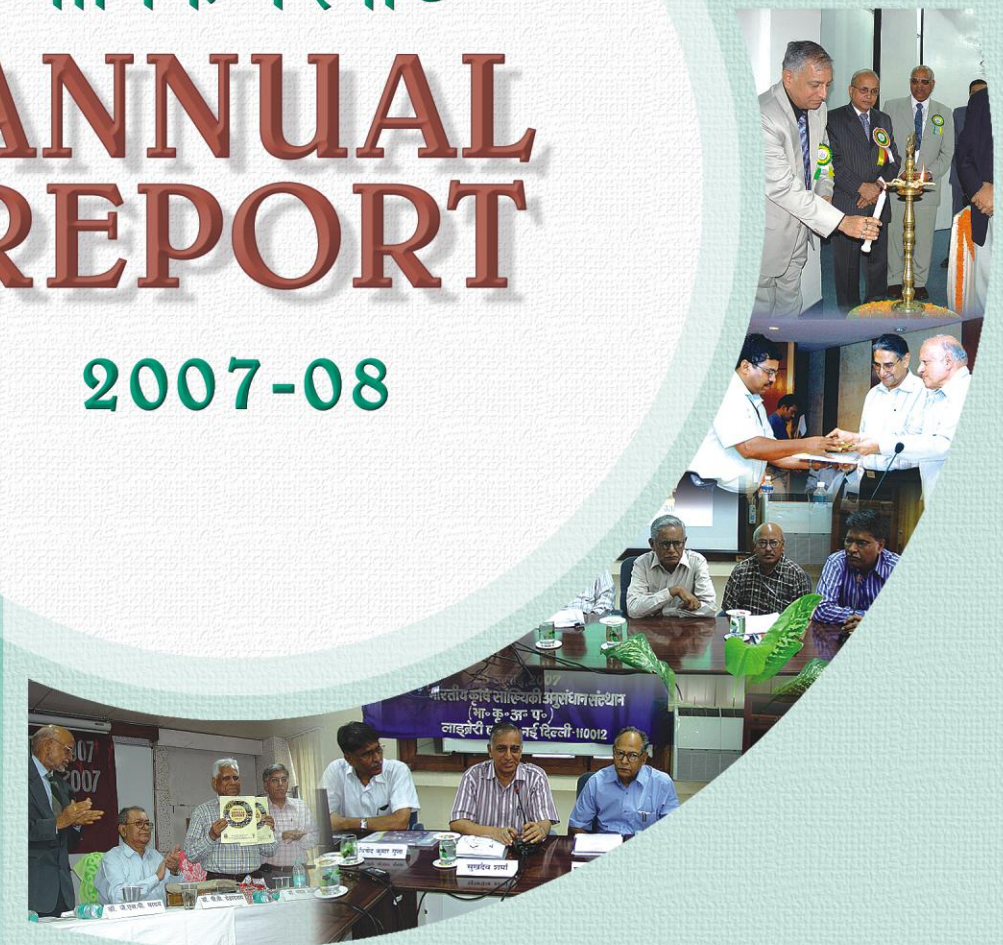




वार्षिक रिपोर्ट ANNUAL REPORT 2007-08

वार्षिक रिपोर्ट  
ANNUAL  
REPORT  
2007-08



भारतीय कृषि सांख्यिकी अनुसंधान संस्थान, भा.कृ.अनु.प.,  
लाइब्रेरी एवेन्यू, पूसा, नई दिल्ली-110012  
INDIAN AGRICULTURAL STATISTICS RESEARCH INSTITUTE, ICAR,  
LIBRARY AVENUE, PUSA, NEW DELHI- 110 012

## Preface



It gives me immense pleasure in bringing out the Annual Report 2007–08 of the Indian Agricultural Statistics Research Institute (IASRI). The Institute made a modest beginning in the year 1930 as a statistical section under ICAR and grew over time

into a full fledged Institute headed by a Director in the year 1970. The Institute got its present name in the year 1978. IASRI is a premier Institute in Agricultural Statistics and Computer Application in the country and has been identified as a Centre of Advanced Studies in Agricultural Statistics and Computer Application. The Institute has made many important and original contributions in the disciplines of Agricultural Statistics and Computer Application and because of its emphasis on applications, it has made its presence felt in the National Agricultural Research System. The Institute is a repository of information on Agricultural Research Data. The Institute has taken a lead in the country in developing a data warehouse on National Agricultural Resources Data.

The present report highlights some of the glimpses of the research achievements made, new methodologies developed, significant advisory and consultancy services provided, dissemination of knowledge acquired and human resource development, linkages cultivated/nurtured with various ICAR Institutes, SAUs and other research organisations in India and abroad. The scientists, technical personnel, administrative, finance and other staff of the Institute have put in their best efforts in fulfilling the mandate of the Institute and also in achieving the targets set during the year.

The Institute initiated 28 new studies/projects during the year. These projects have been formulated under the six broad thrust research areas of the Institute to fulfill objectives and mandate of the Institute. During the year 13 research projects have been completed and 12 projects have been continuing.

Several training programs of different categories like trainings under Center of Advanced Studies, Winter School, Summer School and sponsored National and International training programs were organised.

The Institute also provided consultancy services to various research studies/projects in NARS.

In order to assess the national priorities of research teaching and training in Agricultural Statistics and Computer Application a National Conference of Agricultural Research Statisticians in NARS is held once in three years. This year the XV National Conference of Agricultural Research Statisticians of ICAR was organized at Birsa Agricultural University, Ranchi during 03-04 December, 2007.

I am happy to note that some of our colleagues received academic distinctions during the year. Dr. Rajender Parsad, National Fellow received the NAAS-Associateship, and Dr. Cini Varghese, Senior Scientist received the Lal Bahadur Shastri Young Scientist Award for the Biennium 2005-2006 in the field of Social Sciences.

The scientists of the Institute were deputed for presentation of their papers in various national/international conferences. This year 3 scientists were deputed to present their papers to USA, China and Canada.

To promote Hindi, a poster presentation of research papers in Hindi was organized at the Institute and scientists were also awarded for their outstanding contributions in preparation of Hindi posters.

This report has been compiled through collective efforts rendered by Heads of Divisions, scientists and other staff of the Institute. I wish to express my sincere appreciation to all of them for their sincere and whole-hearted support and cooperation in carrying out various functions and activities of the Institute.

I wish to express my sincere thanks to all my colleagues in Research Coordination and Management Unit for coordinating various related activities and Hindi Section for Hindi Translation of the required material.

It is expected that the scientists in NARS will benefit immensely from the information contained in this publication. I shall look forward to any suggestions and comments on the information contained in this publication, which would prove to be very valuable for our future publications.

**(SD SHARMA)**

Director

## Advisors / Directors

Dr. P.V. Sukhatme	...	September 1940 – July 1951
Dr. V.G. Panse	...	August 1951 – March 1966
Dr. G.R. Seth	...	April 1966 – October 1969
Dr. Daroga Singh	...	November 1969 – May 1971
Dr. M.N. Das (A)	...	June 1971 – October 1973
Dr. Daroga Singh	...	November 1973 – September 1981
Dr. Prem Narain	...	October 1981 – February 1992
Dr. S.K. Raheja (A)	...	February 1992 – November 1992
Dr. R.K. Pandey (A)	...	December 1992 – May 1994
Dr. P.N. Bhat (A)	...	June 1994 – July 1994
Dr. O.P. Kathuria	...	August 1994 – May 1995
Dr. R.K. Pandey (A)	...	June 1995 – January 1996
Dr. Bal B.P.S. Goel	...	January 1996 – October 1997
Dr. S.D. Sharma	...	October 1997 onwards

## Milestones

- 1930 • Statistical Section created under ICAR
- 1940 • Activities of the Section increased with appointment of Dr. PV Sukhatme
- 1945 • Re-organisation of statistical section into statistical branch as a centre for research and training in the field of Agricultural Statistics
- 1949 • Re-named as Statistical Wing of ICAR
- 1952 • Activities of Statistical Wing further expanded and diversified with the recommendations of FAO experts, Dr. Frank Yates and Dr. DJ Finney
- 1955 • Statistical Wing moved to its present campus
- 1956 • Collaboration with AICRP initiated
- 1959 • Re-designated as Institute of Agricultural Research Statistics (IARS)
- 1964 • Installation of IBM 1620 Model-II Electronic Computer
  - Signing of MOU with IARI, New Delhi to start new courses for M.Sc. and Ph.D. degree in Agricultural Statistics
- 1970 • Status of a full fledged Institute in the ICAR system, headed by Director
- 1977 • Three storeyed Computer Centre Building inaugurated
  - Installation of third generation computer system, Burroughs B-4700
- 1978 • Re-named as Indian Agricultural Statistics Research Institute (IASRI)
- 1983 • Identified as Centre of Advanced Studies in Agricultural Statistics and Computer Applications under the aegis of the United Nations Development Programme (UNDP)
- 1985–86 • New Course leading to M.Sc. degree in Computer Application in Agriculture, initiated
- 1989 • Commercialization of SPAR 1
- 1991 • Burroughs B-4700 system replaced by a Super Mini COSMOS LAN Server
- 1992 • Administration-cum-Training Block of the Institute was inaugurated
- 1993–94 • M.Sc. degree in Computer Application in Agriculture changed to M.Sc. (Computer Application)
- 1995 • Center of Advanced Studies in Agricultural Statistics & Computer Application established by Education Division, ICAR
- 1996 • Establishment of Remote Sensing & GIS lab with latest software facilities
  - Outside funded projects initiated

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|------|---|
| 1997 | <ul style="list-style-type: none"> <li>• Senior Certificate Course in 'Agricultural Statistics and Computing' revived</li> <li>• Establishment of modern computer laboratories</li> <li>• First software in India for generation of design along with its randomised layout SPBD release 1.0</li> </ul>   |
| 1998 | <ul style="list-style-type: none"> <li>• Four Divisions of the Institute re-named as Sample Survey, Design of Experiments, Biometrics and Computer Applications</li> <li>• Revolving Fund Scheme on Short Term Training Programs in Information Technology initiated</li> <li>• Training programmes in statistics for non-statisticians in National Agricultural Research System initiated</li> </ul>             |
| 1999 | <ul style="list-style-type: none"> <li>• Strengthening of LAN &amp; Intranet with Fibre optics &amp; UTP cabling</li> <li>• Substantial growth in outside funded projects and training programmes</li> </ul>  |
| 2000 | <ul style="list-style-type: none"> <li>• Two Divisions re-named as Division of Forecasting Techniques and Division of Econometrics</li> </ul>   |
| 2001 | <ul style="list-style-type: none"> <li>• Data Warehousing activities (INARIS project under NATP) initiated</li> </ul>   |
| 2002 | <ul style="list-style-type: none"> <li>• Establishment of National Information System on Animal Experiments Laboratory</li> <li>• Development of PIMSNET(Project Information Management System on Internet) for NATP</li> </ul>   |
| 2003 | <ul style="list-style-type: none"> <li>• Establishment of National Information System on Long-term Fertilizer Experiments funded by AP Cess Fund</li> <li>• Development of PERMISnet (A software for Online Information on Personnel Management in ICAR System)</li> <li>• First indigenously developed software on windows platform released Statistical Package for Factorial Experiments (SPFE) 1.0</li> </ul> |
| 2004 | <ul style="list-style-type: none"> <li>• National Information System on Agricultural Education (NISAGENET) Project launched</li> <li>• Training Programme for private sector initiated and conducted training programme for E.I. DuPont India Private Limited</li> <li>• E-Library Services Initiated</li> </ul>  |
| 2005 | <ul style="list-style-type: none"> <li>• Statistical Package for Augmented Designs (SPAD) and Statistical Package for Agricultural Research (SPAR) 2.0 released</li> <li>• Design Resources Server with an aim to provide E-advisory in NARS initiated</li> <li>• Strengthening of Reproductive Lab with colour photocopier</li> <li>• Installation of Digital Telephone Exchange</li> </ul>                      |
| 2006 | <ul style="list-style-type: none"> <li>• Organisation of International Conference on Statistics and Informatics in Agricultural Research</li> </ul>   |
| 2007 | <ul style="list-style-type: none"> <li>• Establishment of Agricultural Bioinformatics Laboratory(ABL)</li> </ul>  |

## Vision

Statistics and ICT for enriching the quality of Agricultural Research

## Mission

Undertake research, education and training in Agricultural Statistics and Computer Applications for Agricultural Research

## Mandate

- To undertake basic, applied adaptive, strategic and anticipatory research in Agricultural Statistics and related fields and use these researches in meeting challenges and improving quality of agricultural research.
- To conduct post-graduate teaching and in-service, customized and sponsored training courses in Agricultural Statistics and Computer Applications at National and International level so as to be a leading centre of excellence in Human Resource Development.
- To provide methodological support in strengthening National Agricultural Statistics System by establishing linkages with State departments of agriculture and allied fields, other research institutions, industry, etc.
- To lead in development of Agricultural Knowledge Management and Information System for National Agricultural Research System.
- To provide advisory and consultancy services for strengthening the National Agricultural Research System and undertaking sponsored research and consultancy for National and International organizations.

## विशिष्ट सारांश

भारतीय कृषि सांख्यिकी अनुसंधान संस्थान (भा.कृ.सां.अ.सं.) की स्थापना सन् 1959 में कृषि सांख्यिकी अनुसंधान संस्थान के रूप में हुई तभी से यह संस्थान कृषि सांख्यिकी में अनुसंधान के साथ-साथ शिक्षण/प्रशिक्षण करने का महत्वपूर्ण दायित्व निभा रहा है। सूचना प्रौद्योगिकी के क्षेत्र में हो रही प्रगति के दृष्टिगत इस संस्थान ने स्वयं को कृषि अनुसंधान की वर्तमान आवश्यकताओं के अनुरूप ढाल लिया है। इस परिवर्तित परिवेश में, संस्थान को सौंपे गये कार्य हैं - सांख्यिकी में मौलिक, अनुप्रयुक्त और अनुकूली शोध करना, कृषि सांख्यिकी एवं संगणक अनुप्रयोग में स्नातकोत्तर एवं सेवाकालीन प्रशिक्षण पाठ्यक्रम चलाना, परामर्श सेवाएँ प्रदान करना, अनुसंधान हेतु कृषि सांख्यिकी में सूचना कोष के रूप में कार्य करना, कृषि सांख्यिकी एवं संगणक अनुप्रयोग में श्रेष्ठ शिक्षा व प्रशिक्षण के एक उन्नत केन्द्र के रूप में संस्थान को विकसित करना, भारतीय कृषि अनुसंधान परिषद् के अन्य संस्थानों एवं राज्य कृषि विश्वविद्यालयों (रा.कृ.वि.), राज्य कृषि/पशुपालन विभागों के साथ सम्पर्क बढ़ाना, राष्ट्रीय कृषि सांख्यिकी प्रणाली को विकसित करने एवं सुदृढ़ बनाने में सहायता करना तथा इन विषयों में राष्ट्रीय एवं अन्तरराष्ट्रीय संगठनों के द्वारा प्रायोजित अनुसंधान करना और प्रशिक्षण प्रदान करना।

इस वर्ष संस्थान के विभिन्न प्रभागों - प्रतिदर्श सर्वेक्षण, परीक्षण अभिकल्पना, जैवमिति, पूर्वानुमान तकनीक, अर्थमिति एवं संगणक अनुप्रयोग में अनेक अनुसंधान परियोजनाएँ चलाई गईं। संस्थान में विभिन्न महत्व वाले क्षेत्रों में कुल 53 अनुसंधान परियोजनाओं के अन्तर्गत अनुसंधान कार्य किया गया जिनमें से 35 परियोजनाएँ संस्थान द्वारा, 08 ए.पी. सेस फ़ण्ड द्वारा तथा 09 बाह्य एजेंसियों द्वारा वित्त पोषित और एक परियोजना अन्य संस्थान के सहयोग से चलाई गई। इस वर्ष कुल 13 परियोजनाएँ पूरी हो चुकी हैं तथा 28 नयी परियोजनाएँ आरम्भ की गईं हैं।

कुछ प्रमुख अनुसंधानिक उपलब्धियाँ इस प्रकार हैं:-

- क्वालिटी कृषि अनुसंधान के लिए प्रभावी परीक्षण की अभिकल्पनाओं हेतु खोज से कॉलम-वार समन्वित विनिमय एलगोरिथम का उपयोग करते हुए दो स्तरीय कारक सुपर सैचुरेटेड अभिकल्पनाओं (SSD) का विकास किया गया।

यह एलगोरिथम दो स्थितियों के लिए अभिकल्पनाओं का विकास करता है: (अ)  $n$  (सम संख्या) रन अभिकल्पना के लिए जब सभी कारकों के लिए +1 तथा -1 स्तर  $n/2$  गुणा होते हैं, तब अभिकल्पना को संतुलित किया जाता है (ब) अभिकल्पना को संतुलित किया जाता है और वहां कारकों के सबसेट होते हैं जो कि आपस में इस प्रकार सम्बद्ध होते हैं कि इस सबसेट में किसी भी दो कॉलम का आन्तरिक उत्पाद शून्य हो जाता है, जबकि  $n, 4$  का गुणन है। प्रभावी अभिकल्पनाओं के कैटलॉग अभिकल्पना संसाधन सर्वर ([www.iasri.res.in/design](http://www.iasri.res.in/design)) पर उपलब्ध है। इन अभिकल्पनाओं के लिए असंतुलित मिश्रण-स्तर कारक SSDs की अवधारणा की शुरुआत की गयी है तथा प्रभावी दक्षता मानकों में सुधार किया गया। इन प्रभावी दक्षता मानकों की निम्न सीमा प्राप्त की गयी।

- पूर्ण बहु-अनुक्रिया परीक्षणों के लिए यह देखा गया कि जो अभिकल्पना एकल अनुक्रिया परीक्षणों के लिए प्रभावी थी वही, बहु अनुक्रिया परीक्षणों को पूरा करने के लिए भी प्रभावी थी जबकि अनुक्रिया चरों की संख्या, स्वतंत्र रूप से की गई त्रुटियों से कम हो।
- यादृच्छिक पूर्ण ब्लॉक अभिकल्पनाओं (RCB) एवं संतुलित अपूर्ण ब्लॉक अभिकल्पनाओं (BIB)के संयोजन का प्रयोग करते हुए अपूर्ण बहु-अनुक्रिया परीक्षणों के लिए अभिकल्पनाओं का विकास करने के लिए विधि तैयार की गई। इस तरीके से प्राप्त अभिकल्पनाएं संसाधनों की दृष्टि से मितव्ययी है।
- यादृच्छिक पूर्ण ब्लॉक अभिकल्पनाओं एवं संतुलित अपूर्ण ब्लॉक अभिकल्पनाओं के संयोजन से प्राप्त अपूर्ण बहु-अनुक्रिया अभिकल्पनाओं के विश्लेषण की एक पदश: विश्लेषण विधि विकसित की गई।
- NN तथा AR(1) त्रुटि संरचनाओं में सहसंबंध गुणांक के विभिन्न मानों के लिए सह सहसंबंधित ऑब्जर्वेशन के विरुद्ध चक्रीय अभिकल्पनाओं में रॉबस्टनेस का अध्ययन किया गया तथा इन अभिकल्पनाओं की एक सूची तैयार की गई जबकि उपचारों की संख्या 10 से ज्यादा न हो तथा A- दक्षता दी गई हो।

