dairies in such a manner that these cater to the interest of both consumers and producers to an almost equal extent and further help knit the rural milk producers in the form of co-operatives.

40. SAXENA, B.C., SINGH, H.P. AND KUMAR, ASHOK—Effect of management factors on milk production—*Jour. Ind. Agri. Stat.*, Vol, XXXII, No. 3, 1980.

A large number of studies have been carried out to study the effect of various management factors on milk production but these are mainly based on the data collected under farm conditions. In the present study an attempt has been made to study such aspect under rural conditions. Although the later study will not give the true effect of various management factors on milk production, but at the same time it will reveal to a greater extent the effect of management factors on milk production under rural conditions. The present study, however, utilised the data collected under a large scale sample survey "Impact of milk supply scheme on rural economy" carried out by I.A.S.R.I. in rural areas of Chingleput district in the state of Tamil Nadu during 1976. The data on management and related characteristics such as housing of animals, feeding practices of animals, milking practices, veterinary facilities, improved animal husbandry practices etc. collected for 720 commercial milk producer households was utilized. For studying the effect of management factors, the usual scoring technique was deployed for the purpose.

41. SINGH, BHAGAT—Accelerated agricultural development through extension. *Yojna, Ist. March, 1980, pp. 35.*

Agricultural extension under "Benorplan" and television under Satellite Instructional Television Experiment (SITE) have been the recent additions to communication system with a view to give a fillip to agricultural development. Both the systems served Chambal command area of Kota district and adjoining areas of Bundi district of Rajasthan either in combination with or in dependent of each other. The SITE is now closed and the interest lies in the study of its effectivity in conjunction with agricultural extension under the three systems, viz. (i) Agricultural Extension (ii) Television Non-command area and (iii) Agricultural Extension plus Television.

The study is based on data collected by the planning commission during June, 1976 (when SITE was in operation) from a sample of 144 farmers spread over 12 selected villages-4 villages served by each system.

Yield rates of wheat for different areas during the year, increase in yield rate over preceding year and Economics of the programme have been studied.

It emerges from the study that the benefits augment with the use of more developed systems of communications whether it be through agricultural extension or through television. It sharpened when agricultural extension and television were intertwined.

42. SINGH, D., BHARGAVA, P.N. AND GHAI, R.K.—Programme of conservation of water and its employment potential—*Manpower Journal*, Vol. XV, No. 3, Oct.-Dec., 1979 pp. 67-75.

Keeping in view the potentiality of irrigation and the available water resources, a programme of conservation of water has been suggested which consists of storing the run-off in reservoirs or large basins which otherwise goes as waste through streams, rivers and rivulets into sea. This stored run-off can increase irrigation potential in different areas and augment the opportunities for job seekers at different rates depending upon cropping pattern adopted and the degree of intensity of cropping. It has been observed that by increasing crop intensity the additional labour use can be augmented by 100 percent.

The details of employment implications suggest that substantial employment generation effects are achieved, where there is shift from unirrigated to irrigated farming. Further there is evidence that crops like paddy and wheat, which are highly labour intensive than inferior cereals and pulses, would lead to higher employment generation possibilities.

Thus, in the process of conservation of water through the scheme suggested in the present paper substantial number of unemployed persons will be provided with more gainful employment in the preparation of land for development of catchment and command area. Another set of persons who will be associated with the crop husbandry through crop intensity and shift in cropping pattern will also continue to find employment in subsequent crop operations like application of fertilizers, weeding, cultural operations, irrigation and harvesting.

43. SINGH, D. AND KHOSLA, R.K.—Statistical methodology for the estimation of losses of wheat at different post-harvest stages. *Proceedings of the Seminar on "Wheat and Your Needs" at New Delhi during 7-8 April, 1980, pp. 116-22.*

In this article the statistical methodology for estimating the losses of wheat of different post-harvest stages, viz., harvesting, handling, packing, transportation, storage and preservation of produce etc. has been discussed with special reference to developing countries.