- जैव समानता ट्रायल में संदर्भ निरूपण में एक अन्य सेट के साथ परीक्षण निरूपण की तुलना करने के लिए पुनरावृत्ति उपाय डिजाइनों की श्रृंखला प्राप्त की गई और पुनरावृत्ति उपाय डिजाइनों के लिए एक सांख्यिकीय पैकेज (SPRMD) का विकास किया गया।
- एक से अधिक आउटलाईंग प्रसरण की उपस्थिति में रॉबस्ट डिजाइन की पहचान हेतु एक नया तरीका विकसित किया गया। इस तरीके का इस्तेमाल करते हुए दो आउटलाईंग प्रसरण की उपस्थिति में सभी द्विधारी प्रसरण संतुलित ब्लॉक डिजाइन रॉबस्ट पाई गई। आउटलाईंग प्रसरण की उपस्थिति में परीक्षण आंकड़ों के विश्लेषण हेतु ग्राफिक उपयोग इंटरफेस आधारित सॉफ्टवेयर विकसित किया गया।
- मिश्रित परिक्षणों में, ट्रेस  $(X'X)^{-1}$  (A- दक्षता कसौटी), न्यूनतम  $|(X'X)^{-1}|$  (D- दक्षता कसौटी) एवं G- दक्षता (G- के लिए वैश्विक) कसौटी के मापदण्डों को न्यूनतम करके दक्ष अभिकल्पनाओं को प्राप्त किया गया।
- समानान्तर पंक्ति और ढलाव दर विश्लेषण के लिए ब्लॉक डिजाइन रॉबस्टनेस के दो तरीके विकसित किए गए पहला तरीका जहां गुणों से संपर्क आधारित था वहीं दूसरा तरीका मूल डिजाइन के आकलन से हटाए जाने के पश्चात प्राप्त अवशेष डिजाइन की एक-प्रभावशीलता पर आधारित था। आंकड़ों के नुकसान में बायोएसे के रॉबस्ट डिजाइन को भी सूचीबद्ध किया गया।
- समान प्रवृत्ति वाले क्रमगुणित परीक्षणों के लिए दो गैर पारस्परिक कारकों के साथ उपचारों के क्रम को शामिल करते हुए एक डिजाइन श्रृंखला प्राप्त की गई। उक्त डिजाइनें परिपत्र एसोसिएशन स्कीम पर आधारित प्रत्येक कारक के स्तर के लिए आंशिक रूप से परिवर्ती रूप से संतुलित थीं।
- वर्षा वितरण की सर्व-बहुलकता और द्वि-बहुलकता के चरित्रांकन के लिए यह निष्कर्ष निकला कि सर्व-बहुलकता वर्षा डेटा सेट के लिए सामान्यीकृत लैम्बडा वितरण (GLD) परिवार का इस्तेमाल किया जाए जबकि दूसरी ओर द्वि-बहुलकता डाटा सेट के लिए वर्षा वितरण का वर्णन वितरण सम्मिश्रण द्वारा किया जा सकता है।
- बागवानी फसलों के क्षेत्रफल एवं उत्पादन का आकलन करने के लिए एक वैकल्पिक प्रणाली विकसित की गई जिसमें बाजार पहुंचने पर सब्जियों और फलीय फसलों तथा उपयोग की गई अतिरिक्त सूचना इत्यादि के लिए एकीकृत डिजाइन का प्रावधान है। नई प्रणाली लागत प्रभावी है एवं विधियाँ सरलीकृत हैं।
- स्थानों के विभिन्न सबसेट के लिए जीनप्ररूपों के सबसेट की पहचान हेतु बाईप्लॉट विश्लेषण किया गया।
- स्टेट स्पेस मॉडल्स का इस्तेमाल करते हुए फसल पूर्वानुमान के लिए लीनियर गॉसीयन, स्टेट स्पेस और बैक्टर ऑटो रिग्रेशन (VAR) जैसे बाईवेरिएट टाइम सीरिज मॉडलों की फिटिंग की गई। इन मॉडलों का अनुप्रयोग करते हुए अनुवर्ती वर्षों के लिए पूर्वानुमान किए गए और इनकी तुलना इनके सादृश्य गैर-वेरिएट मॉडलों यथा ARIMA और स्टेट स्पेस मॉडलों से किए गए पूर्वानुमानों से की गई। राज्य स्तर पर VAR मॉडल का उपयोग करते हुए प्राप्त किये गये कपास उत्पादन पूर्वानुमान अन्य मॉडलों के उपयोग द्वारा पाए गए पूर्वानुमान की तुलना में कहीं बेहतर थे।
- चावल, गेहूं और गन्ने की उपज के पूर्वानुमान के लिए बहुस्तरीय पर्सेट्रॉन (MLP), रेडियल आधारित कार्य (RBF) आर्कीटैक्चर तथा मौसम आधारित परावर्तन मॉडल का इस्तेमाल करते हुए न्यूरल नेटवर्क मॉडल विकसित किए गए और उनमें से 36 मॉडल स्थापित किए गए। यह पाया गया कि 13 मामलों में MLP आर्कीटैक्चर आधारित मॉडल कहीं बेहतर थे जबकि 6 मामलों में RBF आर्कीटैक्चर आधारित मॉडल एवं 17 मामलों में मौसम आधारित परावर्तन मॉडल कहीं बेहतर पाए गए।
- न्यूरल नेटवर्क का उपयोग करते हुए संपादन एवं वर्गीकरण पर किए गए अध्ययन से यह पता चला कि गैर अनुक्रिया संपादन के लिए ANN मॉडल अधिक उपयुक्त पाये गए।
- खेत किफायत पर संसाधन संरक्षण प्रौद्योगिकियों (RCT) के अनुकूलन और प्रभाव पर किए गए अध्ययन से यह पता चला कि RCT के उपयोग से भारत के इन्डो-गंगोटिक मैदानों में विभिन्न राज्यों में चावल तथा गेहूं उगाने वाले किसानों की कुल आमदनी में उल्लेखनीय वृद्धि हुई।
- भारत में मात्स्यकीय अनुसंधान के प्रभावी मूल्यांकन के तहत यह पाया गया कि कुल नियत पूंजी निर्माण (ग्रॉस फिक्सड कैपिटल फार्मेशन) (GFCF) के साथ-साथ कृषि GFCF



के क्षेत्र में मात्स्यकी का हिस्सा 80 के दशक के उपरांत निश्चित मूल्यों के साथ संतुलित गति से बढ़ रहा था। 70 के दशक के अंतिम वर्षों में मत्स्य समग्र घरेलू उत्पाद (GDP) में हुई बहुत कम वृद्धि के कारण मत्स्यकीय क्षेत्र में संवृद्धि पूंजी परिणाम दर (इंक्रिमेंटल कैपिटल आउट-पुट रेशो-ICOR) बहुत अधिक थी तथा इसमें 80 के दशक में प्रभावी GDP वृद्धि के कारण निचले स्तर तक हास हुआ। 90 के दशक के अंतिम वर्षों में विशेषकर समुद्रीय उत्पादन में ठहराव के कारण GDP में धीमी बढ़ती वृद्धि की वजह से ICOR में अधिक वृद्धि हुई।

- स्थायी एवं रॉबस्ट गुच्छ प्रक्रियाओं पर किए गए एक अध्ययन से यह देखा गया कि गुच्छ विधियों और दूरी माप के विभिन्न संयोजनों के प्रति अपवर्गीकरण की बारंबारता निम्न पायी गयी।
- दीर्घावधि उर्वरक परीक्षणों से कोयम्बटूर, लुधियाना और पंतनगर केन्द्रों को छोड़कर अधिकतर केन्द्रों पर मिट्टी में नाइट्रोजन युक्त उर्वरकों के लगातार उपयोग से फसल पैदावार में कमी देखी गयी। पालमपुर, रांची और बंगलुरु में अम्लीय मृदा में अकेले नाइट्रोजन का उपयोग करने से फसल पैदावार में होने वाली वृद्धि कहीं ज्यादा थी।
- NPK के संतुलित अधिकतम अनुप्रयोग के निर्धारण के लिए सघन परीक्षणों से यह देखने में आया कि जैविक खाद FYM @ 10-15 टन प्रति है। प्रति वर्ष के साथ 100 प्रतिशत NPK अजैविक (अधिकतम खुराक) के एकीकृत अनुप्रयोग से टिकाऊ फसल उत्पादकता और मृदा उर्वरकता में बढ़ती हुई। इन निष्कर्षों की पुष्टि वर्ष के दौरान किए गए उनके संबंधित पैदावार टिकाऊ आंकड़ों से की गई। FYM के अनुप्रयोग से NPK की अतिरिक्त मात्रा की आपूर्ति के अलावा इसका मृदा गुणों पर लाभदायक प्रभाव पड़ा।
- दाना पैदावार और सहायी गुणों के बीच परावर्तन विश्लेषण से यह पता चला कि पौधों की ऊंचाई का दानों की पैदावार में कोई उल्लेखनीय योगदान नहीं था जबकि प्रति गुच्छ दानों की संख्या और डंठल/एस.यू. वाली बालियों की संख्या का योगदान दाना पैदावार में उल्लेखनीय था।
- विभिन्न कृषि पारिस्थितिकी प्रणाली में फसल अनुक्रमण के उत्पादन का आर्थिकी और ऊर्जा क्षमता पर की गई सांख्यिकीय जांच से यह निष्कर्ष निकला कि 3 फसल अनुक्रमण जिसमें

एक फसल के रूप में प्याज भी शामिल है, को बाजरा-प्याज-लोबिया तथा सोयाबीन-प्याज-लोबिया जैसे फसल चक्र की तरह CSR, जूनागढ़ पर प्रयोग किया जा सकता है। इससे न केवल किसानों की कुल आमदनी में बढ़ती होगी वरन् इससे कार्बोहाइड्रेट और आयरन शक्ति समृद्ध प्याज के साथ अनाजों, दलहन और तिलहन की प्राप्ति होगी। इन अनुक्रमणों से भूमि उपयोग प्रभावशीलता भी अधिकतम पाई गई।

- एक बेव सामर्थ्य कृषि खेत परीक्षण सूचना प्रणाली (AFEIS) का विकास किया गया जिसमें देश में आयोजित कृषि क्षेत्र के परीक्षणों (शुद्ध किस्मीय परीक्षणों को छोड़कर) से संबंधित जानकारी भंडारित की जाती है और इसका ऑन लाईन रखरखाव किया जाता है। यह प्रणाली कृषि विज्ञान के क्षेत्र में कार्यरत वैज्ञानिकों, शोधकर्ताओं एवं योजनाकारों के लिए संदर्भ सामग्री के रूप में प्रभावी है। वर्तमान में उक्त डॉटाबेस में विभिन्न कृषि विश्वविद्यालयों, भारतीय कृषि अनुसंधान परिषद् अनुसंधान संस्थानों, परियोजना निदेशालयों, अखिल भारतीय समन्वित अनुसंधान परियोजनाओं और राज्य सरकारों के कृषि निदेशालयों आदि में आयोजित 24,000 कृषि खेत परीक्षणों से संबंधित जानकारी समाहित है।
- स्वतंत्र त्रुटियों और पारस्परिक त्रुटियों दोनों के लिए नेस्टेड ब्लॉक डिजाइन के सृजन हेतु एक वीटावर्जन सॉफ्टवेयर विकसित किया गया।
- भारत में कृषि शिक्षा नेटवर्क पर राष्ट्रीय सूचना प्रणाली (NISAGENET) विकसित की गई और इसका क्रियान्वयन 42 प्रतिभागी संगठनों में किया गया जिनमें कि भारत में कृषि शिक्षा को बढ़ावा देने वाले राज्य कृषि विश्वविद्यालय, भारतीय कृषि अनुसंधान परिषद् मानद विश्वविद्यालय, इलाहाबाद कृषि संस्थान, केन्द्रीय कृषि विश्वविद्यालय और केन्द्रीय विश्वविद्यालय शामिल हैं।
- सर्वे डॉटा विश्लेषण के लिए सॉफ्टवेयर (SSDA) विकसित किया गया। इस सॉफ्टवेयर से साधारण यादृच्छिक, स्ट्रेटिफाइड, प्रणालीगत, गुच्छ, द्विस्तरीय तथा स्ट्रेटिफाइड द्विस्तरीय जैसे महत्वपूर्ण सामान्य प्रतिदर्श अभिकल्पनाओं का उपयोग करते हुए एकत्रित किए गए नमूना आंकड़ों पर जनसंख्या आंकड़ों के आधार पर जनसंख्या पैरामीटर्स का आकलन किया जाता है।

- वर्तमान परमिसनेट को .NET प्लेटफार्म तक उन्नत किया गया और इसे न्यू मॉड्यूल और मानवशक्ति योजना रिपोर्ट के साथ सुदृढ़ किया गया। RMP (अनुसंधान प्रबंधन कार्मिक) मॉड्यूल पहुंच योग्य अधिकारों में सुधार तथा उन्नत निर्णय सहयोग के लिए नए फार्म एवं रिपोर्ट जैसे बहुत से नए गुणों के साथ प्रणाली को समृद्ध बनाया गया।
- पशु प्रजनन हेतु सांख्यिकीय पैकेज 2.1 (SPAB 2.1) की पहल की गयी तथा पैकेज के आठ कार्यक्रम विकसित किए गए।
- “मानवशक्ति योजना-परमिसनेट हेतु निर्णय समर्थित प्रणाली” की शुरूआत की गयी। आन-लाइन परमिसनेट प्रणाली के आंकड़ों को परमिसनेट-॥ प्रणाली के नये डॉटाबेस ढांचे में मिलाया गया। मानवशक्ति योजना हेतु कुछ नवीन रिपोर्टें विकसित की गयीं तथा उन्हें परमिसनेट-॥ प्रणाली के साथ एकीकृत किया गया।
- “आंशिक रूप से संतुलित अपूर्ण ब्लॉक डिजाइन (PBIB) हेतु बेव समाधान” की पहल की गयी। PBIB डिजाइन की कुछ श्रेणियों के निर्माण के तरीकों का मिलान उपलब्ध साहित्य से किया गया। इन डिजाइनों की यादृच्छिक स्थापना के सृजन हेतु कम्प्यूटर मॉड्यूल विकसित किया गया। PBIB डिजाइनों पर ई-लर्निंग सामग्री की अभिकल्पना की शुरूआत की गयी।
- “कृषि अनुसंधान के लिए सूचना डॉटा वेअर हाउस” की शुरूआत की गयी। कुछ राज्यों के लिए जनगणना सर्वेक्षण डॉटा (2001) हेतु OLAP क्यूबस तैयार किए गए।
- NRC on R&M, भरतपुर तथा DWR, करनाल से IVT डॉटा का विश्लेषण परीक्षण सामग्री में विसंगति नियंत्रण में अघुलनशील अपूर्ण ब्लॉक डिजाइन की उपयोगिता की जांच के लिए किया गया।
- $\alpha$ -डिजाइन, बायोएसे के लिए डिजाइन, सुपर-संतुप्त डिजाइन जैसे स्कवेयर लैटिस डिजाइनों के यादृच्छिक विन्यास को उत्पन्न करने के लिए मॉड्यूल, मूल डिजाइन जैसे पूर्ण यादृच्छिक डिजाइन, RCB डिजाइन, लेटिन स्कवेयर डिजाइन तथा प्रवधि डिजाइन पर संपर्क द्वारा डिजाइन संसाधन सर्वर का सुदृढ़ीकरण किया गया। डिजाइन संसाधन सर्वर पर सृजित किए “डॉटा आकलन” के नए पेज से SAS तथा

SPSS का इस्तेमाल करते हुए अभिकल्पित परीक्षणों द्वारा सृजित डॉटा का आकलन प्राप्त किया जा सकता है। वैज्ञानिक समुदाय के ध्यानाकर्षण हेतु वर्तमान ज्वलंत मुद्दों पर विश्व स्तर पर वैज्ञानिकों के अनुसंधान अनुभव बांटने के लिए एक विचार पटल की शुरूआत की गयी। परीक्षण डिजाइन में विश्व स्तर पर विशेषज्ञों की सूची प्रस्तुत की गयी है जो कि संपर्क स्थापित करने में सहायक होगी।

- संपूर्ण मेघालय राज्य में धान की फसल के क्षेत्र का आकलन करने के लिए संस्थान द्वारा विकसित कार्यप्रणाली को क्रियान्वित किया गया और उत्तर पूर्वी पर्वतीय क्षेत्र में कृषि सांख्यिकी आंकड़ों के एकीकरण हेतु सुदूर संवेदन आधारित पद्धति विकसित करने के लिए बहुफसल क्षेत्रफल हेतु सुदूरसंवेदन आधारित नमूना कार्यप्रणाली के विकास की पहल की गई।
- कपास उत्पादन के सरकारी एवं ट्रेड आकलनों में विभिन्नता के कारणों की जांच हेतु तथा कार्य प्रणाली विकास के लिए फसल कटाई परीक्षणों से संबंधित आंकड़ों का पुनः विश्लेषण किया गया।
- “ऊर्जा उपयोग के साथ खेत अभ्यासों, संसाधनों और गतिविधियों की सीमा का आकलन” शीर्षक पर एक अध्ययन प्रारंभ किया गया।
- मशरूम उत्पादन के आकलन हेतु प्रतिदर्श कार्यप्रणाली को विकसित करने हेतु अध्ययन की शुरूआत की गई।
- कृषि उपकरणों एवं मशीनरी की दशा एवं परिलक्षित आंकलन पर अध्ययन प्रारंभ किया गया।
- गेहूं फसल प्रबंधन पर विशेषज्ञ प्रणाली को सुदृढ़, परिष्कृत एवं क्रियान्वित करने की पहल की गई। इनमें से कुछ को हिन्दी में तैयार किया गया।
- भारत में कृषि शिक्षा नेटवर्क पर राष्ट्रीय सूचना प्रणाली (NISAGENET II) की शुरूआत की गई।
- संस्थान, वर्ष 1996 से कृषि अनुसंधान डॉटा पुस्तकों के प्रकाशन में अग्रणी बना हुआ है। कृषि अनुसंधान डॉटा पुस्तक-2007 प्रकाशित की गई जोकि इस श्रृंखला की 11वीं कड़ी थी।

संस्थान के वैज्ञानिकों द्वारा राष्ट्रीय एवं अंतरराष्ट्रीय स्तर के जर्नलों में कुल 67 शोधपत्र, 07 सारांश, 10 लोकप्रिय लेख, 03 पुस्तक

अध्याय, 13 परियोजना एवं तकनीकी रिपोर्टें, 02 मोनोग्राफ, 01 ई-मैनुअल, 01 पाठ श्रृंखला तथा एक संगोष्ठी विवरण प्रकाशित किए गए।

वैज्ञानिक, तकनीकी तथा प्रशासनिक वर्ग के साथ QRT की बहुत सी बैठकों का आयोजन किया गया। IMC के सदस्यों से फीडबैक प्राप्त करने हेतु QRT, IMC के सदस्यों से भी मिली। अंततः परिषद् के महानिदेशक के परामर्श पर QRT अध्यक्ष ने अपनी रिपोर्ट संस्थान के निदेशक को सौंपी।

भारतीय कृषि सांख्यिकी अनुसंधान संस्थान तथा कृषि अर्थशास्त्र एवं नीति अनुसंधान के राष्ट्रीय केन्द्र की सामूहिक अनुसंधान परामर्श समिति की पहली बैठक डॉ. पी.वी. शिर्नॉय, पूर्व विशेष सचिव, कृषि मंत्रालय, भारत सरकार की अध्यक्षता में आयोजित की गई।

डॉ. राजेन्द्र प्रसाद, राष्ट्रीय अध्येता को NAAS एसोसिएटशिप प्रदान की गई।

डॉ. सिनी वर्गीज, वरिष्ठ वैज्ञानिक को सामाजिक विज्ञान के क्षेत्र में 2005-06 का द्विवार्षिक लाल बहादुर शास्त्री युवा वैज्ञानिक पुरस्कार मिला।

डॉ. पी. विशाखी, लाइब्रेरियन को सूचना विज्ञान के लिए सोसायटी (SIS) द्वारा “2006 के लिए युवा सूचना वैज्ञानिक” प्रतिष्ठित पुरस्कार प्रदान किया गया।

संस्थान के बहुत से वैज्ञानिकों को अनेकों राष्ट्रीय/अंतरराष्ट्रीय संगोष्ठी में अपने शोध पत्रों के प्रस्तुतिकरण के लिए भेजा गया।

डॉ. प्रजनेशु, अध्यक्ष, जैवमिति ने 12-14 अक्टूबर 2007 के दौरान संयुक्त राज्य अमेरिका के ग्रीन्सबोरो में आयोजित अन्तर विषयी सांख्यिकी में प्रगति पर अंतरराष्ट्रीय सम्मेलन में भाग लिया।

डॉ. वी. के. भाटिया, प्राध्यापक (कृषि सांख्यिकी) तथा प्रभारी (RCMU) ने बीजिंग, चीन में 22-24 अक्टूबर 2007 के दौरान आयोजित कृषि सांख्यिकी के चौथे अंतरराष्ट्रीय सम्मेलन में भाग लिया।

डॉ. सुशीला कौल, वरिष्ठ वैज्ञानिक ने 12-14 सितंबर 2007 के दौरान मास्को में आयोजित आर्थिक मॉडलिंग सम्मेलन तथा 22-25 अक्टूबर 2007 के दौरान विक्टोरिया, बी.सी. कनाडा में आयोजित सामाजिक आर्थिकी पर प्रथम CIREC अंतरराष्ट्रीय सम्मेलन में भाग लिया।

हिन्दी को प्रोत्साहन देने के लिए संस्थान में एक शोधपत्र पोस्टर प्रस्तुति प्रतियोगिता का आयोजन किया गया जिसमें हिन्दी पोस्टर तैयार करने में उल्लेखनीय योगदान देने वाले वैज्ञानिकों को पुरस्कृत किया गया।

संस्थान द्वारा 03-04 दिसंबर 2007 के दौरान बिरसा कृषि विश्वविद्यालय रांची में भा.कृ.अ.प. के कृषि अनुसंधान सांख्यिकीविदों के 15वें राष्ट्रीय सम्मेलन का आयोजन किया गया।

NISAGENET के लिए विकसित सॉफ्टवेयर के स्थापन और क्रियान्वयन के लिए संस्थान द्वारा दो दिवसीय कार्यस्थल प्रशिक्षण का आयोजन किया गया और सभी 42 प्रतिभागी संगठनों में LAN पर सॉफ्टवेयर को कार्यशील किया गया।

परमिसनेट तथा भा.कृ.अ.प. की बौद्धिक रिपोर्टिंग प्रणाली पर एक दो दिवसीय कार्यशाला का आयोजन किया गया।

स्थानिक तथा गैर स्थानिक सूचना प्रबंध और कृषि में माइनिंग, कृषि अर्थमिति में नीति विश्लेषण हेतु मात्रात्मक तकनीकों में प्रगति, कृषि में जानकारी प्रसार के लिए बेव अनुप्रयोग की जैवमिति तकनीकों और विकास में प्रगति पर प्रगत अध्ययन केन्द्र के तहत 21 दिवसीय चार प्रशिक्षण कार्यक्रमों का आयोजन किया गया।

संस्थान द्वारा अंतरराष्ट्रीय प्रतिभागियों के लिए 31 अक्टूबर 2007 को “कार्यालयीन सांख्यिकी एवं संबंधित कार्य प्रणाली” विषय पर एक दिवसीय प्रशिक्षण पाठ्यक्रम आयोजित किया गया।

अफगानिस्तान के वरिष्ठ प्रमाण पत्र पाठ्यक्रम के दो प्रतिभागियों के लिए अध्ययन दौरा आयोजित किया गया।

10-29 दिसंबर 2007 के दौरान FAO द्वारा प्रायोजित अफगानिस्तान के प्रतिभागियों का अध्ययन दौरा आयोजित किया गया। अध्ययन दौरे में प्रतिभागियों को 16-19 दिसंबर 2007 के दौरान DES, त्रिवेन्द्रम् तथा 25-27 दिसंबर 2007 के दौरान DES, हैदराबाद ले जाया गया।

संस्थान द्वारा 16 जनवरी से 05 फरवरी 2008 के दौरान “कृषि अनुसंधान में नमूना सर्वेक्षण तकनीक” विषय पर शीतकालीन स्कूल का आयोजन किया गया।

“अनुसंधान कार्य प्रणाली” पर 07-18 जनवरी 2008 के दौरान भारतीय वानिकी अनुसंधान एवं शिक्षा परिषद् के वैज्ञानिकों के लिए एक प्रशिक्षण कार्यक्रम आयोजित किया गया।

संस्थान की शिक्षण एवं प्रशिक्षण से सम्बन्धित गतिविधियां, जिनमें

समस्त स्नातकोत्तर अध्यापन कार्यक्रमों का नियोजन, आयोजन एवं समन्वयन सम्मिलित है, भारतीय कृषि अनुसंधान संस्थान के पी.जी. स्कूल के सहयोग से चलायी गयीं। इस वर्ष कुल 19 छात्रों {07 पी.एच.डी. (कृषि सांख्यिकी), 05 एम.एस.सी. (कृषि सांख्यिकी) एवं 07 एम.एस.सी. (संगणक अनुप्रयोग)} ने अपना डिग्री पाठ्यक्रम पूरा किया। 12 नए छात्रों {03 पी.एच.डी. (कृषि सांख्यिकी), 05 एम.एस.सी. (कृषि सांख्यिकी) एवं 04 एम.एस.सी. (संगणक अनुप्रयोग)} को प्रवेश दिया गया।

भारत एवं सार्क देशों सहित विदेश के अनुसंधान संस्थानों/विश्वविद्यालयों में सांख्यिकीय आँकड़ों के संकलन, विश्लेषण एवं विवेचना के कार्य में लगे शोधकर्ताओं के लाभार्थ 'कृषि

सांख्यिकी एवं संगणन' में एक उच्च प्रमाण-पत्र पाठ्यक्रम आयोजित किया गया। इस प्रमाण-पत्र पाठ्यक्रम में 08 अधिकारियों ने सहभागिता की।

संस्थान का पुस्तकालय राष्ट्रीय कृषि अनुसंधान प्रणाली (NARS) के अन्तर्गत देश का एक क्षेत्रीय पुस्तकालय है जो संस्थान के प्रयोक्ताओं के साथ-साथ अन्य अनुसंधान संगठनों के प्रयोक्ताओं की सूचना सम्बन्धी आवश्यकताओं को पूरा करने में महत्वपूर्ण भूमिका निभा रहा है। पुस्तकालय की सेवाओं को पूरी तरह से डिजिटाइज्ड कर दिया गया है जो पुस्तकालय की वेबसाइट (<http://lib.iasri.res.in>) पर उपलब्ध है। इस पुस्तकालय में उपलब्ध सभी संसाधनों और सेवाओं के लिंक दिये गये हैं।



## Executive Summary

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

in these disciplines.

A number of research projects were undertaken during the year in different Divisions of the Institute namely Sample Survey, Design of Experiments, Biometrics, Forecasting Techniques, Econometrics and Computer Applications. Research was carried out under 53 research projects in the Institute, of which 35 were Institute funded, 08 AP Cess funded, 09 funded by outside agencies and 01 in collaboration with other institute in various thrust areas. This year, 13 projects were completed and 28 new projects were initiated.

Some of the salient research achievements were:

- Search for Efficient Design of Experiments for Quality Agricultural Research has generated two-level factors Super Saturated Designs (SSDs) using a column-wise coordinate exchange algorithm. The algorithm generates designs for two situations, (a) the design is balanced in the sense that for an  $n$  run design, the +1 and -1 levels appear  $n/2$  times each for all the factors,  $n$  even;

- (b) the design is balanced and there is a subset of factors that are mutually orthogonal in the sense that the inner product of any two columns in this subset vanishes to zero,  $n$  is a multiple of 4. Catalogue of efficient designs generated are available at Design Resources Server ([www.iasri.res.in/design](http://www.iasri.res.in/design)). The concept of unbalanced mixed-level factors SSDs has been introduced and efficiency criteria have been modified for these designs. Lower bounds to these efficiency criteria have been obtained.
- For complete multi-response experiments, it was shown that the designs that were efficient for single response experiments were also efficient for complete multi-response experiments provided that the number of response variables is less than the error degrees of freedom.
  - A method of construction of designs for incomplete multi-response experiments was obtained using combination of randomized complete block (RCB) designs and balanced incomplete block (BIB) designs. The designs obtainable from this method are economical from resource point of view.
  - A step wise procedure of analysis of incomplete multi-response designs obtained as a combination of RCB design and BIB design was developed.
  - Robustness of cyclic designs against correlated observations was studied for Nearest Neighbor [NN] and autoregressive of order 1 correlation structures for different values of correlation coefficients and a list of these designs for number of treatments upto 10 giving A-efficiency was prepared for different values of correlation coefficient.
  - A series of repeated measurements designs for comparing a set of test formulations with another set of reference formulations in bioequivalence trials was obtained and a package Statistical Package for Repeated Measurements Designs (SPRMD) has been developed.
  - A new criterion for identifying robust designs against presence of more than one outlier was developed. Using this criterion, all binary variance balanced block designs were shown to be robust against the presence of two outlying observations. Graphic user interface based software was developed for analyzing experimental data in the presence of outlying observations.
  - In mixture experiments, the efficient designs were obtained by using the criteria of minimizing  $trace(\mathbf{X}\mathbf{X}^{-1})$  (A-efficiency criterion), minimizing  $|\mathbf{X}\mathbf{X}^{-1}|$  (D-efficiency criterion) and G-efficiency (G for global) criterion.
  - Two criteria of robustness of block designs for parallel line and slope ratio assays were developed. Criterion I was based on connectedness property and Criterion II was based upon the A-efficiency of the residual design obtained after deletion of observations from the original design. Robust designs for bioassays against the loss of data were also catalogued.
  - A series of designs involving sequences of treatments with two non-interacting factors for symmetric factorial experiments was obtained. These designs were partially variance balanced for levels of each factor based on circular association scheme.
  - For characterising unimodality or bimodality of rainfall distribution, it was concluded that for unimodal rainfall data sets, the family of Generalized Lambda Distributions (GLD) might be used and on the other hand for bimodal data sets the rainfall distribution could be explained by mixtures of distribution.
  - An alternative methodology for estimation of area and production of horticultural crops was developed which provides integrated design for vegetables and fruit crops and utilised additional information on market arrivals etc. The new methodology is cost effective and procedures are simplified.
  - Biplot analysis was done for identification of subset of genotypes for different subset of locations.
  - For crop forecasting using state space models, Bivariate time series models viz. linear Gaussian state space and Vector Auto-Regression (VAR) were fitted. Using these models, forecasts were obtained for subsequent years and compared with those obtained earlier from corresponding univariate models viz. ARIMA and state space models. At state level, cotton production forecasts obtained using VAR model were found better as against the other models.
  - Neural network models using multilayer perceptron (MLP), radial basis function (RBF)

architectures and weather indices based regression models for forecasting yield of rice, wheat and sugarcane were developed and out of 36 fitted models, it was found that model based on MLP architecture were better in 13 cases, RBF architecture were better in 6 cases and weather based regression models were better in 17 cases.

- A study on editing and imputation using neural networks showed that ANN model performed well for editing non-response.
- The study on adoption and impact of Resource Conservation Technologies (RCT) on Farm Economy showed that RCT helped significantly in increasing the net returns of both rice and wheat growers in various states on Indo-Gangetic Plains of India.
- Under impact assessment of fisheries research in India, it was observed that the share of fisheries sector in Gross Fixed Capital Formation (GFCF) as well as Agriculture GFCF was increasing at a steady pace at constant prices since mid eighties. The Incremental Capital Output Ratio (ICOR) in fisheries sector was very high due to poor growth in fish Gross Domestic Product (GDP) during late seventies and it decelerated to a very low level during eighties due to impressive GDP growth and during late nineties there was a large increase in ICOR due to slow growth in GDP especially due to stagnation in marine production.
- In a study on stable and robust clustering procedures it was seen that the relative percentage misclassification under multiple imputation was found to be low irrespective of the clustering method and distance measure.
- From long term fertilizer experiments, decline in crop yields with the continuous use of nitrogenous fertilizer in soils was observed at most of the centers except at Coimbatore, Ludhiana and Pantnagar. The decline in yield with N alone was quite high in acidic soils at Palampur, Ranchi and Bangalore.
- From intensive cropping experiments for determination of balanced optimum application of NPK, it was observed that integrated application of 100% NPK inorganic (Optimal dose) with organic FYM @ 10-15 t ha<sup>-1</sup> yr<sup>-1</sup> enhanced and sustained crop productivity and soil fertility. These findings were also corroborated by their respective yield sustainability indices worked out across the years. The application of FYM besides supplying additional quantities of NPK had its beneficial effect on the soil properties.
- Regression analysis between grain yield and auxiliary characters showed that plant height was not significantly contributing to the grain yield whereas number of grains/panicles followed by number of ear bearing tillers/s.u. were significantly contributing to the grain yield.
- From a statistical investigation on production, economic and energy potential of crop sequences in different agro-ecosystems, it was concluded that the three crop sequences including onion as one of the crop could preferably be tried at CSR Junagarh centre like pearl millet-onion-cowpea and soyabean-onion-cowpea. It not only enhanced the net return but also provided the cereal, pulses, oilseeds along with carbohydrates and iron energy enriched onions. Land use efficiency was also found to be maximum of these sequences.
- A web-enabled Agricultural Field Experiments Information System (AFEIS) has been developed wherein information relating to informed agricultural field experiments (excluding pure varietal trials) conducted in the country are stored and maintained on-line. The system has potential to serve as a reference material for scientists, research workers and planners, etc. in the field of agricultural sciences. Presently, the database has an information relating to 24000 agricultural field experiments conducted at various Agricultural Universities, ICAR Research Institutes, Project Directorates, All India Coordinated Research Projects and Directorates of Agriculture of State Governments, etc.
- A Beta-version of software for generation of nested block designs both for independent errors and correlated errors was developed.
- A "National Information System on Agricultural Education Network in India (NISAGENET)" was developed and implemented at 42 participating organizations that included State Agricultural Universities, ICAR Deemed to be Universities, Allahabad Agricultural Institute, Central Agricultural University and Central Universities imparting agricultural education in India.
- Software for Survey Data Analysis (SSDA) was developed. This software estimates the

population parameters based on the sampling data collected using the important common sampling designs like simple random, stratified, systematic, cluster, two stage and stratified two stage.

- Existing PERMISnet has been upgraded to .NET platform and strengthened with new modules and manpower planning reports. System has been enriched with many new features like RMP (Research Management Personnel) module, Modification in access rights, new forms and reports for improved decision support.
- “Statistical Package for Animal Breeding 2.1 (SPAB2.1)”, was initiated and eight programs of the package were developed.
- “Decision support system for manpower planning - PERMISnet” was initiated. Data of online PERMISnet system was merged with the new database structure of PERMISnet-II system. Some new reports for manpower planning were developed and integrated with PERMISnet-II system.
- “Web solutions for Partially Balanced Incomplete Block (PBIB) Designs” was initiated. Methods of construction of some classes of PBIB designs were compiled from the literature. Computer module was developed for generating the randomized layout of these designs. Designing of e-learning material on PBIB designs has been initiated.
- “Knowledge data warehouse for agricultural research” was initiated. OLAP cubes for the Census Survey Data (2001) were prepared for some states.
- Data on IVT from NRC on R&M, Bharatpur and from DWR, Karnal were analyzed to examine the usefulness of resolvable incomplete block designs in controlling the variability in the experimental material.
- Design Resources Server was strengthened by adding links on  $\alpha$ -designs, designs for bioassays, supersaturated designs, modules for generation of randomized layout of square lattice designs, basic designs such as completely randomized designs, RCB designs, latin square designs and augmented designs. A new page “Analysis of Data” has been created on Design Resources Server that provides steps of analysis of data generated through designed experiments using

SAS and SPSS. A Discussion Board has been initiated for sharing research with fellow scientists over the globe and for flagging issues for attention of scientific community. A list of experts in design of experiments over the globe is uploaded which will be useful for establishing linkages.

- The methodology developed by the Institute for estimation of area under paddy crop was implemented in the whole Meghalaya State and another study “Developing remote sensing based methodology for collecting agricultural statistics in North-East hilly region, was initiated to develop remote sensing based sampling methodology for multiple crops acreage.
- For identifying the causes of variation between the official and trade estimates of cotton production, the re-analysis of data pertaining to crop cutting experiments was taken up for methodological developments.
- A study entitled “Estimation of extent of farming practices, resources and activities with energy use” was initiated.
- A study “to develop sampling methodology for estimation of production of mushroom” was initiated.
- “Study on status and projection estimates of agricultural implements and machinery”, was initiated.
- “Strengthening, refining and implementation of expert system on wheat crop management” was initiated. Few interfaces were designed in Hindi.
- National Information System on Agricultural Education Network in India (NISAGENET II) was initiated.
- The Institute had taken lead in publication of Agricultural Research Data Books since 1996. The Agricultural Research Data Book 2007 which was eleventh in the series was published.

Scientists of the Institute published 67 research papers in National and International refereed Journals along with 7 abstracts, 10 popular articles, 3 book chapters, 13 project/technical reports, 2 monographs, 1 e-manual, 1 lesson series and 1 seminar write-up.

Several meetings of the QRT were held with different scientific, technical. and administrative groups. QRT also met with IMC of the Institute for getting feedback from the members of the IMC. Finally Chairman, QRT



on the advice of Director General of the Council submitted the report of QRT to the Director of the Institute.

The first meeting of common Research Advisory Committee (RAC) of the Indian Agricultural Statistics Research Institute (IASRI) and National Centre for Agricultural Economics and Policy Research (NCAP) was held under the Chairmanship of Dr. P.V. Shenoi, Former Special Secretary, Ministry of Agriculture, Govt. of India.

Dr. Rajender Parsad, National Fellow received the NAAS- Associateship.

Dr. Cini Varghese, Senior Scientist, received the Lal Bahadur Shastri Young Scientist Award for the Biennium 2005-2006 in the field of Social Sciences.

Dr. P. Visakhi, Librarian was awarded a prestigious award of "Young Information Scientist for 2006" by Society for Information Science (SIS).

Scientists of the Institute were deputed for presentation of their papers in several National/International conferences.

Dr. Prajneshu, Head Biometrics, participated in the International Conference on Advances in Interdisciplinary Statistics at Greensboro, U.S.A. during 12-14 October 2007.

Dr. V.K. Bhatia, Professor (Agricultural Statistics) and In-charge(RCMU) participated in Fourth International Conference in Agricultural Statistics at Beijing, China during 22-24 October 2007.

Dr. Sushila Kaul, Senior Scientist, participated in Economic Modelling Conference at Moscow during 12-14 September 2007 and 1st CIRIEC International Conference on Social Economy at Victoria, BC, Canada during 22-25 October 2007.

To promote Hindi, a poster presentation was organized at the Institute and scientists were also awarded for their outstanding contributions in preparation of Hindi posters.

XV National Conference of Agricultural Research Statisticians of ICAR was organized by the Institute at Birsa Agricultural University, Ranchi during 03-04 December 2007.

For installation and implementation of application softwares developed for NISAGENET, 2 days onsite trainings were organized and the software was made operational at the LAN of all the 42 participating organisations.

A two days workshop was organized on PERMISnet and Intelligent Reporting System of ICAR.

Four 21 days duration training programmes under Centre of Advanced Studies on Spatial and Non-Spatial Information Management and Mining in Agriculture, Advances in Quantitative Techniques for Policy Analysis in Agricultural Economics, Advances in Biometrical Techniques and Development of Web Applications for Knowledge Dissemination in Agriculture were organised.

One day training course entitled "Official Statistics and related Methodology", was organised on 31 October 2007 for the International participants.

A study tour for the two participants of Senior Certificate Course from Afghanistan was conducted.

A FAO sponsored Study Visit of participants from Afghanistan was organised during 10-29 December, 2007. As part of the study visit, the participants were taken to DES, Trivandrum during 16-19 December 2007 and to DES, Hyderabad during 25-27 December 2007.

A winter school on "Sample Survey Techniques in Agricultural Research", was organized at the Institute from 16 January to 05 February, 2008.

A training programme on "Research Methodology" was organized from 07 to 18 January 2008 for scientists of Indian Council of Forestry Research and Education (ICFRE).

The activities relating to education and training which include planning, organization and coordination of the entire Post-graduate teaching programmes of the Institute were undertaken in collaboration with PG School, IARI. During the year, a total of 19 students (07 Ph.D. (Agricultural Statistics), 05 M.Sc. (Agricultural Statistics) and 07 M.Sc. (Computer Application)] completed their degrees. 12 new students (03 Ph.D. (Agricultural Statistics), 05 M.Sc. (Agricultural Statistics) and 04 M.Sc. (Computer Application) were admitted.

A "Senior Certificate Course in Agricultural Statistics and Computing" was organised for the benefit of research workers engaged in handling statistical data collection, processing, interpretation and employed in research Institutions/Universities of India and foreign including SAARC countries. Eight officials participated in this Certificate Course.

The Library of the Institute with a status of Regional Library under NARS, played a vital role in meeting the information needs of the in-house users as well as users from other research organisations. The library services have been totally transformed into digital form with the launch of elaborated and well featured website of Library (<http://lib.iasri.res.in>) with link to all resources and services available in Library.

# ORGANOGRAM

RESEARCH ADVISORY COMMITTEE

DIRECTOR

INSTITUTE MANAGEMENT COMMITTEE

HEAD OF DIVISION

- SAMPLE SURVEY
- DESIGN OF EXPERIMENTS
- BIOMETRICS
- FORECASTING TECHNIQUES
- ECONOMETRICS
- COMPUTER APPLICATIONS

OFFICER INCHARGE

- RESEARCH COORDINATION AND MANAGEMENT UNIT
- INSTITUTE TECHNOLOGY MANAGEMENT UNIT
- LIBRARY AND DOCUMENTATION
- CENTRE OF ADVANCED STUDIES
- GUEST HOUSE

PROF.(AG. STAT.)  
PROF. (COM.APPLN.)  
WARDEN

TRAINING ADMINISTRATION CELL

OMV UNIT

OSD & HEAD OF OFFICE

- ADMN. I SECTION
- ADMN. II SECTION

ADMINISTRATION

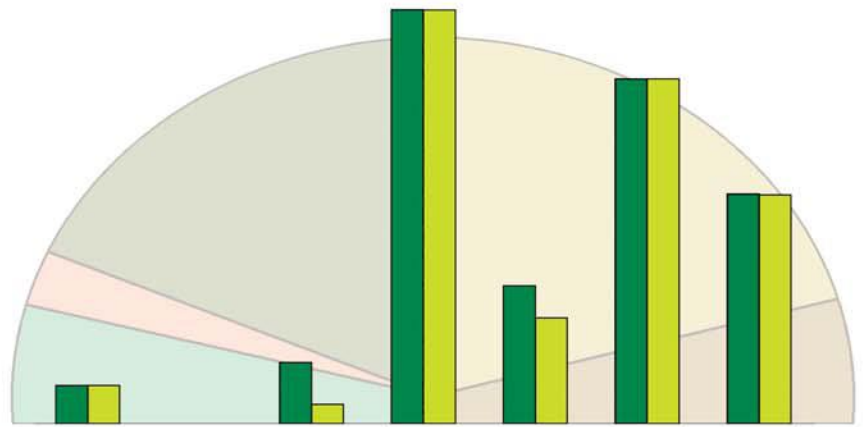
CAO

- CASH SECTION
- CENTRAL PURCHASE SECTION
- WORKS SECTION
- R & D SECTION
- HINDI SECTION
- MAINTENANCE SECTION

F & AO

- AUDIT SECTION
- ACCOUNTS SECTION

# 2



## Introduction

### Brief History

The Institute made a modest beginning in 1930 as a small Statistical Section in the then Imperial Council of Agricultural Research to assist the State Departments of Agriculture and Animal Husbandry in planning their experiments, analysis of experimental data, interpretation of results and also rendering advice on the formulation of the technical programmes and examining the progress reports of the schemes funded by the Council. The activities of the Section increased rapidly with the appointment of Dr. PV Sukhatme as Statistician to the Council in 1940 and researches were initiated for developing objective and reliable methods for collecting yield statistics of principal food crops. The efficiency and practicability of these methods was demonstrated in different States for estimating yield by crop cutting experiments. The result was such that, in the course of a few years, the method was extended practically to the entire country to cover all principal food and non-food crops.