44. SINGH, PADAM, JHA, M.P. AND BATHLA, H.V.L.—A note on modified ratio estimator. *Jour. Ind. Soc. Agri. Stat., Vol. XXXII, April, 80.*

The ratio method of estimation on sampling is recommended only when the regression of the study variable (Y) on the auxiliary variable (X) is linear and passes through the origin. In practice, the regression of Y on X may not be linear and even if it is linear, it need not to pass through the origin.

In the present note, a procedure has been suggested with which the usual ratio method of estimation can be modified when regression of Y on X in the population is of the general form.

$$Y=f(x)$$

where, $f(x)$ is some function of x . It has been observed that the modified ratio estimator is even better than the regression estimator which in turn is known to be always better than the ratio estimator. However, if the relationship is only linear, the modified estimator has no gain over the regression estimator.

45. SINGH, PADAM AND SRIVASTAVA, A. K.—Sampling Schemes, providing unbiased regression estimators—*Biometrika (1980), Vol. 67, No. 1.*

A sampling scheme is proposed for which the usual regression estimator is unbiased. Another sampling scheme with an unbiased regression type estimator is also considered. On comparing the efficiencies of these sampling strategies with some existing strategies, the performance of the first of the new schemes is found to be highly satisfactory.

46. SINGH, SHIVTAR, RAUT, K.C. AND KAUL, SUSHILA—Factors influencing efficiency in milk production—*Indian Dairyman, Vol. 32, No. 8, August, 1980, pp. 577-580.*

In this paper, costs and returns of commercial milk producers under different management practices (based on criterion of efficiency of factors viz.,

feed, labour, size of stock and level of production), have been compared. It was seen that of the 160 producers studied, 32 percent were considered efficient in one factor; 31 percent in two factors; 24 percent in three factors; and 6 per cent in four factors. Seven percent of the Producers were inefficient in all the four factors realised a profit of Rs. 250 per month and family labour income of Rs. 59 per month. At the other end of the scale, producers, who were inefficient in all the four factors incurred a loss of Rs. 42 per month by way of milk production, when family labour was included in the cost.

It was further observed that among producers efficient in one factor only, the return was maximum for those who were efficient in level of production. Of two factor combinations, the net return was maximum for those, who were efficient in level of production and feed cost. Among the producers, who were efficient in three factors, the returns were maximum for the combination-level of production, feed and labour cost.

47. SINHA, K., MATHUR, S.N. AND NIGAM, A.K.—Kronecker Sum of Incomplete Block Designs—*Utilitas Mathematica*, November, 1979.

A operationally convenient Kronecker sum of matrices is defined as $A [S] B = A [X] J + J [X] B$. The Kronecker sum of incomplete block designs gives ternary designs. However, under different collapsing schemes, these ternary designs yield various binary designs. As particular cases, group divisible and rectangular designs are obtained from the Kronecker sum of BIB designs. The quality of Kronecker sum designs is also studied. It is found that the regular group-divisible designs R 189, R 200 and R 208 of class worthy are truly self-dual.

APPENDIX VI

List of Papers accepted for Publication during the year 1980.