Research in sampling theory and training of field staff and statistical staff were the activities initiated in this period resulting in the re-organization of the Statistical Section into a Statistical Branch in 1945 with appropriate expansion in its strength. The designation of Statistician was changed to Statistical Advisor. The Statistical Branch was renamed as Statistical Wing in 1949. The Statistical Wing soon acquired international recognition as a centre for research and training in the field of Agricultural Statistics. During 1952 on the recommendations of two FAO experts, Dr. Frank Yates and Dr. DJ Finney, who visited the Council on the invitation of the Government of India, activities of the Statistical Wing were further expanded and diversified. Subsequently, in recognition of its important role as a training and research institution, the Statistical Wing was re-designated as the Institute of Agricultural Research Statistics (IARS) on 02 July 1959. An important landmark in the development of the Institute was the installation of an IBM 1620 Model-II Electronic

Computer in 1964. Another major landmark for the Institute was the signing of a Memorandum of Understanding with Indian Agricultural Research Institute (IARI), New Delhi in 1964, consequent to which new courses leading to M.Sc. and Ph.D. degrees in Agricultural Statistics were started in collaboration with IARI in October 1964. In April 1970, the Institute was declared as a full-fledged Institute in the ICAR system and is since then headed by a Director. On 01 January 1978 the name of the Institute was changed to Indian Agricultural Statistics Research Institute (IASRI) emphasizing the role of 'Agricultural Statistics' as a full-fledged discipline by itself.

The main thrust of the Institute is to conduct basic, applied and adaptive research in Agricultural Statistics and Computer Application, to develop trained manpower and to disseminate knowledge and information produced so as to meet the methodological challenges of agricultural research and also to improve the quality of agricultural research in the country. Through the untiring and concerted efforts of the scientists, the Institute has made its presence felt in the National Agricultural Research System (NARS). The Institute is also becoming progressively a repository of information on agricultural research data and has taken a lead in the country in developing a data warehouse on agricultural research data. The Institute also occupies a place of pride in the National Agricultural Statistics System and has made several important contributions in the strengthening of the National Agricultural Statistics System, which has a direct impact on the national policies. The methodology for agricultural crop insurance based on small area statistics is one of the recent important contributions of the Institute.

As the activities of the Institute started expanding in all directions, the infrastructure facilities also started expanding. Two more buildings 'Computer Centre' and 'Training-cum-Administrative Block' were constructed in the campus of the Institute in the years 1976 and 1991, respectively. A third generation computer Burroughs B-4700 system was installed in March 1977. A large number of computer programs for specific problems as also general purpose application softwares were developed. The Burroughs B-4700 system was replaced in 1991 by a Super Mini COSMOS-486 LAN Server with more than hundred nodes consisting of PC/AT's, PC/XT's and dumb terminals all in a LAN environment. Later, COSMOS-486 LAN Server was

replaced by a PENTIUM-90 LAN Server having state-of-art technology with UNIX operating system. Computer laboratories equipped with PCs, terminals and printers, etc. had been set up in each of the six Scientific Divisions as well as in the Administrative Wings of the Institute.

For undertaking research in the newer emerging areas, a laboratory on Remote Sensing (RS) and Geographic Information System (GIS) was created in the Institute. The laboratory was equipped with latest state-of-art technologies like computer hardware and peripherals, Global Positioning System (GPS), softwares like ER Mapper, PC ARC/INFO, Microstation 95, Geomedia Professional, ARC/INFO Workstation and ERDAS Imagine with the funds received through two AP Cess Fund projects. This computing facility has further been strengthened with the procurement of ARC-GIS software under NATP programme.

Recently an Agricultural Bioinformatics Lab (ABL) fully equipped with software and hardware has been created to study crop and animal biology with the latest statistical and computation tools.

The LAN at IASRI has steadily been strengthened and the three buildings of IASRI have been connected using fiber optics cable as backbone and connectivity has been established for 413 nodes, the LAN being switch manageable. E-mail and Internet facilities are being provided to the scientists/technical/administrative staff of IASRI. The Intranet services consisting of E-mail, notice board, details of the account holders, search facility, etc. are also available over the LAN to all the users. The notice board facility is being used for information dissemination among the users of the Institute.

Keeping pace with the emerging technologies in the area of Information Technology (IT), from the year 1998 onwards the computer hardware and software have been constantly upgraded/replaced with newer platforms, new software and upgrades. Currently the internet services are being provided through three secure servers, two of them being high-end servers with multiple CPU capabilities on a 2 Mbps leased line with 1.5 Mbps bandwidth provided under the NATP projects. The computing environment in the Institute has latest PCs, note book computers, laser printers both colour and B/W inkjet printers, scanners, CD-writers and video projectors. Software packages that are needed for application development, statistical

data analysis, network securities, etc. are being made available to the scientists and staff of the Institute. Some of the important softwares that are available in the Institute are SAS, SPSS, SYSTAT, GENSTAT, GLIM, Data warehouse software – Cognos, SPSS clementine, Irwin, MS Office, MS Visual Studio, Macro-Media, MS Project, STAR3, E-views, Gauntlet Active Firewall, Trend Micro Antivirus, etc. The latest versions of software package STATISTICA NEURAL NETWORKS, Gauss Software, Minitab 14, Maple 9.5, Matlab Eviews Std 5.0, Systat, Statistica, Sigma Plot and Lingo Super have been recently added to the library of software packages. Web Statistica software package has also been added to the list of software packages. All the administrative and accounts sections of the Institute have been provided with PCs, printers and UPS.

The Institute continued to provide selective information documentation services to scientists in the ICAR Institutes and Agricultural Universities on references to documents relating to areas of their specific interest. The bibliographic databases in Biotechnology and Animal Science Research are being maintained in the Bio-Informatics Laboratory providing Selective Dissemination of Information (SDI) services on VETCD, BEASTCD and AGRICOLA databases of the Food and Agriculture Organisation under United Nations.

The Institute functioned as a Centre of Advanced Studies in Agricultural Statistics and Computer Application during October, 1983 to March 1992 under the aegis of the United Nations Development Programme (UNDP). This programme aimed at developing a Centre of Excellence with adequate infrastructure and facilities to undertake advanced training programmes and to carry out research on various aspects of Agricultural Statistics and Computer Application. Under this programme, a number of distinguished statisticians and computer experts from abroad visited the Institute with a view to interacting with the scientists of the Institute, giving seminars/lectures and suggesting improvements in the research programmes of the Institute.

Another Centre of Advanced Studies (CAS) programme in Agricultural Statistics and Computer Application was established during the VIII Five Year Plan in 1995.

During the year 2004 training programmes were organised by the Institute under this programme, so far 39 training programmes have been organised. In

all a total of 700 participants have been benefited.

A course leading to M.Sc. degree in Computer Application in Agriculture was initiated from the session 1985–86, which was subsequently changed to M.Sc. (CA) from the session 1993–94. The Institute has so far produced 163 Ph.D. and 277 M.Sc. students in the discipline of Agricultural Statistics and 73 M.Sc. students in the discipline of Computer Application.

For the benefit of statisticians and other workers for whom the knowledge of statistics is essential, the Institute had been organizing four professional courses in statistics namely Professional Statisticians' Certificate Course (PSCC), Senior Certificate Course (SCC), Junior Certificate Course (JCC) and Post Graduate Diploma in Agricultural Statistics. The PSCC and SCC courses were of one year duration while JCC was of six months duration. The Post Graduate Diploma Course was of one year duration, in which the students were required to conduct research for one year. These courses were providing a linkage of the Institute with State Departments of Agriculture and Animal Husbandry. Due to some reasons these courses were discontinued. Later on, in view of growing demand from various quarters, the Institute revived the Senior Certificate Course in 'Agricultural Statistics and Computing' in 1997 with appropriate changes in the course curriculum in Agricultural Statistics with adequate exposure of Computer Application.

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

The Standing Finance Committee had approved the X Plan budget of the Institute. The total outlay of Rs. 825 lakhs was sanctioned under the X Plan budget of the Institute.

### Organisational Set-up

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

**Divisions**

- Sample Survey
- Design of Experiments
- Biometrics
- Forecasting Techniques
- Econometrics
- Computer Applications

**Units**

- Research Co-ordination and Management Unit (RCMU)
- Institute Technology Management Unit (ITMU)

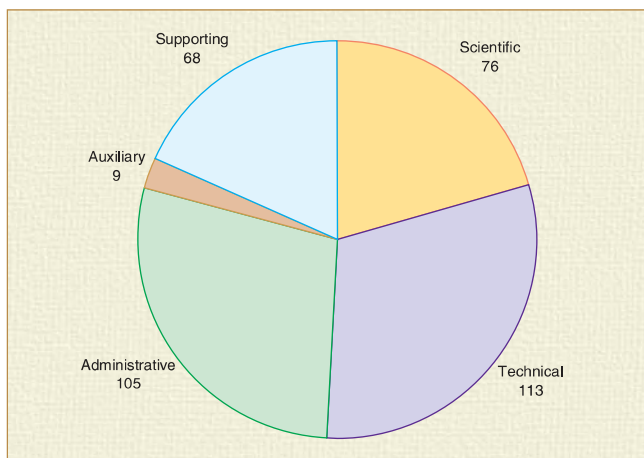
**Cells**

- Training Administration Cell (TAC)
- Consultancy Processing Cell (CPC)
- Planning, Monitoring and Evaluation Cell (PMEC)

**Staff Position (as on 31 March 2008)**

Manpower	No. of posts sanctioned	No. of posts filled
Director	1	1
Scientific	130	75
Technical	232	113
Administrative	109	*105
Auxiliary	14	9
Supporting	85	68
<b>Total</b>	<b>571</b>	<b>371</b>

\*After reduction the cadre strength of three administrative posts (three Steno Grade-III) would be effective from the date of superannuation.



Staff Strength in Position as on 31 March 2008

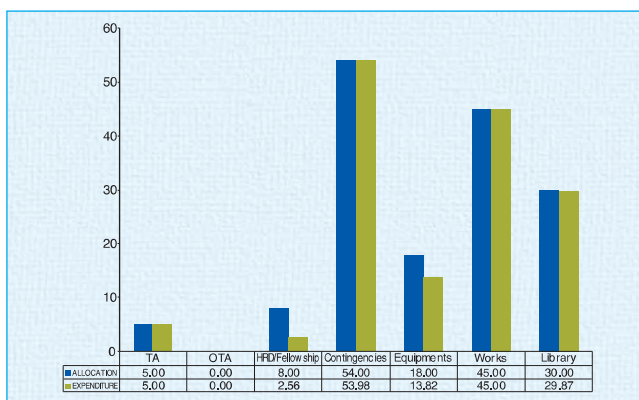
**Financial Statement**

Through regular monitoring, the Institute was able to ensure optimal utilization of funds available in the budget. The actual utilization of the budget both under the plan and non-plan is furnished below:

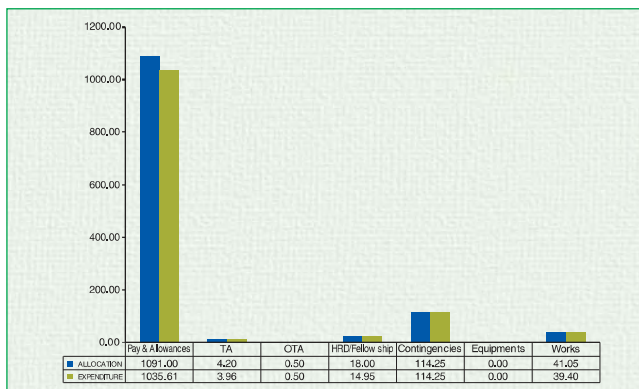
**Budget Allocation vis-à-vis Utilization (2007-08)**

(Rupees in Lakhs)

Head of Account	Allocation		Expenditure	
	Plan	Non-Plan	Plan	Non-Plan
Pay & Allowances	0.00	1091.00	0.00	1035.61
TA	5.00	4.20	5.00	3.96
OTA	0.00	0.50	0.00	0.50
HRD/Fellowship	8.00	18.00	2.56	14.95
Contingencies	54.00	114.25	53.98	114.25
Equipments	18.00	0.00	13.82	0.00
Works	45.00	41.05	45.00	39.40
Library	30.00	0.00	29.87	0.00
<b>Total</b>	<b>160.00</b>	<b>1269.00</b>	<b>150.23</b>	<b>1208.67</b>



Budget for the Year 2007-08 (Plan)



Budget for the Year 2007-08 (Non-Plan)

# 3



## Research Achievements

The research targets set by the Institute were implemented by six Divisions of the Institute, viz. Sample Survey, Design of Experiments, Biometrics, Forecasting Techniques, Econometrics and Computer Applications. The basic, applied, adaptive and strategic research in Agricultural Statistics and Computer Application is carried out under six broad programmes that cut across the boundaries of the Divisions and encourage interdisciplinary research. The six programmes are as under:

1. Development and analysis of experimental designs for agricultural system research
2. Forecasting and remote sensing techniques and statistical applications of GIS in agricultural systems
3. Development of techniques for planning and execution of surveys and analysis of data including economic problems of current interest
4. Modeling and simulation techniques in biological systems

5. Development of informatics in agricultural research
6. Teaching and training in Agricultural Statistics and Computer Application

### Programme 1: DEVELOPMENT AND ANALYSIS OF EXPERIMENTAL DESIGNS FOR AGRICULTURAL SYSTEM RESEARCH

#### Designs for Single Factor and Multi-Factor Experiments and their Applications in Agricultural Systems Research (National Professor Scheme)

Supersaturated designs (SSDs) offer a potentially useful method of examining many design factors with few tests or experiments. Once the factors influencing the design's performance are identified, the designer may rapidly make meaningful design decisions. SSDs investigate  $m$  factors with  $n$  experiments, where  $m > n-1$ . These designs are useful for screening out the important and potentially active factors and economize on the resources to a great extent. SSDs

do not allow an estimation of individual effects, since even the main effects are confounded. But because of their run size economy, these designs can be broadly exploited to screen active factor main effects when experimentation is expensive and the number of factors are large.

A column-wise coordinate exchange algorithm has been developed that generates two-level factors SSDs. The algorithm generates efficient designs for two different situations, viz. (a) the design is balanced in the sense that for an  $n$  run design, the +1 and -1 levels appear  $n/2$  times each for all the factors and  $n$  is even; (b) the design is balanced and there is a subset of factors that are mutually orthogonal in the sense that the inner product of any two columns in this subset vanishes to zero and  $n$  is a multiple of 4. The algorithm also computes lower bound to efficiency of the design generated. Computer Catalogue of SSDs obtained are available on the Design Resources Server for use of experimenters.

For mixed-level factors SSDs, efficiency criteria  $E(f_{UNOD})$  and  $\chi_U^2(D)$  have been defined for the unbalanced designs for which the factor levels do not appear a constant number of times in the design. Lower bounds to  $E(f_{UNOD})$  and  $\chi_U^2(D)$  have been obtained. Some examples of efficient unbalanced designs are given.

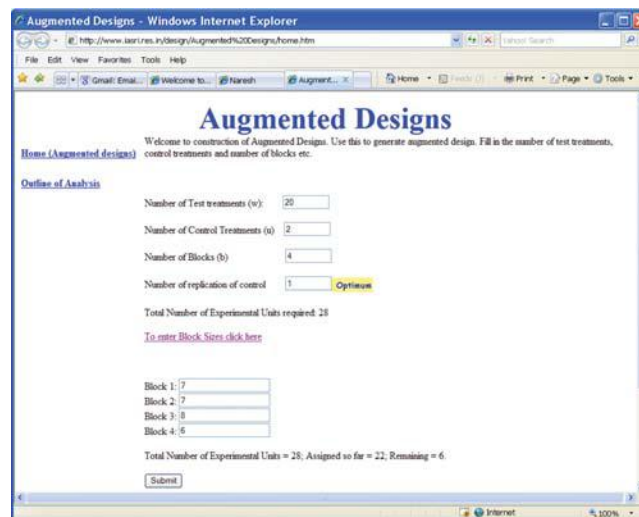
Orthogonal arrays (symmetric) and Mixed orthogonal arrays (MOA) are useful as fractional factorial plans. In particular, MOAs of strength two are used extensively as orthogonal main effect plans for asymmetrical factorials. The notion of resolvable MOAs along with the notion of Kronecker product and Kronecker sum of matrices has been exploited intensely in the literature to develop methods of construction of OAs and MOAs. The concept of Kronecker sum of matrices has been extended to MOAs and using this concept together with resolvable MOAs many series of new MOAs have been obtained. These arrays can be exploited to obtain SSDs.

A monograph on Hadamard matrices has been published. The monograph contains a compact disk that gives Hadamard matrices of all permissible orders up to 1000. This monograph would be useful for students as well as researchers in many areas of statistics, particularly in design of experiments, sample surveys and coding theory.

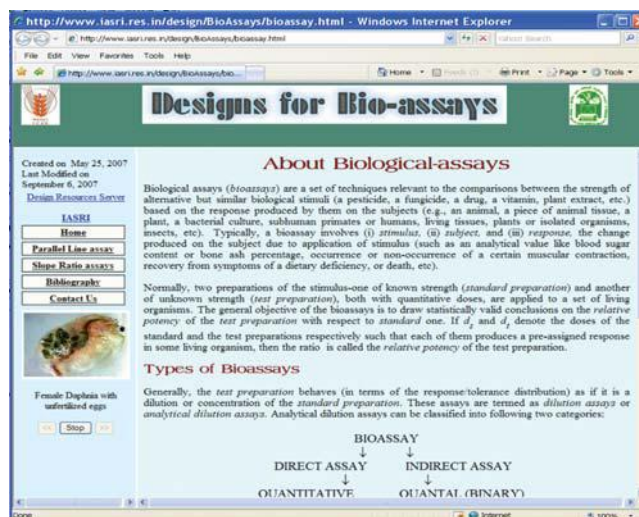
The Design Resources Server was strengthened in collaboration with National Fellow by adding the

following links.

**Online Module for Generation of Randomized Layout of an Augmented Randomized Complete Design with Optimum Replication of Control Treatments in Each Block:** Randomized layout of augmented randomized complete block designs for given number of test treatments, control treatments and number of blocks can be generated using ([www.iasri.res.in/design/Augmented%20Designs/home.htm](http://www.iasri.res.in/design/Augmented%20Designs/home.htm)).



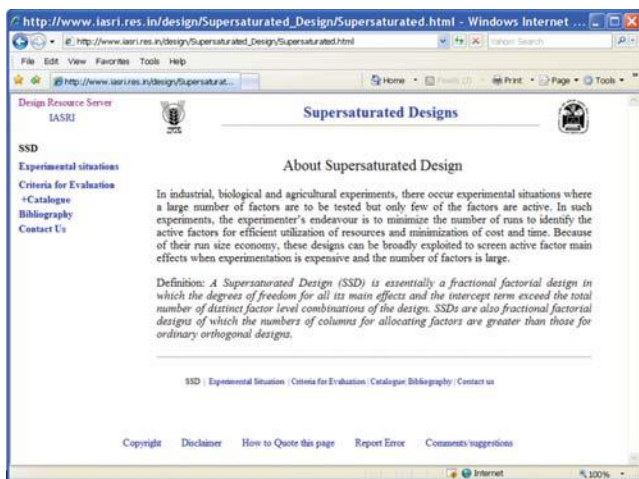
**Designs for Bioassays:** Designs for biological assays help in the estimation of the *relative potency* of the *test preparation* with respect to *standard* one. The material uploaded on Design Resources Server includes





contrasts of interest in parallel line assays and slope ratio assays. The catalogue of efficient block designs for parallel line assays was given. One can generate the block contents of the required design by clicking on the design in catalogue. ([www.iasri.res.in/design/BioAssays/bioassay.html](http://www.iasri.res.in/design/BioAssays/bioassay.html)).

**Supersaturated Designs:** Definition of supersaturated designs, experimental situations in which supersaturated designs are useful, efficiency criteria for evaluation of supersaturated designs, catalogue of supersaturated designs for asymmetrical factorial experiments and bibliography on supersaturated designs has been uploaded on the Server. The complete details of the runs can be obtained by clicking on the required design in the catalogue. ([www.iasri.res.in/design/Supersaturated\\_Design/Supersaturated.html](http://www.iasri.res.in/design/Supersaturated_Design/Supersaturated.html))



### Efficient Design of Experiments for Quality Agricultural Research (National Fellow Scheme)

Experiments, in which data on several response variables are measured from an experimental unit corresponding to the application of a treatment, are known as multi-response experiments. Complete multi-response experiments are those experiments in which all the response variables are recorded from each experimental unit. These experiments are generally conducted using designs that are optimal/efficient for single response situations. The question, therefore, is, whether the designs that are optimal/efficient for single response situations are efficient for multi-response experiments? To answer this question, it has been

shown that the designs that are efficient for single response experiments are also efficient for complete multi-response experiments. The only requirement is that the number of response variables should be less than the error degrees of freedom.

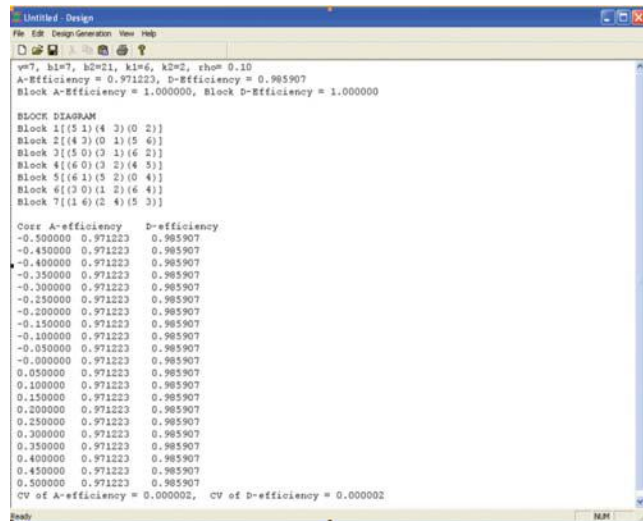
In many multi-response experiments, due to constraints on resources and time, it may not be feasible to collect the observations on all the response variables from each experimental unit. As a consequence, the data on a subset of response variables is collected from one subset of units; the data on other subset of response variables is collected from other subset of units. Some of the subsets of units/response variables may be common. Such experiments are known as incomplete multi-response experiments and are quite common in agro-forestry experiments, intercropping experiments, microbial experiments where the interest is in studying rate of growth of a number of bacterial cultures and it is not possible to record all the growth parameters. A method of construction of designs for incomplete multi-response experiments has been obtained using combination of randomized complete block (RCB) designs and balanced incomplete block (BIB) designs. Here RCB design is treatment-wise design (experimental designs used to allocate the treatments in each set) and BIB design is response-wise design (experimental designs used to allocate the response variables in different sets). To accommodate more number of response variables, the use of a singular group divisible design as response-wise design instead of a BIB design has been suggested. One can also take a minimally connected design with some extra observations as treatment-wise design and select a response-wise design in which pair wise concurrences of the response variables is greater than one. The designs obtainable from this method are economical from resource point of view.

A step wise procedure of analysis of incomplete multi-response designs obtained as a combination of RCB designs and BIB designs has been developed and illustrated through an example.

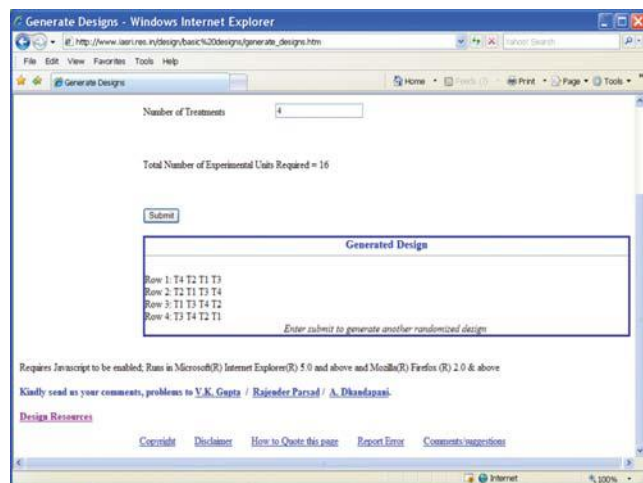
A  $\beta$ -version of the software for generation of efficient nested block designs has been developed. It consists of 3 modules viz. (i) nested block designs with independent observations; (ii) nested block designs when the observations within a sub-block have a nearest neighbour correlation structure and (iii) nested block designs when the observations within a sub-block

have a nearest autoregressive correlation structure. Once the number of treatments ( $v$ ), number of bigger blocks ( $b$ ), bigger block size ( $k$ ), number of sub-blocks nested within a block ( $q$ ) and the value of correlation coefficient ( $r$ ) is entered (in correlated case), the design gets generated.

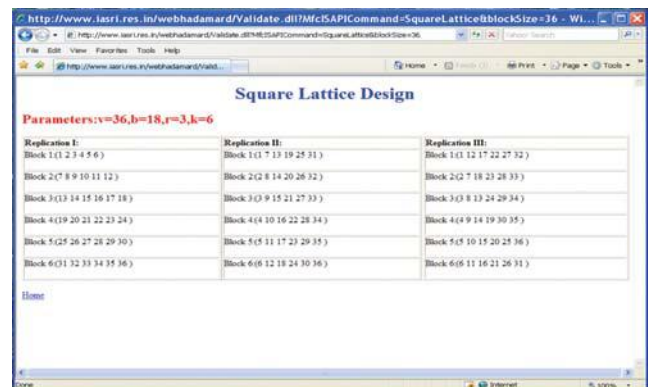
Design Resources server has been further strengthened in collaboration with National Professor. The following new additions have been made.



- Online modules for generation of randomized layout of basic designs such as completely randomized designs, randomized complete block designs and latin square designs can be obtained at ([www.iasri.res.in/design/Basic%20Designs/generate\\_designs.htm](http://www.iasri.res.in/design/Basic%20Designs/generate_designs.htm)).

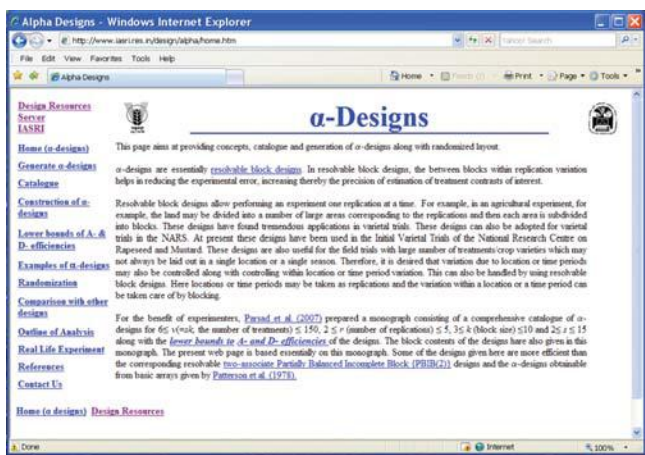


- Online software for generation of square lattice designs with 3 replications has been prepared and uploaded on Design Resources Server ([www.iasri.res.in/WebHadamard/square%20lattice.htm](http://www.iasri.res.in/WebHadamard/square%20lattice.htm)).

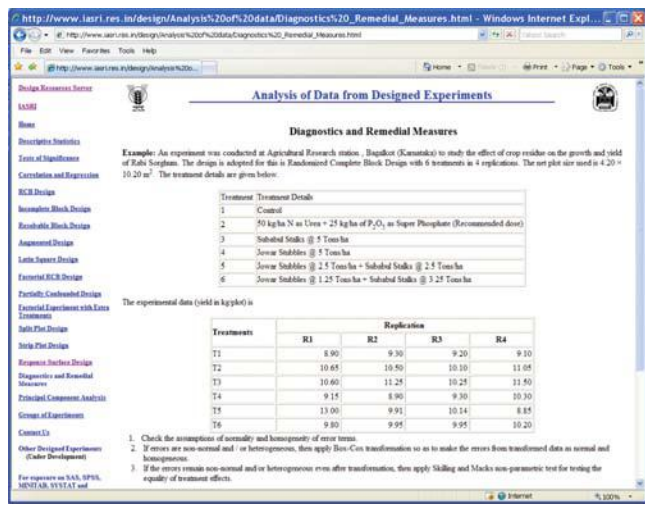


- For the benefit of experimenters and practicing statisticians, a webpage of  $\alpha$ -designs has been linked to Design Resources Server and is available at [www.iasri.res.in/design/Alpha/Home.htm](http://www.iasri.res.in/design/Alpha/Home.htm). One can generate  $\alpha$ -designs along with the randomized layout for number of treatments lying between 6 and 150, replications less than or equal to 5 and of block sizes lying between 3 to 10 along with block contents. All concepts and details on  $\alpha$ -designs are also available on this URL.

- A new page "Analysis of Data" has been launched on Design Resources Server. The purpose of this web page is to provide steps of analysis of data generated from designed experiments by using statistical packages like SAS, SPSS,



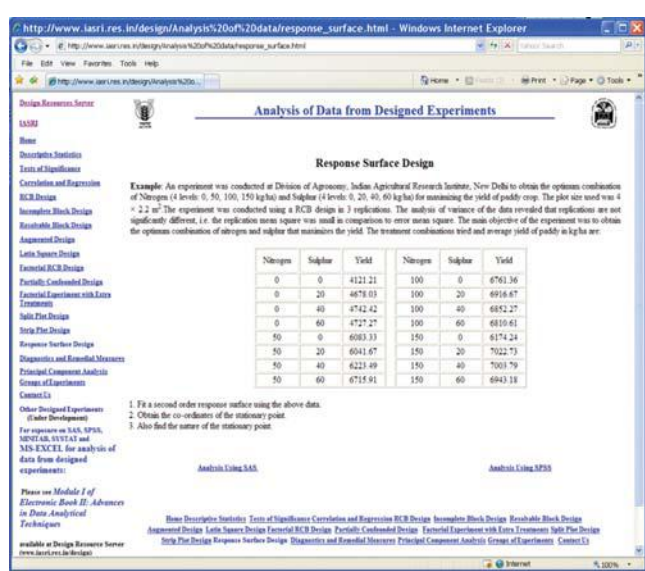
- A SAS macro for performing diagnostics (normality and homogeneity of errors) in



MINITAB, SYSTAT, MS-EXCEL, etc. At present steps for analysis of data generated from randomized complete block designs, incomplete block designs, resolvable incomplete block designs, latin square designs, factorial experiments conducted using a randomized complete block design, partially confounded factorial experiments, balanced confounded factorial experiments with extra treatment, response surface designs, correlation and regression and test of significance using SAS and SPSS are uploaded on this page. The steps for performing multiple comparison procedures and treatment contrast analysis are also given both using SAS and SPSS. The data files and result files can also be downloaded.

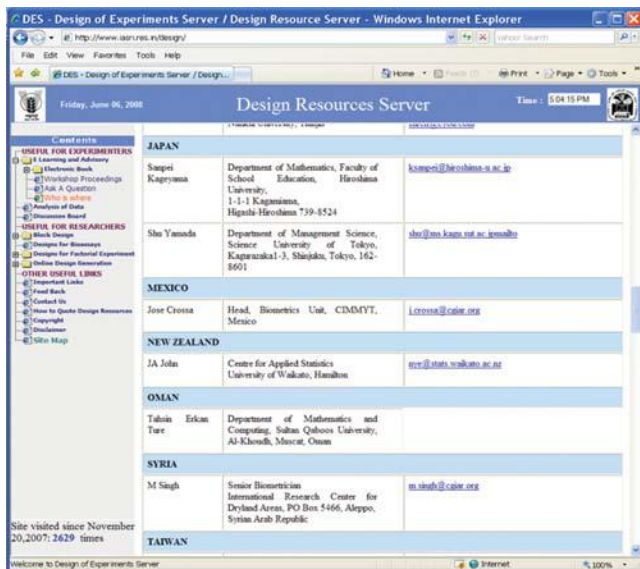
experimental data generated through randomized complete block designs and then applying remedial measures such as Box-Cox transformation is also available on this server.

- A Discussion Board has also been created for sharing any useful piece of research or idea with any other scientist over the globe. Number of



registered participants till 31 March 2008 are 38 (18: Agricultural Research Statisticians; 19: Experimenters and One Vice-Chancellor). (www.iasri.res.in/design/MessageBoard/MessageBoard.asp).

- Addresses of important contributors in Design of Experiments including their E-mail addresses are linked to Design Resources Server. The list



includes experts from USA, Canada, Australia, UK, China, Japan, Mexico, New Zealand, Oman, Syria, Taiwan, Vietnam and India. This information is useful for all the researchers in Design of Experiments in establishing linkages with their counterparts over the globe.

- Feedback/ comments received on the Design Resources Server has also been linked with Design Resources Server. Feedback from 18 researchers (6: Design Experts from India; 7: Experts from abroad; 3: Experimenters and 2: Agricultural Research Statisticians) were received.

### Cropping Systems Research

#### Planning, designing and analysis of experiments planned 'On Stations' under the Project Directorate for Cropping Systems Research

An experiment "Sustainable production model on rice-wheat cropping system" was conducted at Kanpur centre (1997-98 to 2004-05) for sustainable production management. First of all, unsustainable practices were critically examined and treatments were formulated accordingly to develop alternative strategies for sustainable production. It was observed that recommended dose of fertilizer along with 10% extra N (T4) applied to both the crops gave the maximum

yield of 49.13 q/ha (rice) and 43.83 q/ha (wheat). None of the other three treatments were found statistically at par. Order of performance of treatments both during kharif and rabi and in terms of Rice Equivalent Yield was found to be same i.e. T4 > T3 > T2 > T1.

#### Planning, designing and analysis of 'On Farm Research Experiments' planned under the Project Directorate for Cropping Systems Research

Under the 'On Farm Research' programme, three different types of experiments viz. Response of nutrients, Diversification and/or intensification of cropping system and Sustainable production system were undertaken at 32 on-farm centres. The data of 130 experiments conducted at 1984 farmer's field during 2006-07 at 28 on-farm centres were processed for statistical analysis.

Under Sustainable Production System, experiments were undertaken to address the deficiency of micronutrients (Zinc) in Rice-Wheat Cropping Systems at Bhavanipatnam (Orissa) and Sultanpur (U.P.) from 2001-02 to 2005-06. At Bhavanipatnam (Orissa) application of ZnSO<sub>4</sub> @ 25 kg/ha to both crops brought out about 11.36% and 15.02% increase in yield over farmer's practice during kharif and rabi seasons respectively. Also application of recommended dose of fertilizer along with ZnSO<sub>4</sub> @ 25 kg/ha gave the highest increase (21.78% and 24.94%) in grain yield of rice and wheat respectively. At Sultanpur (U.P.) application of ZnSO<sub>4</sub> @ 25 kg/ha increased rice and wheat yield 11.47% and 13.29% over the farmer's practice.

#### Planning, designing and analysis of data relating to experiments conducted under AICRP on Long-Term Fertilizer Experiments

Under the project yearly and pooled analysis of data from experiments have indicated that

- Decline in crop yields with the continuous use of nitrogenous fertilizer in soils at most of the centres except at Coimbatore, Ludhiana and Pantnagar. The decline in yield with N alone was quite high in acidic soils at Palampur, Ranchi and Bangalore.
- Balanced optimum application of NPK was found to be essential for sustainable high productivity under intensive cropping.
- Integrated application of 100 % NPK inorganic (Optimal dose) with organic FYM @ 10-15 t ha<sup>-1</sup>

yr<sup>-1</sup> further enhanced and sustained crop productivity and soil fertility.

- These findings were also corroborated by their respective yield sustainability indices worked out across the years. The application of FYM besides supplying additional quantities of NPK had its beneficial effect on the soil properties.
- The deficiency of Zinc and Sulphur was becoming the major yield limiting factor in some of the intensive cropping systems. At Pantnagar the superimposition of micronutrient zinc (i) with sulphur, (ii) without sulphur in original 150% NPK treatment (super-optimal dose) resulted with significantly higher yields both for rice and wheat crops during all the years (1993-2006).

#### **Combined analysis of experiments on long range effect of continuous cropping and manuring on soil fertility and yield stability**

In a crop sequence, both the crops are taken on the same site, therefore the application treatments of the previous crop may affect the performance of the succeeding crop thus to study the effect of different treatments on the crop sequence, multivariate analysis was performed for each year taking kharif and rabi yields.

Under rice-wheat sequence at Rewa center, during kharif, treatment T<sub>18</sub> i.e. NPK (120:80:40) was found to be most productive giving the mean grain yield of 41.23q/ha followed by T<sub>17</sub> (120:80:0) giving 40.06q/ha and treatment T<sub>19</sub> i.e. control gave the lowest mean grain yield of 19.3q/ha. During rabi season, treatment T<sub>17</sub> (120:80:0) gave maximum grain yield of 33.48q/ha followed by T<sub>18</sub> (120:80:40) giving 30.06q/ha. In terms of gross return, T<sub>18</sub> gave the maximum return of Rs.22781/ha followed by T<sub>17</sub> (Rs.21389/ha).

Linear relationship between grain yield and soil data (organic carbon, available N, P and K) for all the eleven centres under study were fitted. Under rice-wheat sequence at Rewa centre for wheat crop, it was observed that the soil fertility was maintained as the grain yield was increasing over the time. The coefficients of available P, K and O.C. were positive and significant, whereas the coefficient of available N was negative and non-significant.

Regression analysis between grain yield and auxiliary characters viz, mean number of total tillers per unit,

mean plant height, mean number of grain per panicle etc. for all the eleven centres was also performed. Various methods like dropping variable, ratio approach and ridge regression were attempted. Among all the methods, ridge regression method provided satisfactory results. Results showed that plant height was not significantly contributing to the grain yield whereas number of grains/panicles followed by number of ear bearing tillers/s.u. was significantly contributing to the grain yield.

Stability analysis was performed to study the stability of nineteen fertilizer treatments on grain yield of different crops over the years for eleven centres. Since the design used was an incomplete block design, therefore, adjusted means were computed. LS means were used for obtaining the regression coefficients (b<sub>j</sub>) using Eberhart and Russel's model by SPAR 2.0. The analysis of data (1981-2002) revealed that treatments T<sub>8</sub> (80, 0, 40), T<sub>12</sub> (80, 80, 40) and T<sub>14</sub> (120, 0, 40) were more stable over other treatments for kharif season of rice-rice cropping system at Karamana centre. For rabi season, treatments, T<sub>10</sub> (80, 40, 40) and T<sub>17</sub> (120, 80, 0) came out to be most stable over other treatments. For Bhubaneswar centre (1978-2003), the treatments T<sub>4</sub> (40, 40, 40), T<sub>16</sub> (120, 40, 40) and T<sub>17</sub> (120, 80, 0) were more stable over other treatments for kharif season of rice-rice cropping system.

The TFP index was calculated using Divisia-Tornqvist method which indicated that at most of the centres, treatments T<sub>12</sub> (80:80:40) and T<sub>18</sub> (120:80:40) were found most to be sustainable that showed the role of balanced nutrition in long-term sustained productivity.

#### **A statistical investigation on production, economic and energy potential of crop sequences in different agro-ecosystems**

At one of the CSR center Junagadh, the experiment was initiated during 1997-98 and continued upto 2000-01 with set of 7 treatments (treatments as different crop sequences) which were kept same over the years. From 2001-02 to 2004-05, experiment was continued with a new set of 10 treatments which were formulated through intensification or diversification in the previous set (1997-2001) with different oilseeds, vegetables and pulse crops. In this study, identification of productive and profitable need based crop sequence was done for each set i.e. Set I (1997-2001) and Set II (2001-2005) and then comparison of two sets was done.

The experiment was laid out using Randomized Complete Block Design with four replications and cropping sequences as treatments. The cropping sequences included a variety of crops whose agronomic productivity could not be directly aggregated. As such conversion on univariate basis in terms of monetary value, energy equivalents like proteins, carbohydrates, calories, iron and fat was done to carry out analysis of variance for comparing the performance of sequences. Data was examined from point of view of all objectives and it was concluded that the three crop sequences including onion as one of the crop could preferably be tried at this centre like pearl millet-onion-cowpea and soyabean-onion-cowpea. It not only enhanced the net return but also provided the cereal, pulses, oilseeds along with carbohydrates and iron energy enriched onions. Land use efficiency was also found to be maximum of these sequences.

#### Planning, designing and analysis of experiments relating to AICRP on STCR

Under the project "Planning, designing and analysis of experiments relating to AICRP on Soil Test Crop Response Correlations", experiments with new treatment structure involving organic manures and major nutrients N, P and K in a 3<sup>3</sup> factorial setup were conducted at all its 17 centres.

Data for the year 2005-06 from 12 centres were received, analyzed and the results were sent to the respective centres and to the Project coordinator. New layout plans for experiments to be conducted during 2007-08 were received from 3 centres, which were checked and the centres were advised accordingly.