1. AGARWAL, (MRS.) RANJANA, JAIN, R.C., JHA, M.P. AND SINGH, D.—Forecasting of rice yield using climatic variables—*Ind. Jour. Agri. Sci.*
2. AGGARWAL, S.K. AND KUMAR, PRANESH.—Combination of Ratio and P.P.S. estimators—*Jour. Ind. Soci. Agri. Stat.*
3. ANEJA, K.G. AND NIRMAN, K.P.S.—Effectiveness of Matching the sampling units under Repeat Surveys in milkshed area of Delhi Milk Scheme—*Ind. Jour. Dairy Science.*
4. BATHLA, H.V.L. AND KRISHNAN, K.S.—Analysis of data from groups of experiments. *Food Farming and Agriculture.*
5. CHOUDHARY, H.B. AND PANDEY, R.K.—A study on marketed surplus of wheat in union territory of Delhi.
6. GUPTA, S.C. AND RAI, S.C.—Rank analysis in Paired Comparisons—*Jour. Ind. Soc. Agri. Stat.*
7. IYER, V.N., SEHGAL, D.K. AND LAL, RAMJI—A study on trend in long term effect of continuous and phased manuring of Phosphatic Fertilizers in rice—*Fertilizer News, New Delhi.*
8. JAIN, R.C., AGARWAL, (MRS.) RANJANA AND JHA, M.P.—Effect of climatic variables on rice yield and its forecast. *Mausam, Vol. 31, No. 4, Oct., 1980.*
9. KAISTHA, A.C. AND GOEL, B.B.P.S.—Estimation of vegetable products using Partial Harvest Data. *Jour. Ind. Society Agri. Stat.*
10. KATHURIA, O.P., RAO, P.P. AND TYAGI, B.N.—A note on combining results of similar experiments of 2ⁿ type. *Pantnagar Jour. of Research.*
11. KUMAR, PRANESH AND GUPTA, V.K.—On ratio estimators in two phase sampling under size stratification and estimation over two successive occasions. *Mathematische Operation for-schung Und. Statistik*, Series Statistics, a German publication.
12. KUMAR, PRANESH AND GUPTA, V.K.—On ratio estimators in two phase sampling under size stratification. *Mathematische Operation for-schung Und. Statistik*, Series Statistics, a German publication.
13. MAINI, J.S. AND GOEL, B.B.P.S.—Estimation of production of hides and skins using random sampling technique. *Ind. Jour. Anim. Sci.*

14. MISHRA, R.K., SINGH, GURMEET, SINGH, V.K. AND DUTTA, O.P.—Genetic and environmental sources of variations. *Ind. Jour. Anim. Sci.*
15. NADKARNI, U.G. AND WAHI, S.D.—Discriminatory analysis for graded breeds of sheep. *Ind. Jour. Anim. Res.*
16. NADKARNI, U.G., JAIN, T.B. AND SOMAYAZULU, L.B.S.—Price spread of eggs in selected traits of Punjab and Delhi. *Ind. Jour. of Poultry Sci.*
17. NARAIN, P. AND LAL CHAND.—Lactation performance index in Sahiwal & Haryana Cattle. *Ind. Jour. Anim. Genetics & Breeding.*
18. NARAIN, P.—Cross-breeding in buffaloes—a breeding plan. *Ind. Jour. Anim. Genet. and Breeding.*
19. PRABHAKARAN, V.T. AND RAUT, K.C.—Labour utilization in livestock keeping in mixed farming system. *Ind. Jour. Anim. Sci., Nov., 80.*
20. RAHEJA, S.K. AND SUBBA RAO, D.V.—Sample surveys for estimation of lac production. *Agricultural Situation in India.*
21. RAO, M.G. AND JAIN, J.P.—Effect of non-normality on response to selection in small populations. *Biom. Jour.*
22. SAHNI, M.L. AND SARUP, SHANTI—Trends in yield rates of pulses. *Eastern Economist, New Delhi.*
23. SAXENA, B.C., SINGH, H.P. AND VERMA, S.P.—Amount of milk sucked by calves in rural areas of District Nadia (W.B.). *Ind. Jour. Dairy Sci.*
24. SINGH, BHAGAT—Tractor use and Technological change on Sugarcane farms. *Yojna.*
25. SINGH, H.P., NARAIN, P. AND KHANNA, N.D.—Association between blood group antigenic factors and quantitative traits in some Indian herds of cattle and buffaloes. *Ind. Jour. Anim. Sci.*
26. SINGH, PADAM, JHA, M.P. AND BATHLA, H.V.L.—A note on modified ratio estimator—*Jour. of Ind. Soc. of Agri. Stat.*
27. SONI, P.N. AND MUKHERJEE, A.K.—Effect of fertilizer application under resources constraints in crop sequence—*Ind. Jour. Agronomy.*
28. SONI, P.N. AND BHATNAGAR, K.C.—Intensive Farming System for small farmers.
29. SRIVASTAVA, A.K. AND SINGH, D.—A sampling procedure with inclusion probabilities proportional to size.