The type of analysis performed included: (1) Evaluation of responses to N, P and K, (2) Checking and creation of fertility gradient maps, (3) Analysis of variance with and without covariates, (4) Fitting of response surfaces at various levels of organic manure and also combined over all levels, (5) Homogeneity of the regression equations, (6) Exploration of response surface in the vicinity of the stationary point, (7) Estimating the optimal values of N, P and K to be applied for a given fixed targeted yield and (8) Targeted yield equations.

Various analyses mentioned above were carried out for all the centres and for Hissar centre of the STCR experiment on wheat.

The effect of the strips was found to be significantly different in all the cases. This indicated that the fertility

gradient was created in respect of N, P and K respectively at FYM at 0 t/ha, FYM at 7.5 t/ha and FYM at 15 t/ha.

For obtaining the optimum dose of FN, FP and FK, separate multiple regressions were fitted at the three levels of FYM and found to be homogeneous and therefore, combined regression over all the levels of FYM was obtained to arrive at appropriate response function in the combined regression equation, for given values of SN=134.8, SP=18.42 and SK=285.9, complete second order response surface was obtained as:

$$Y = 2752.879 + 24.50827 * FN + 6.057644 * FP + 10.07512 * FK - 0.08506 * FN^2 - 0.24757 * FP^2 - 0.09365 * FK^2 + 0.12727 * FNFP - 0.05264 * FNFK + 0.09585 * FPFK$$

Canonical analysis of response surface gave the stationary point as MAXIMUM with optimum doses of Fertilizer Nitrogen =190.66kg/ha, Fertilizer Phosphorus =65.69 kg/ha and Fertilizer Potash= 39.42 kg/ha and with predicted yield at stationary point as 5446 kg/ha.

Targeted yield approach for different yield targets and with same set of values of Soil N, Soil P and Soil K gave the optimal values of fertilizer doses as 106 kg/ha of FN, 51 kg/ha of FP and 41 kg/ha of FK for yield target 4500 kg/ha; 165 kg/ha of FN, 84 kg/ha of FP and 64 kg/ha of FK for yield target 5500 kg/ha and 194 kg/ha of FN, 101 kg/ha of FP and 75 kg/ha of FK for yield target 6000 kg/ha, respectively.

#### Information System for Agricultural and Animal Experiments

##### Agricultural field experiments information system

Agricultural Field Experiments Information System (AFEIS) is a web-enabled information system, wherein information relating to informed agricultural field experiments (excluding pure varietal trials) conducted in the country are stored and maintained on-line. The objective is to have at a central place, in a compatible form, the results and ancillary information of Agricultural Field Experiments conducted in the past. The system has potential to serve as a reference material for scientists, research workers and planners, etc. in the field of agricultural sciences.

Presently, the database has an information relating to 24000 agricultural field experiments conducted at various Agricultural Universities, ICAR Research Institutes, Project Directorates, All India Coordinated

Research Projects and Directorates of Agriculture of State Governments, etc. Provision for on-line data analysis has also been made for some of the commonly used designs viz. Randomized Complete Block Designs, Factorial Experiments (2 and 3 factors) and Split-Plot Designs (Main-A and Sub-B). Users can access the site through URL: <http://www.iasri.res.in> and clicking the subsequent link "Field Exp Info System". In addition to some most commonly used pre-defined reports, users can also generate various real time reports dynamically as per their requirements based on crop, location, treatment factors, soil type, etc. through search module of the system. The system has facilities for on-line data entry as well as modification of experiments by the users whom this privilege is bestowed.

### Experimental Designs for Agricultural, Animal, Agro-forestry and Fisheries Research

#### Design and analysis of experiments for spatially correlated observations (DST Funded)

Robustness of Cyclic designs against correlated observations was studied for Nearest neighbour [NN] and autoregressive of order 1 [AR(1)] correlation structures for different values of correlation coefficients and a list of these designs for number of treatments upto 10 giving A-efficiency was prepared for different values of correlation coefficient.

A list of robust cyclic designs for correlated observations was prepared.

Neighbour balanced block designs for observations correlated within a block were investigated. The performance of these designs for NN and AR(1) error correlation structure was studied.

A-efficiency of complete block designs in  $v-1$  blocks of size  $v$  each (for  $v$  prime) balanced for two-sided neighbours in the presence of NN and AR(1) error structure was obtained.

SAS codes for obtaining the efficiencies of neighbour balanced block designs for a given correlated error structure and the value of correlation coefficient were developed.

A catalogue of neighbour balanced designs for correlated observations was prepared.

### Statistical and algorithmic approach for improved estimation of treatments effects in repeated measurements designs

A series of repeated measurements designs for comparing a set of test formulations with another set of reference formulations in bioequivalence trials was obtained.

The data simulated under fixed as well as mixed (taking units and error as random) effects models of RMDs with random variables following normal distribution, non-normal (Beta of first kind and Gamma) distribution and under autocorrelated error situation were analyzed. Variance estimates of treatment effects were low under normal distribution as compared to the estimates obtained from non-normal distributions and autocorrelated errors. Within the non-normal distributions, the variance estimates under beta distribution were lower than those obtained under gamma distribution. Variance estimates from beta were closer to normal than that of variance estimates from gamma with normal. The variance estimates of treatment contrasts under mixed effects model were lower than those obtained under fixed effects model for both ANOVA and ML methods of estimation under all the considered situations.

Bayesian analysis was done using WINBUGS 1.4. For the class of designs considered, the BUGS approach gave better estimates of variance of treatment contrasts than those obtained under classical approaches.



Significance tests of various sources of variation in the ANOVA, contrast analysis and HTML Content, Index and Search Help were developed/modified in the software SPRMD – Statistical Package for Repeated Measurements Designs. Integration and testing of various modules of SPRMD was also done.

### Outliers in designed experiments

An outlier in a set of data is an observation (or an observation vector) that appears to be inconsistent with the remainder of the observations in that data set. In agricultural experiments, outlier(s) is/are likely to appear in the experimental data due to various reasons. It is very important to analyze data carefully if outliers are present. In the present investigation, a number of test statistics were applied to detect outliers in designed experiments viz. Cook-statistic, AP and  $Q_k$ -statistic. These statistics were applied to real experimental data taken from Agricultural Field Experiments Information System (AFEIS), IASRI. It was found that many of these experiments contained outliers.

The detection of influential subsets or multiple outliers is more difficult, owing to masking and swamping problems. Masking occurs when one outlier is not detected because of the presence of others, swamping when a non-outlier is wrongly identified owing to the effect of some hidden outliers. In the present investigation, a method to identify influential subsets was developed. The proposed method was illustrated with examples.

M-estimation procedure is a very powerful robust method of estimation used in linear regression model. In M-estimation a function of errors is minimized to obtain parameter estimates. This function is called objective function. A good number of objective functions such as Huber's function, Andrew's function etc. are now available. Most of these objective functions involved some tuning constants. For application to designed experiments the appropriate values of these constants were proposed. A new objective function was proposed. All these functions along with the newly developed function were illustrated with some examples. Another procedure of robust estimation of parametric function is Least Median of Squares (LMS) method. LMS method was modified for application in designed experiments. Robust methods of estimation available in the literature as well as modified methods were applied to the real life experimental data.

A new criterion for identifying robust designs against presence of more than one outlier was developed. Using this criterion, all binary variance balanced block designs were shown to be robust against the presence of two outlying observations.

Graphic user interface based software has been developed for analyzing experimental data in the presence of outlying observations. The software has the following features:

- Can identify outliers in experimental data.
- Can directly apply the robust methods of estimation viz. M-estimation (Huber's function) or LMS method for analyzing the data.
- Option to analyze the data after deleting the outlying observations.

### Designs for mixture experiments in agriculture

In mixture experiments, the efficient designs are obtained by using the criteria of minimizing trace  $(X'X)^{-1}$  (A-efficiency criterion), minimizing  $|(X'X)^{-1}|$  (D-efficiency criterion) and G-efficiency (G for global) criterion. G-efficiency criterion of the design is given by

$$\text{G-efficiency (percent of optimum)} = \frac{100 \times p}{n \times d}$$

where  $p$  is number of parameters in the model and  $d$  is the maximum value of  $v = x(X'X)^{-1}x'$  over the experimental design. Both A-efficiency and D-efficiency criteria are the decreasing functions of the number of points ( $n$ ) in the design and depend on  $n$ . Since G-efficiency criterion is on per point basis so it is independent of  $n$ .

SAS code was developed to calculate the A-, D- and G-efficiency of the mixture designs.

Mixture experiments conducted in Agricultural Field Experiments Information System were investigated. Usually these experiments were not planned as mixture experiments. Some of the observations made on these experiments are as follows:

In some of the experiments matrix  $(X'X)$  is singular and thus proper analysis of such mixture experiments is not possible.

In some of the experiments total for levels of treatments is not 1.



The efficiency of these designs is generally less than the available lattice and -centroid designs.

Investigated A-, D- and G-efficiencies for the simplex-lattice and centroid designs given by scheffe (1958, 1963) for  $q = 3$  to 7 components, for Centroid Designs for  $q = 3$  to 7 components and for  $(q, m)$  simplex-lattice designs for  $m = 2$  and 3. G-efficiency for these designs was also worked out.

### Study on robustness of block designs for biological assays against loss of data

Two criteria of robustness of block designs for parallel line and slope ratio assays were developed. Criterion I was based on connectedness property and Criterion II was based upon the A-efficiency of the residual design obtained after deletion of observations from the original design.

Robustness of A-optimal (efficient) block designs for parallel line assays catalogued by Srivastava, Parsad, Dey and Gupta (2007, *Utilitas Mathematica*, **73**, 239-253) was studied under four different situations viz., when all the observations pertaining to a dose of (i) test treatment occurring with maximum replications were lost, (ii) test treatment occurring with minimum replications were lost, (iii) one standard and one test treatment occurring with maximum replications were lost, and (iv) one standard and one test treatment occurring with minimum replications were lost. It was observed that the residual designs exhibit poor efficiency when observations pertaining to doses appearing with maximum replications were lost. On the other hand residual designs, obtained when observations pertaining to minimum replications were lost, were either highly efficient or were more efficient than the original design.

The block designs for parallel line assays given by Nigam and Boopathy (1985, *Journal of Statistical Planning and Inference*, **11**, 111-117) were found to be robust. Some of residual designs exhibited better efficiencies than the original designs, under both the criteria. The possible reason for this was that the class of residual design was changed.

A-optimal (efficient) block designs for asymmetric slope ratio assays catalogued by Srivastava, Parsad, Dey and Gupta (2006, *Journal of Statistics and Applications: A Publication of 'Forum for Interdisciplinary Mathematics'*,

**1(2-4)**, 185-192.) were examined for robustness in two different settings viz. robustness of original design (i) when all the observations pertaining to a dose of test preparation occurring with maximum replications were lost, (ii) when all the observations pertaining to a dose of a test preparation occurring with minimum replications were lost.

It was observed that while the residual designs obtained after losing observations pertaining to a dose of test preparation with minimum replications are sometimes more efficient than the original designs, the residual designs obtained after losing observations pertaining to a dose of test preparation have poor efficiencies.

The loss of all the observations corresponding to a dose (standard or test) gives rise to designs for asymmetric parallel line assays. Using the structure resistance property several bioassay designs for asymmetric assays were obtained. This study gave rise to many new efficient designs that could be used in the event of scarcity of experimental material.

Robust designs for bioassays against the loss of data were catalogued and are available at the Design Resources Server.

### Experimental designs for agricultural research involving sequences of treatments

In many experimental situations, it is often required to measure the effect of response from two unrelated factors in the presence of first order residual effects of both the factors. A series of designs involving sequences of treatments with two non-interacting factors for symmetric factorial experiments was obtained. These designs were partially variance balanced for levels of each factor based on circular association scheme.

When a sequence of treatments are applied to each experimental unit over varying periods of time using a change over design, the presence of residual effects is possible. Many times, residual effects will have an additive effect which is proportional to the immediate or direct effect of the treatments applied in the previous period. The value of proportionality parameter may be unknown. A computer program has been developed to obtain empirically efficient designs under various values of proportionality parameter.

**Programme 2: FORECASTING AND REMOTE SENSING TECHNIQUES AND STATISTICAL APPLICATIONS OF GIS IN AGRICULTURAL SYSTEMS**

**Developing remote sensing based methodology for collecting agricultural statistics in north-east hilly region**

Under this project, attempt was made to develop integrated methodology for estimation of multiple crop area of all six important crops i.e. rice, maize, potato, ginger, pineapple and banana of Meghalaya state. In order to develop this methodology four representative districts of the state were selected i.e. Rhi-bhoi, East Khasi, West-Garo and East-Garo. The schedules of data collection were developed, training for data collection were imparted to the officials of state government. The field work was supervised by IASRI and NESAC officials.

**Crop forecasting using state space models**

The study on Crop Forecasting using State Space Models aimed at developing models based on time series data using state space approach for obtaining crop forecasts. Bivariate time series models viz. linear Gaussian state space and Vector Auto-Regression (VAR) were fitted using thirty years data (1970-71 to 1999-2000) on production and area of cotton crop for Maharashtra state and at all-India level. Using these models, forecasts were obtained for subsequent years and compared with those obtained earlier from corresponding univariate models viz. ARIMA and state space models by using Mean Absolute Percent Error (MAPE) and Percent Root Mean Square Error (%RMSE) measures. At state level, cotton production

forecasts obtained using VAR model were found better as against the other models, those from bivariate and univariate state space models were almost at par and found better than ARIMA models. At all-India level, production forecasts from bivariate models were found better than univariate models as per MAPE measure. As far as cotton acreage forecasts were concerned, the performance of ARIMA, univariate and bivariate state space models were almost at par and better than VAR model at both state and all-India levels. The results pertaining to forecasts performance of various models are given below:

**Neural network based forecast modeling in crops**

In this study neural network models using multilayer perceptron (MLP), radial basis function (RBF) architectures and weather indices based regression models for forecasting yield of rice, wheat and sugarcane were developed. Weather data on maximum & minimum temperatures, rainfall and morning relative humidity for the period from 1971-72 to 1997-98 were used for model development. Models were developed for Eastern Plain zone (Allahabad, Varanasi, Faizabad and Ballia), Central Plain zone (Kanpur, Lucknow, Fatehpur and Hardoi) & Bundelkhand zone (Jhansi, Banda, and Jalaun) of Uttar Pradesh. For rice, weather data from 23<sup>rd</sup> standard meteorological week (smw) to 35<sup>th</sup> smw, for wheat data from 40<sup>th</sup> smw to 52<sup>nd</sup> smw and for sugarcane data from 2<sup>nd</sup> fortnight of March to 2<sup>nd</sup> fortnight of September were used. Besides these, data on previous year's yield, per cent area under irrigation, 2 to 4 years' moving averages of yield, Nitrogen, Phosphorus and Potassium, total fertilizer and dummy variables (to take care of location effect) were

**Comparison of forecast models for area and production of cotton crop**

Location	Statistic	Measure	ARIMA	Univariate state space	VAR	Bivariate state space
Maharashtra	Area	MAPE	3.64	2.81	15.35	2.96
		%RMSE	4.23	3.11	16.05	3.14
	Production	MAPE	33.30	17.41	12.31	17.81
		%RMSE	35.65	18.89	12.43	19.58
All-India	Area	MAPE	6.34	6.52	7.41	6.53
		%RMSE	6.97	7.28	9.21	7.28
	Production	MAPE	26.30	26.43	24.42	24.94
		%RMSE	37.49	26.27	26.79	29.29

used as input variables and crop yield as output variable. Forecasts (for rice, wheat and sugarcane yield for various zones and years in all 36 cases) were obtained for subsequent years 1998-99 to 2000-01 not included in model development. It was found that model based on MLP architecture were better in 13 cases, RBF architecture were better in 6 cases and weather based regression models were better in 17 cases.

Weather indices based regression models and neural network models using multilayer perceptron architecture were developed for forewarning crop age at first appearance of disease, crop age at peak severity of disease and maximum severity of diseases in different varieties of mustard crop for *Alternaria blight* (Varuna & Rohini – Bharatpur, Varuna & Binoy – Behrampur and Varuna & Pusabold – Dholi) and powdery mildew (Varuna & GM2 – S.K. Nagar) using weather variables viz. maximum & minimum temperatures, morning & evening relative humidities, bright sunshine hours from week of sowing to 50<sup>th</sup> smw as input variables. For Bharatpur, neural network models using radial basis function (RBF) architecture were also developed. For cotton crop, neural network models using multilayer perceptron architecture for forewarning bacterial blight (% of disease incidence) & pinkboll worm (counts) for Akola and white fly (counts) for Sirsa were developed. Comparison of forecasts with the observed ones for crop age at first appearance of *Alternaria blight* on leaf in Varuna variety of mustard crop for 2006-07 for Bharatpur are presented in Fig.1.

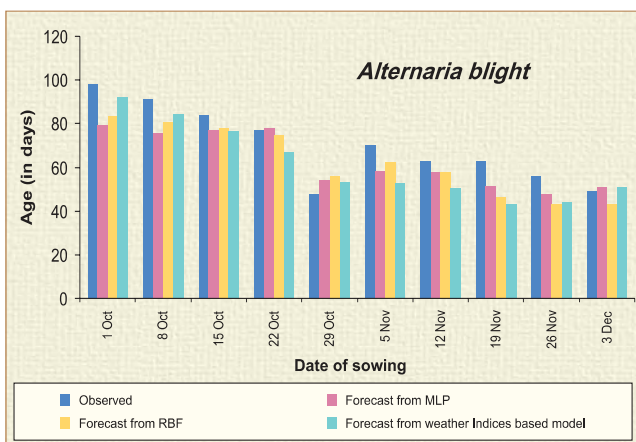


Fig. 1. Comparison of crop age at first appearance of on Leaf in Mustard (Varuna) for 2006-07 for Bharatpur

### Weather based models for forecasting potato yield in Uttar Pradesh

The project aimed at development of models for forecasting potato yield using data of weather variables and to obtain the forecasts at district, agro climatic zone & state level. The data procurement, collection of crop-details and designing/preparation of data files was almost over. The forecast models were developed for the district Agra (U.P.) which had maximum potato-production. The data from 36<sup>th</sup> to 44<sup>th</sup> standard meteorological weeks (smw) for the period 1971-98 were used for development of two types of models, weather indices based regression (W.I.R) models and the complex polynomial (C.P.) models developed using GMDH technique. The results from the models developed by taking the data up to 43<sup>rd</sup> smw were equally good. Thus the forecasts could be obtained by using the data from 36<sup>th</sup> to 43<sup>rd</sup> smw.

The coefficients of determination of the models were highly significant (range 87-92%). The models were validated by computing the forecasts for the subsequent years, 1999-2000 to 2001-02. The results of validation are presented in the Fig. 2

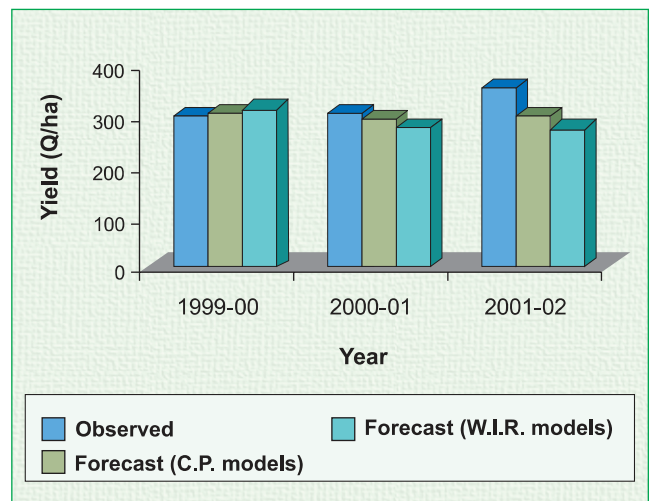


Fig. 2. Forecast of Potato Yield - Agra (data used 36-43 smw)

For the years 1999-2000 to 2000-01, the percent deviation (from observed yield) of the forecasts obtained from W.I.R. models was in the range 0.9 to 4.3 whereas this deviation was in the range 7.9 to 31.1 in case of C.P. models developed using GMDH technique. Thus, the results from the former were better than the later

one. Hence, reliable forecasts, two/three weeks before harvest, can be obtained from W. I. R models developed by taking the data from 36 to 43 smw.

#### **Use of discriminant function and principal component techniques for weather based crop yield forecast**

The project aimed at developing yield forecast models for rice, wheat and sugarcane crops for Uttar Pradesh. Compilation of weather data from 1970-2003 pertaining to various districts of Uttar Pradesh was carried out. Data files were prepared for developing yield forecast models for rice, wheat and sugarcane crops.

The rice yield forecast models were developed for Allahabad district. The weather data from 23<sup>rd</sup> to 38<sup>th</sup> standard meteorological weeks (smw) for the period 1971-2001 were used for development of models. Discriminant function and principal component techniques were used for fitting models. The R<sup>2</sup> values of the fitted models were found highly significant (0.93 for the model based on discriminant function technique and 0.86 based on principal component technique). Rice yield forecasts for the years 2002 and 2003 were found to be 23.59 and 19.98 as against the observed yield 22.55 and 26.63 qt/ha respectively using model developed through discriminant function technique. These forecasts were found to be 18.88 and 21.17 qt/ha using principal component technique. Further analysis for developing forecast models was in progress.