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| 25. | Analysis of non-orthogonal data from animal experimentation. | 39,40 | Dr. M.N. Das |
| 26. | Statistical problems in evolving new breeds of Dairy Cattle. | 41,42 | Dr. Prem Narain |
| 27. | Formulation of selection programmes for livestock improvement. | 43
44 | Sh. R. Gopalan
Sh. J.C. Malhotra |
| 28. | Stochastic models for studying the pattern of growth and structure of dairy populations. | 45 | Dr. J.P. Jain |
| 29. | Multivariate techniques as applied to analysis of livestock data. | 46
47 | Sh. U.G. Nadkarni
Dr. H.P. Singh |
| 30. | Role of Computer in livestock data analysis. | 48 | Dr. S.S. Pillai |
| 31. | Mechanical processing of livestock data. | 49 | Sh. A.C. Kaistha |
| 32. | Electronic data processing & Computer programming for analysis of livestock data. | 50
51 | Sh. S.N. Mathur
Sh. K.V. Sathe |
| 33. | Programme for development of data bases in the field of animal sciences. | 52 | Sh. R. Gopalan |

GROUP DISCUSSIONS

- | <i>S. No.</i> | <i>Topic</i> | <i>Discussion (D) Code</i> | <i>Scientists</i> |
|---------------|--|----------------------------|---|
| 1. | Large scale surveys for estimation of livestock number & products. | 1 | Dr. B.B.P.S. Goel
Sh. J.S. Maini |
| 2. | Statistical techniques for objective assessment of livestock improvement programmes. | 2 | Dr. H.P. Singh
Sh. B.C. Saxena
Sh. S.R.S. Arya |
| 3. | Statistical methodology for estimation of cost of production of livestock products and index of production cost (milk, wool, poultry and pig). | 3
4 | Dr. K.C. Raut
Dr. Shivtar Singh
Sh. R.L. Rustagi
Sh. U.G. Nadkarni
Dr. L.B.S.
Somayazulu.
Sh. T.B. Jain
Sh. H.C. Gupta |

4.	Methodological studies on economics of rearing livestock.	5	Dr. K.C. Raut Dr. Shivtar Singh Sh. R.L. Rustagi
5.	Estimation of herbage yield & intake by animals through grazing	6	Sh. B.C. Saxena Sh. Anand Prakash
6.	Statistical methods for livestock projection studies.	7	Sh. U.G. Nadkarni Sh. Jose Abraham
7.	Measurement of socio-economic changes in rural population through livestock development programmes.	8	Dr. H.P. Singh Sh. B.C. Saxena Sh. S.P. Verma Sh. S.R.S. Arya.
8.	Status of Animal Experimentation	9	Dr. A. Dey Sh. G.C. Chawla Sh. S.N. Bajpai

PRACTICALS

<i>S. No.</i>	<i>Topic</i>	<i>Practical (P) Code</i>	<i>Scientists</i>
1.	Large scale surveys for estimation of livestock products.	1	Dr. B.B.P.S. Goel
2.	Statistical techniques for objective assessment of livestock improvement programmes.	2	Sh. B.C. Saxena
3.	Statistical methodology for estimation of cost of production of livestock products and index of production cost (milk, wool and poultry).	3 4	Dr. Shivtar Singh Sh. T.B. Jain
4.	Statistical Methods for livestock production studies.	5	Sh. U.G. Nadkarni
5.	Analysis of non-orthogonal data from animal experimentation.	6	Sh. R.P. Singh.
6.	Analysis of Switch over designs.	7	Sh. G.C. Chawla,

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Impact of Milk Supply Scheme on Rural Economy in Milk-collection Areas of Madhavaram Milk Supply Scheme, Chingleput (Tamil Nadu)—A Bench Mark Survey, IASRI Bulletin (1978)—H.P. Singh, B.C. Saxena, Prem Narain and S.P. Verma.
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Souvenir Volume of I.A.S.R.I., New Delhi released on the occasion of ICAR Golden Jubilee (1929-1979)—P. Narain, R.K. Khosla, D.S. Aneja and R.S. Khatri.
Sampling Methodology for estimation of Milk Production in Southern Region, A.P., 1971-74 (1979)—D. Singh, B.B.P.S. Goel, J.N. Garg and K.B. Singh.
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