#### **Visioning, policy analysis and gender(V-PAGE)-component II : Technology Forecasting**

This project is under NAIP with Consortium lead centre NCAP, New Delhi. The detailed work plan was presented at the launching workshop of the project held at NCAP, New Delhi on 26-27 June, 2007. Literature was collected and studied on various techniques of technology forecasting. Historical development for selected cereals (rice and wheat) was collected and studied for India, China and Brazil. It was observed that rice and wheat had negligible area under cultivation in Brazil. Therefore, Brazil was not considered for further study. For pulses (chickpea, pigeonpea and blackgram) and oilseeds (mustard, groundnut and soyabean) material was collected and studied for India. The information about developments in ICT & remote sensing and their implications on agricultural research is collected and is under process of compilation.

Production scenario of selected crops for last 35-50 years was collected for major producing countries and different states in India. For all selected crops, different countries were arranged in descending order of production, area and productivity (as per 2005). For each crop, countries contributing 80% of total production were selected for further analysis. In order to compare Indian scenario with that in other countries, production, area and productivity of different countries were plotted alongwith these parameters for India. Further, analysis was carried out for rice and wheat. For rice, trend analysis for productivity and area under high yielding varieties for major states in India was carried out. The data on export of rice from India (category wise) was also collected for last 15 years. For China, provinces were arranged in descending order of production and data for last 50 years were plotted for important provinces. For wheat, trend analysis in India was carried out for productivity and export statistics for 25 years were collected.

Crop specific institutions (DWR, Karnal; CRRI, Cuttack and IIPR, Kanpur) for cereals and pulses were visited and brainstorming sessions conducted with subject matter specialists in connection with bringing out edited documents. The detailed work plan of the project alongwith international & national production scenario analysis and the outline of the proposed document was presented and discussed in detail; lead person for preparation of document and contributors on various aspects were identified. During the discussions at IIPR, Kanpur, it was pointed out that black gram did not have much importance and therefore, it was dropped from the study. The document for rice was received from CRRI, Cuttack. The document covers world production scenario; problems/ constraints in rice production in India; strategies to increase rice productivity in India; emerging issues in farm mechanization and plant protection management; socio economic concerns; sustainable production under changing climatic & environmental scenario; gender equity supporting technologies and quality & nutritional aspects. The document also consists of list of various varieties released for different ecosystems from 1992 to 2006 and broadly mentions technological gaps and expected future technologies/technological needs.

#### **A study on editing and imputation using neural networks**

The study aimed at evaluating performance of Artificial

Neural Networks (ANNs) for data editing and imputation. Evaluation of ANN applications for data editing was done. For this, data on six variables viz. land holding size class, proportional area of wholly irrigated holdings, proportional irrigated area of partly irrigated holdings, proportional area of holdings irrigated by well source, proportional net irrigated area of holdings and proportional area of holdings irrigated by sources other than wells pertaining to 174 selected tehsils of Maharashtra state corresponding to ten size classes of individual operational land holdings were used from the 5<sup>th</sup> Agricultural Census (1995-96). The variables were converted into categorical form by classifying the given observations into various classes formed independently for each variable according to their range and skewness properties. Three different edit error situations viz. non-response errors, interchange errors and their joint effects were considered. Out of these, fitting of ANN model for editing under non-response errors was completed. The true dataset of 1740 records was bifurcated into two distinct subsets, one with randomly selected 1044 records for edit model development and the other with remaining 696 records (60 % and 40% respectively of the whole dataset) for its use in model validation. Considering whole of the true data set of 1740 records, non-response edit errors were introduced randomly in its records (cutting across all variables except size class) to obtain the raw dataset. This dataset was further subdivided by maintaining correspondence between data record identifications of the 1044 and 696 records earlier divided for the true dataset. The 1044 pairs of

erroneous and the corresponding true records were used to train the ANN model to impute missing values of the different variables. The trained model was then used to impute non-response errors in the 696 record dataset. On evaluation for proportional area of wholly irrigated holdings, it was found that ANN model performed well for editing non-response and the results obtained are given below:

### Programme 3: DEVELOPMENT OF TECHNIQUES FOR PLANNING AND EXECUTION OF SURVEYS AND ANALYSIS OF DATA INCLUDING ECONOMIC PROBLEMS OF CURRENT INTEREST

#### Visioning, Policy Analysis and Gender (V-PAGE) (Sub-Prog. III): Policy Analysis & Market Intelligence (NAIP Project)

The work plan was presented in the launching workshop. The work on reviewing the literature on demand and supply of various commodities was completed. During this period the region-wise / rural & urban analysis of consumption pattern of major commodities and commodity groups (cereals, pulses, oils, milk & milk products, egg, meat & fish, fruits & vegetables) was undertaken based on previous rounds of NSSO data. This included the increase/decrease in proportion of households consuming particular food items, and increase/decrease in monthly per capita expenditure and quantum of food items. The production patterns of major fruits & vegetables as well as integration of markets of major vegetables was undertaken.

**Class-wise deviations between ANN based edited vis-à-vis corresponding true records**

Class	Number of						
	True records	Records edited (classified) by ANN	Records un-classified	Record mis-classified	Record classified more than once	Records correctly classified	% correctly classified
1	205	195	10	1	4	190	93
2	165	147	18	7	7	133	81
3	198	168	30	8	2	158	80
4	63	60	3	6	3	51	81
5	32	26	6	3	-3	26	81
6	13	12	1	3	0	9	69
7	20	16	4	3	-3	16	80

### **An econometric analysis of groundwater markets in Indo-Gangetic plains of India**

Secondary data collection on source-wise irrigated area, net and gross irrigated area for all the districts of Indo-Gangetic plains was completed. Agro-climatic sub-region wise compilation of collected data was also completed for Trans-Gangetic plains. In order to study the existing scenario of groundwater development the analysis of secondary data was also initiated. The schedule for primary data collection was finalized. The selection of districts for primary data collection for the three sub-regions of Trans-Gangetic plains was completed. Further collection of primary data was started. Literature on Data Envelopment Analysis (DEA) for estimating the technical, allocative and economic efficiency on groundwater use was reviewed.

### **Adoption and impact of resource conservation technologies on farm economy in Indo-Gangetic plains of India (AP-Cess Funded)**

The project is completed and the draft report of the same is submitted. The zero tillage technology was the most preferred practice among the various Resource Conservation Technologies followed by bed planting and only few farmers were practicing other techniques in the Indo-Gangetic Plains of India. On an average Punjab, Haryana and Bihar have more than 70 percent of zero tillage adoption. The adoption of bed planting technique was found to be around 59 percent in Rajasthan. A study on pattern of usage of RCT equipments showed that approximately 79% of the adopters who owned farm equipments rented it out to other farmers. The incidence of custom hiring of equipments was very much prevalent in the state of Punjab, where nearly 35 percent owners of the combine harvesters and almost 20 percent owners of other equipments, namely zero-ferti-seed drill, rotary tiller and reaper were engaged in custom hiring. Local farmers were the major source of hiring for all required equipment used in RCT technique. Maximum respondents in the entire study area did not have any problem while using zero-ferti-seed-drill and straw chopper.

Economics of rice cultivation amongst adopters and non- adopters showed that under the sampled group the adopters of RCT in rice in all the four states, require lesser hours of human and mechanical labour as compared to the non adopters. The adopters also saved

on the application of urea, number of irrigation, amount of pesticides and total plant protection chemicals in all the states as compared to the non -adopters. RCT gave a saving edge to adopters over non-adopters in all the states on cost of human and mechanical labour and on irrigation. Remarkably, the returns over cost of adopters were more than that of non-adopters in all the four states. This clearly indicated that the net returns of adopters was more than that of non-adopters due to reduced total input cost which could in turn be attributed to the adoption of RCT.

Economics of wheat cultivation amongst adopters and non- adopters showed that the adopter farmers save a lot of manpower and machine power used in the cultivation of wheat. The adopters of RCT in wheat cultivation in Bihar, Haryana, Punjab, Rajasthan and Uttar Pradesh saved on number of ploughing, land levelling, harrowing and hand weeding, amount of urea used, number of irrigations and total plant protection chemicals. The total input cost of adopters of zero tillage in Bihar was found to be 11 percent lower than that of non-adopters. The adoption of RCT brought down the total input cost of the adopters of RCT, giving them a cost advantage of around 10 per cent over non-adopters of RCT in Rajasthan, 16 per cent in Punjab, 14 per cent in Haryana and of 13 per cent in Uttar Pradesh. The grain yield obtained by adopter farmers was significantly higher than that of non-adopters in all the states. The net returns and the returns to cost ratio were also found to be higher for farmers adopting resource conserving technology. This clearly illustrated the superiority of adopting RCT over conventional planting technique in all the five states.

Project appraisal worked out for adoption of RCT in case of both rice and wheat cultivation based on existing scenario (assuming constant cost and returns over five year period), scenario I (assuming annual rise in cost and return by 4 percent), scenario II (assuming annual rise in cost by 4 percent and return rise by 8 percent) and scenario III (assuming annual rise in cost and return by 8 per cent) showed that the BC ratios in all the scenarios were greater than one, the net present value was positive and the estimated IRR was much greater than opportunity cost i.e., interest rate given by the commercial bank on deposits. All the project appraisal indicators were found to be desirable, which indicated that the adoption of RCT was economically viable in the region.

The RCTs had advantage over conventional techniques in terms of time saving, increase in the number of tillage saved, water saving, decrease in the incidence of weeds and decrease in yield losses. Regarding impact of adoption of RCT on environment, most of the adopters in Punjab, Rajasthan, Bihar and Haryana were of the opinion that the soil temperature decreased due to adoption of RCT, and there was also an increase in the ground water level.

In terms of suggestions of farmers in accelerating adoption of RCT, 59 per cent ranked publicity as the most important suggestion for accelerating RCT in the study area, training usefulness was ranked second important suggestion by 35 per cent of respondents, price of drill machine was ranked 3<sup>rd</sup>, availability of machine on rent was ranked 4<sup>th</sup> and refinement of machine as the least important suggestion for accelerating the adoption of RCT in the study area.

With reference to the factors influencing farmer to adopt RCT in the study area, 100 per cent respondents of all the five states were of the opinion that reduction in cost was the most influencing factor. Reduction in cost, reduction in fuel consumption, knowledge about RCT, labour saving, water saving and moisture conservation were considered as the other major influencing factors in adoption of RCT by around 98 per cent of the respondents of Bihar, Haryana, Punjab, Rajasthan and Uttar Pradesh. More than 90 per cent of adopters of the study area felt that less time consumption, uniformity in crop stand establishment, decrease in soil erosion, improvement of soil texture, crop growth performance and availability of equipments were the main factors influencing farmers to adopt RCT. The logit results showed that education and net returns have a positive influence on adoption of RCT and farm family worker and formal source of knowledge have a negative impact on adoption of RCT.

In overcoming shortcomings in adoption of RCT, requirement of more expertise on RCT was considered as a moderately important suggestion by the respondent farmers (69%), non availability of RCT equipments/inputs was felt as a very important shortcoming by more than 80 per cent farmers, high cost of machinery needed for RCT was felt as another important shortcoming in the adoption of RCT by 100 per cent respondents of Punjab and 76 per cent of total respondents. Around 70 per cent respondents considered non availability of timely and adequate

subsidy as very important shortcoming in the adoption of RCT. Other factors considered were sub optimal use of family labour, non availability of timely and adequate subsidy and sub optimal use of family labour.

New technologies designed to significantly reduce the cost per unit of output produced either through a positive shift in yield or through an increase in input use efficiencies would enhance farm level profitability of rice-wheat systems and in turn promote the adoption of RCT. Popularization of RCT also requires evolving an entirely new set of package of practices as well as new soil, water and nutrient management practices. There is a need to bring researchers, extension workers and farmers on a common platform to conceive end to end strategies to promote RCTs. Extending the adoption of these technologies from crop based approach to the system approach would further bring about a sea change in the adoption of RCTs in the entire Indo-Gangetic plains transect. In nutshell, the adoption of Resource Conservation Technology has helped in increasing the net returns of both rice and wheat growers in various states of Indo-Gangetic plain region.

#### **Impact assessment of fisheries research in India**

The secondary data pertaining to various aspects was compiled from various secondary sources. The data relating to determinants of capital formation and production growth in fisheries sector was also collected. The relevant data relating to revenue expenditure and capital expenditure in fisheries as well as agriculture & allied sectors was collected. The proportionate share of Gross Fixed Capital Formation (GFCF) of fisheries sector in agriculture and total economy was worked out. The data was analyzed to estimate the effect of GFCF on GDP and the determinants of GFCF in fisheries sector were also estimated. The Incremental Capital Output Ratio of Fisheries sector was also worked out. The results of the study were presented in a workshop held at Central Institute of Brackish Water Aquaculture (CIBA), Chennai. The primary data collection work in the State of Punjab was initiated during this period.

#### **An econometric study of women empowerment through dairying in selected districts of Haryana**

The review of literature pertaining to the project as well as collection of secondary data was undertaken. Sampling design was finalized for the collection of primary data. A schedule was developed to collect the

relevant information from the selected households. Instructions for filling the schedule were prepared, so as to provide guidelines for collection of appropriate data from the respondents.

#### **Study on supply constraints in tur production**

The overall growth pattern in area, production and yield of tur during the period 1971-2006 indicated that the major supply constraints were decline in area under tur, especially in major tur growing states and no improvement in yield of tur over the years. The coefficient of variation in area during different periods showed that there was a wide variation in area allocated under tur.

The estimates of tur production based on experimental/potential yield in different states indicated that if the experimental yield would have achieved on farmers fields in major tur growing states, the total production would increased by 188 percent and the domestic demand of tur could be met by domestic production itself.

Almost in all the states the cost benefit ratios were declining over the years. This showed that the returns in tur cultivation were declining and that was why the farmers did not prefer to grow tur. It may also be mentioned that there was a wide variation in the cost-benefit ratios among the states.

The analysis of impact of import on domestic prices indicated that if import price and minimum support price of tur were high, the farm harvest price would also be high. But if quantity imported was more, the farm harvest price might be less.

An increase in gross value of competing crop relative to tur would reduce area under tur in Andhra Pradesh. In Karnataka, an increase in irrigated area and yield of competing crop relative to tur would decrease in the area allocation under tur. Any price increase of competing crop relative to tur would induce the farmers to adjust the area allocation in favour of competing crop in Gujarat and Madhya Pradesh. In the state of Maharashtra the only variable of lagged area under tur was found positive and highly significant. In the state of Rajasthan, an increase in irrigated area in competing crop would decrease the allocation of area under tur. If the price and irrigated area under competing crop relative to tur increased, the allocation of area under tur would go down in Tamil Nadu and in case of Uttar Pradesh, an increase in the yield of competing crop would induce the farmers to allocate less area under tur crop.

#### **Pilot study to develop an alternative methodology for estimation of area and production of horticultural crops – (funded by CSO, Ministry of Statistics and Programme Implementation, GOI, New Delhi)**

This study is undertaken in two states namely, Maharashtra and Himachal Pradesh. Data entry pertaining to acquired data on area, production, productivity, market arrival and price was completed for both the states. Methodological development was completed. Estimation procedures for estimation area, production, productivity and number of trees etc. for fruits and vegetables were developed as per the proposed sampling designs for fruit and vegetable survey respectively. The use of market arrival data and the time series data on area, production and productivity was explored in developing the alternative methodology.

#### **Pilot study to develop sampling methodology for estimation of production of mushroom**

The list of mushroom growing villages with mushroom growers for the year 2006-07 was received from District Horticulture Officer (DHO), Sonapat. On the basis of this list, all the blocks were stratified into 3 strata by suitably combing the adjoining blocks. These three strata were Gannaur, Sonapat and Rai. A total of 8 villages, 3 from each of Gannaur and Sonapat and 2 from Rai were selected by probability proportional to size (pps) with replacement taking previous year weight of wet compost used by the mushroom growers in the year 2006-07 in cultivation of mushroom crop as the size measure. Five schedules were prepared, tested and finalized. Complete enumeration of 8 selected villages was done. All the mushroom growers in each of the selected villages were categorized into three categories as Small, Medium and Large. Six cultivators (2 from each) were selected in proportional allocation by simple random sampling without replacement for intensive data collection on production of mushroom and cultivation practices to be adopted in mushroom production.

#### **Pilot study on small area crop estimation approach for crop yield estimates at the gram panchayat level**

The study to develop a sampling methodology for estimation of crop yield at the gram panchayat level was undertaken in one district each of the States of Uttar Pradesh, Karnataka, Andhra Pradesh, Punjab and



Rajasthan. The crops covered in the study were Wheat-U.P., Rajasthan and Punjab; Paddy – Andhra Pradesh; and Jowar – Karnataka. One district and three blocks within the selected districts were identified in each State. The Schedules and Instructions Manual were finalized. Training in all the five states was imparted to the primary workers. The data entry format was finalized.

The estimates developed at Gram Panchayat level would be useful for micro level planning by the Central/State Govts.

#### **Programme 4: MODELING AND SIMULATION TECHNIQUES IN BIOLOGICAL SYSTEMS**

##### **Some investigations on stable and robust clustering procedures**

In this study, performances of five hierarchical clustering methods, namely, Average between group linkage, Average within group linkage, Single linkage, Complete linkage and Ward's methods with several distance measures, like Euclidean, Squared Euclidean, Chebychev and City Block were studied. Among different clustering methods, the performance of Ward's method, for all the four distance measures, was adjudged as the best in terms of low percentage misclassification followed by average within group linkage method. The performance of all the clustering methods were affected by presence of outliers and the influence was comparatively higher in case of Ward's method. In case of missing data, performance of different clustering methods was examined by different imputation methods. The relative percentage of misclassification was lowest for the Average within group linkage method followed by the Ward's method. In general, relative percentage misclassification under multiple imputation was found to be the lowest irrespective of the clustering method and distance measure.

##### **Statistical investigation on the performance of non-parametric stability measures when the genotype by environment data was non-normal (AP Cess funded)**

Some new nonparametric stability measures were developed and compared with available nonparametric measures. Type 1 error and power for different developed nonparametric stability measures were obtained for genotypes 8, 12, 16, 20, 24 at environments 5, 10, 15, 20 for different level of

significance i.e. .01, .025, .05, and .1 in case of Beta and t distributions.

##### **Effect of selection and incomplete model specification on heritability estimates**

The estimation of heritability under different selection pressures was undertaken for various parametric values of heritability. It was observed that the estimates obtained by different procedures under no selection pressure were more or less close to the parametric values. It was observed that in the case of phenotypic selection different populations having different parametric values performed almost in a similar fashion and yielded same estimates of heritability.

##### **A statistical study of rainfall distribution and rainfall based crop insurance**

Daily rainfall data sets exhibiting unimodality or bimodality were identified. To describe unimodal rainfall data sets, the family of Generalized Lambda Distributions (GLD) might be used. On the other hand bimodal data sets require fitting of mixtures of distributions and to this end, Vapnik- Chervonenkis dimension of likelihood function was evaluated. To obtain thresholds of rainfall below and above which yields were reduced, weekly rainfall data and yield of rainfed crops in four districts were analysed using method of moving maxima and minima.

#### **Programme 5: DEVELOPMENT OF INFORMATICS IN AGRICULTURAL RESEARCH**

National Statistical Commission (NSC-2001) and the Department of Secondary & Higher Education of the Ministry of Human Resource Development, Government of India recommended that educational statistics related to agricultural education should be regularly compiled by the Department of Agricultural Research and Education (DARE), Ministry of Agriculture, Government of India on an annual basis and a mechanism for the purpose should be established. Such statistics were needed for various policies and planning of agricultural education and manpower in the country. To cater such requirements, Indian Council of Agricultural Research (ICAR) under its AP Cess Fund Scheme approved a project, 'National Information System on Agricultural Education Network in India (NISAGENET)'. The project was executed by the Indian Agricultural Statistics Research Institute (IASRI), New Delhi as Lead Center with 42 participating

organizations that included State Agricultural Universities, ICAR Deemed to be Universities, Allahabad Agricultural Institute Deemed University, Central Agricultural University, Imphal and 2 Central Universities imparting agricultural education in India. The website for on-line information with the usual facilities of updating, retrieval and dissemination at the national level was made available on the Internet at the web address [http://www.iasri.res.in/ Nisagenet/](http://www.iasri.res.in/Nisagenet/) having modules for the facilities like:

- i) Agrikhoj – A Search Engine for Agricultural Education in India
- ii) Directory – Classified information from NISAGENET
- iii) Reports / Queries – Dynamic Reports at Country/State/University/College levels for user's.

### Agrikhoj – A search engine for agricultural education in India

In contrast to popular search engines like Google and Yahoo, Agrikhoj search engine is designed to restrict the search information about agricultural education in India with in the framework of NISAGENET. This search engine allows one to search for desired keywords specific to agricultural education and hence retrieve a list of document references that matches the desired criteria. Agrikhoj search engine use regularly updated indexes to operate quickly and efficiently. The keyword can be any word like related to equipment's name,



discipline's name or name of a person for which one wants to search or to have some detailed information. The engine examines its database and provides a list of best-matching web pages, with a short summary containing the document's title and parts of the text describes the content of the documents.

The mission statement of Agrikhoj is to 'Organize the India's agricultural education related information and make it universally accessible and useful'. Its scope is limited to NISAGENET.

For example for the keyword "Computer Applications" the web pages containing the specified keyword is displayed along with the title and brief description about its contents.

The courses in the desired discipline available at agricultural universities in India are depicted in the web page image.

S.No.	Degree	Discipline	Eligibility	Duration (In Months)	Intake Capacity	University/College	State
1	B. Sc.	Computer Science	+2 Science	36	16	College of Basic Science and Humanities, Bhubaneswar	Orissa
2	B. Tech.	Computer Science and Engineering	10+2 Physics Chemistry and Maths	48	40	Maharaja Pratap University of Agriculture and Technology, Udaipur	Rajasthan
3	B. Tech.	Computer Science and Engineering	10+2 with physics, chemistry, maths through APET-60%	48	40	College of Technology and Engineering, Udaipur	Rajasthan
4	M. Sc.	Computer Application	60% in Graduation	24	6	Indian Agricultural Research Institute, New Delhi	Delhi
5	M. Sc.	Statistics & Computer Appl.	B. Sc. Ag.	24	4	Sri A. Agricultural University, Ranchi	Jharkhand
6	M. Tech.	Computer Science and Engineering	B.Tech/BE in Computer Sci. Electronics/Electrical Engineering	24	7	Punjab Agricultural University, Ludhiana	Punjab
7	M. Tech.	Computer Science and Engineering	B.Tech/BE in Computer Sci. Electronics/Electrical Engineering	24	7	College of Agricultural Engineering, Ludhiana	Punjab

### Directory – Classified information from NISAGENET

Directory services act as a repository of information about users, devices and services on a network, including names, locations, capabilities, access rights and security authorizations. The NISAGENET Directory basically supports the services like:

- Directory of Administrators at Universities/ Colleges
- Directory Search by Designations
- Directory Search by Faculty Last Name
- Directory Search by Equipments
- Directory of Research Extension Activities

The directory of the administrators for any one and/or all the participating organizations may be generated. Under Directory Search by Designations, the list of desired designation like Vice Chancellor of all the State Agricultural Universities may be generated along with facility to print the hard copy of the document.

As an example the directory information of the Administrators at CCS Haryana Agricultural University (CCSHAU), Hisar (Haryana) along with its affiliated/constituent colleges is presented in the following web image.

SNo	Name & Designation	Address	Phone	Fax	E-Mail
1	Dr. J.C. Kataria (Vice Chancellor)	V.C. CCS HAU, Hisar - 125004 (Haryana)	01662-231640	01662-224952	vc@hau.ernet.in
2	Dr. S.K. Nagpal (Dean, Faculty of Veterinary Science)	Dean COVS CCS HAU, Hisar - 125004 (Haryana)	01662-284312	--NA--	dcovs@hau.ernet.in
3	Dr. (Ms) Neelam Khetrapal (Dean, COHS)	Dean COH Sc CCS HAU, Hisar - 125004 (Haryana)	01662-284311	--NA--	dcoshs@hau.ernet.in
4	Dr. V.K. Chowdhury (Dean, COBS)	Dean COBS and H CCS HAU, Hisar - 125004 (Haryana)	01662-284310	--NA--	dcobs@hau.ernet.in
5	Dr. R.K. Malik (Dean, COA)	Dean College of Agriculture CCS HAU, Hisar - 125004 (Haryana)	01662-284308	--NA--	dcosag@hau.ernet.in
6	Dr. S.K. Nagpal (Dean Post Graduate Studies)	Dean POS CCS HAU, Hisar - 125004 (Haryana)	01662-284314	--NA--	dpgs@hau.ernet.in
7	Dr. Narinder Singh (Dean, Faculty of Dairy Science)	Dean college of animal sciences CCS HAU, Hisar - 125004 (Haryana)	01662-284309	--NA--	dcosans@hau.ernet.in
8	Dr. Pratap Singh (Dean)	Dean College of Agricultural Engineering and Technology CCS	01662-284313	--NA--	dcosaeq@hau.ernet.in

**Query/reports at country, state, university and college levels**

Reports were mainly categorized according to the needs of different categories of users. Major categories of users are NARS Management that includes the academicians, planners, policy makers, scientists and technologists, general users include students pursuing higher education in agriculture, other interested individuals and institutions in the field of agricultural sciences and technology. NISAGENET system also generates reports to fulfill the requirements of Ministry of HRD and other users.

The queries and reports made available at Local Server(s), broadly cover general aspects and academic data of the universities, infrastructural facilities in the universities, budget provision, manpower employed, personal information of the faculty and R&D activities pertaining to the respective university and its constituent/affiliated colleges.

The queries and reports made available at Central Server broadly cover general aspects and academic data of the universities, infrastructural facilities in the universities, budget provision, manpower employed, personal information of the faculty and research & development activities pertaining to any of the participating university and its constituent/affiliated colleges and aggregated reports of all the universities at the country level.

As an example the information about the budget status of the State Agricultural Universities for a particular financial year can be viewed by selecting the financial year and the report containing information about the total budget, total expenditure and total income is presented in the following web page.

The network architecture of the NISAGENET system is such that it acts as an independent information system at the organization level and will be useful for the agricultural education data management of the

SNo.	University	Total Budget (lakhs)	Total Expenditure (lakhs)	Total Income (lakhs)
1	Acharya N.G. Ranga Agricultural University, Hyderabad (Andhra Pradesh)	7,825.18	16,864.47	--NA--
2	Aligarh Muslim University, Aligarh (Uttar Pradesh)	52.00	52.00	--NA--
3	Anand Agricultural University, Anand (Gujrat)	286.71	4,085.44	310.39
4	Bidhan Chandra Krishi Vignavidyalaya, Kalyani (West Bengal)	1,087.51	4,101.06	126.73
5	CCS Haryana Agricultural University, Hisar (Haryana)	13,896.11	13,102.74	902.10
6	Central Agricultural University, Imphal (Manipur)	5,471.00	5,362.10	50.88
7	Central Institute of Fisheries Education, Mumbai (Maharashtra)	958.73	2,446.73	--NA--

university and its affiliated/constituent colleges. The system from the Central Server at IASRI, New Delhi acts as a decision support system and is quite useful to academicians, planners, policy makers, scientists & technologists, and the students pursuing higher education in agriculture. It has the capability to provide information on Agricultural Education in India on continuing basis provided the data is updated regularly.

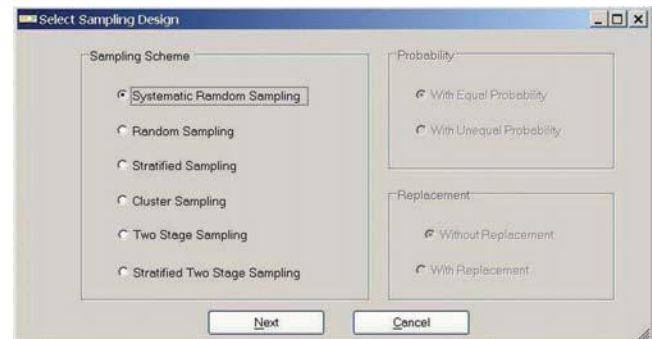
Development of a windows based user friendly Software for Survey Data Analysis (SSDA) is completed. This software estimates the population parameters i.e. mean based on the sampling data collected using the important common sampling designs like simple random, stratified, systematic, cluster, two stage and stratified two stage. These schemes are considered under the options of with/without replacement under equal probability of selection and with replacement under unequal probabilities. SSDA also has a module for imputation of missing values using mean, zero and mean of neighbouring units methods. SSDA was developed using Microsoft Visual C#.NET which is a part of Microsoft Visual Studio.NET 2003. The SSDA offers most of the usual features of any typical windows based software, such as menu driven functions, push buttons for common operations, keyboard accelerators as hot keys, informative status bar and toolbars for carrying out common tasks.

The concepts of Class Libraries in .NET programming language are utilized in SSDA for various sampling schemes where complex mathematical calculations are handled. The main program includes the reference to these libraries and the results of computations are returned in the main program. This provides the advantage of avoiding complex calculations in the main program and the reusability of the libraries again and again in the same program as well as for future use to other applications. It has a user friendly data management module for importing data from various file formats such as MS Excel, Text File, MS Access etc., creating new input file and usual editing options. It also has options for working on the loaded or created data sheet such as adding new row/column, delete or insert row/columns etc. It also allows renaming a column, has the menu option for filtering the column or data. The sampling schemes included in the software uses separate libraries. The computation steps provided in the library takes care of the selected sampling

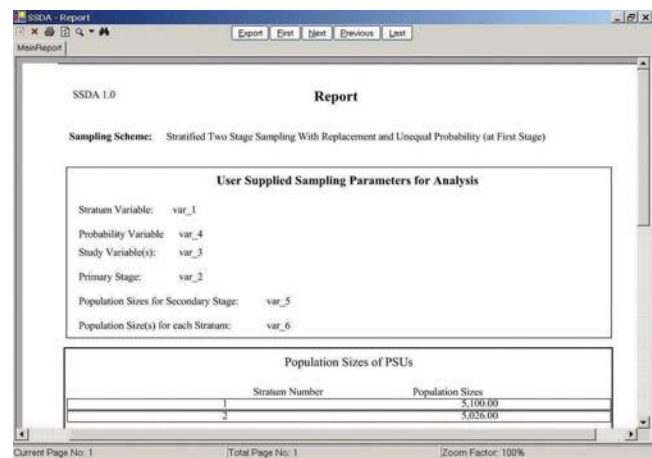


method. The libraries will be useful for reuse to other applications too.

There are three types of imputations carried out in SSDA. These are zero imputation, mean imputation and imputation by mean of neighbouring units. The analysis can be done by selecting the appropriate sampling scheme.



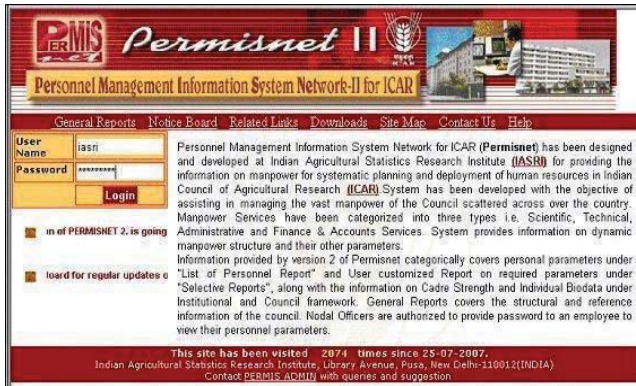
The results of the schemes are presented in the form of Crystal Reports which can be imported into various common file formats.



SSDA is designed and developed to be used by survey statisticians for analysis of survey data and by academicians and teachers for the demonstration of survey data analysis methods.

With the increasing demand for more decision support modules on manpower planning from the users of the PERMISnet system, need was felt to strengthen and maintain this system. Thus PERMISnet-II was initiated as an institute project to convert the entire system on .NET platform and strengthen the system with new modules and manpower planning reports. PERMISnet-

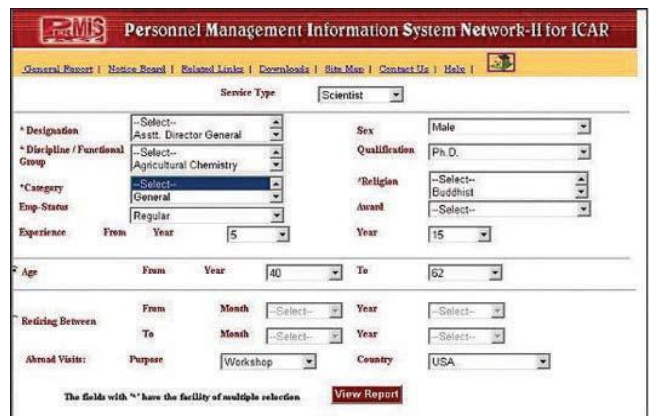
It has been developed using ASP.NET at front end and SQL Server 2000 at backend.



System is enriched with many new features like RMP (Research Management Personnel) module, modification in access rights, new forms and reports for improved decision support. Access rights for different categories of users are identified and implemented in the system.

The main features of the developed system include:

- RMP module providing information on Research Management Personnel of ICAR
- Bio-data reports of ICAR employees to view their personal and professional details
- General reports providing access to all the users covering basic information regarding the council like institutional structure, list and addresses of institutes in the council, list and addresses of the directors of the ICAR institutes, institutes in difficult area etc.
- Institute level reports providing list of employees in the institutes for various parameters and selective reports for



generating reports through selected parameters.

- User customized reports for RMP's of the council to generate reports of their interest.
- Professional and Cadre Strength Reports at subject matter Divisions and Council level.

The work on **Statistical package for animal breeding 2.1 (SPAB2.1)** was initiated to enhance the capabilities of SPAB, which would make the package more useful due to addition of more programs, smoother data processing and better help facility. The following

programs of the package are developed:

- Genetic advance in recurrent selection scheme
- Genetic advance in reciprocal recurrent selection scheme
- Genetic advance in closed nucleus breeding schemes
- Testing the heterogeneity of variance-covariance matrices (Likelihood ratio test)
- D-square analysis (Oblique axis)
- D-square analysis (Iterative Mini-max)
- Genetic advance in closed nucleus breeding schemes
- Genetic advance in open nucleus breeding schemes

The study on **Refining and implementation of expert system on wheat crop management** was initiated to implement and maintain the existing expert system on wheat crop management, to refine the knowledge base of the existing expert system, to enhance the existing expert system by adding new modules as per the requirement and to make a multi media based sub module of the expert system exclusively for farmers in Hindi. Process of refinement was initiated by taking printouts of all the varieties, disease, insects and weeds. The system was being checked thoroughly to remove errors in the contents by the concerned specialists.

The project **Web Solutions for partially balanced incomplete block (PBIB) designs** was initiated to develop an online catalogue of PBIB designs, to develop modules for web generation and analysis of PBIB designs, to compile and prepare e-learning material on PBIB designs and to test and integrate the modules. Methods of construction of following classes of PBIB designs were compiled from the literature:

- Four series of Triangular PBIB (2) designs with parameters
  - i)  $v = b = n(n-1)/2$ ,  $r = k = 2(n-2)$ ,  $l_1 = n-2$ ,  $l_2 = 4$ ,  $n_1 = 2(n-2)$ ,  $n_2 = (n-2)(n-3)/2$
  - ii)  $v = n(n-1)/2$ ,  $b = n$ ,  $r = 2$ ,  $k = n-1$ ,  $l_1 = 1$ ,  $l_2 = 0$ ,  $n_1 = 2(n-2)$ ,  $n_2 = (n-2)(n-3)/2$
  - iii)  $v = n(n-1)/2$ ,  $b = n(n-1)(n-2)/6$ ,  $r = (n-2)$ ,  $k = 3$ ,  $l_1 = 1$ ,  $l_2 = 0$ ,  $n_1 = 2(n-2)$ ,  $n_2 = (n-2)(n-3)/2$
  - iv)  $v = b = n(n-1)/2$ ,  $r = k = (n-2)(n-3)/2$ ,  $l_1 = (n-3)(n-4)/2$ ,  $l_2 = (n-4)(n-5)/2$ ,  $n_1 = 2(n-2)$ ,  $n_2 = (n-2)(n-3)/2$

- Two series of Latin Square PBIB (2) designs with parameters
  - i)  $v = s_2$ ,  $b = s(s-1)$ ,  $r = 2(s-1)$ ,  $k = 2s$ ,  $l_1 = s$ ,  $l_2 = 2$ ,  $n_1 = 2(s-1)$ ,  $n_2 = (s-1)2$
  - ii)  $v = s_2$ ,  $b = s_2$ ,  $r = 2s-1$ ,  $k = 2s-1$ ,  $l_1 = s$ ,  $l_2 = 2$ ,  $n_1 = 2(s-1)$ ,  $n_2 = (s-1)2$
- Group Divisible PBIB (2) designs with parameters  $v = 3m$ ,  $b = 3$ ,  $r = 2$ ,  $k = 2m$ ,  $l_1 = 2$ ,  $l_2 = 1$ ,  $n_1 = m-1$  and  $n_2 = 2m$
- Circular Lattice PBIB(3) designs with parameters  $v = 2n_2$ ,  $b = 2n$ ,  $r = 2$ ,  $k = 2n$ ,  $l_1 = 2$ ,  $l_2 = 1$ ,  $l_3 = 0$ ,  $n_1 = 1$ ,  $n_2 = 4n-4$ ,  $n_3 = 2(n-1)2$
- Nested Group Divisible PBIB(3) designs with parameters  $v = nls$ ,  $b = nC2l2$ ,  $r = (n-1)l$ ,  $k = 2s$ ,  $l_1 = (n-1)l$ ,  $l_2 = 0$ ,  $l_3 = 1$
- Nested L2 designs with parameters  $v = ns_2$ ,  $b = 2(n-1)s_2$ ,  $r = 2(n-1)s$ ,  $k = 2s$ ,  $l_1 = (n-1)s$ ,  $l_2 = 0$ ,  $l_3 = 2$
- Simple Lattice PBIB(2) designs with parameters  $v = s_2$ ,  $b = 2s$ ,  $r = 2$ ,  $k = s$ ,  $l_1 = l$ ,  $l_2 = 0$ ,  $n_1 = 2(s-1)$ ,  $n_2 = (s-1)2$
- Cubic Lattice PBIB(3) Designs with parameter  $v = s_3$ ,  $b = 3s_2$ ,  $r = 3$ ,  $k = s$ ,  $l_1 = 1$ ,  $l_2 = 0$ ,  $l_3 = 0$

Computer Module was developed for the generating the randomized layout of these designs. Web forms were designed to generate these designs. Some material on PBIB designs was compiled for inclusion in the e-learning module. Designing of e-learning material on PBIB designs was initiated.

The project on **Knowledge data warehouse for agricultural research** was initiated to maintain and strengthen analytical capabilities of agricultural Central Data Warehouse (CDW) through generation of various derived parameters and future projections, to extend the scope of CDW through populating the data warehouse with data of human census, agriculture census and livestock census, to generate web enabled geo-reference maps of agricultural indicators such as crops yields, literacy rates etc. and to extract, analyse and disseminate information from CDW on issues of agricultural research and development. Designing of the Dimensional Modeling for the Integrated Data Mart and Analysis of the census data for the dimensional modeling was initiated. OLAP cubes for the Census Survey data (2001) were prepared for some of the states.



## Library and Documentation

The Library of the Institute is a Regional Library under National Agricultural Research System of the country. It plays a vital role in meeting the information needs of the In-house users as well as users from the NARS. It remains open from 9.30 AM to 4.30 PM on all working days. It provides library, documentation and information services to the scientists, staff, students and researchers of the Institute as well as users from ICAR Institutes and State Agricultural Universities.

The Library Advisory Committee plays an important role in the Management of the Library and clears proposals relating to enrichment of resources of the Library such as books, journals, CD-ROMs as well as Infrastructural Development etc. The Library Advisory Committee for the year 2007–08 has been as under:

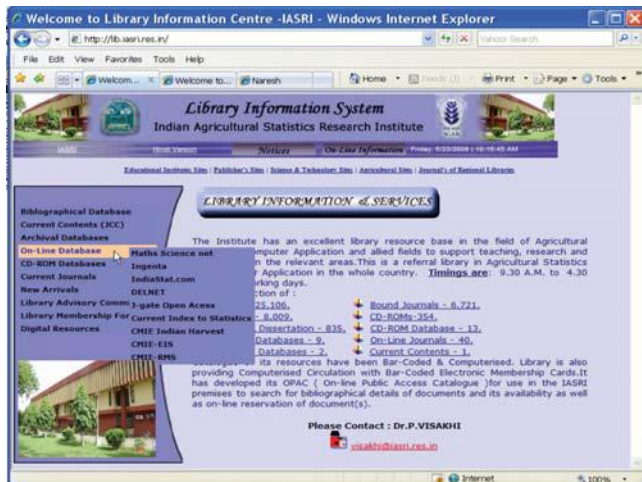
Dr. S.D. Sharma	Chairman
Dr. V.K. Gupta	Member
Dr. H.V.L. Bathla	Member & BOS Member
Dr. V.K. Sharma	Member

Dr. P.K. Malhotra	Member
Dr. Ranjana Agrawal	Member
Dr. Prajneshu	Member
Dr. Amit Kumar Vasisht	Member
Dr. Rajender Parsad	Member
Dr. V.K. Bhatia	Member
Dr. Krishan Lal	BOS Member
Sh. A.K. Chaturvedi	Member
Capt. Mehar Singh	Member
Sh. K.K. Hamza	Member
Sh. D.C. Mishra	Student Rep.
Dr. P. Visakhi	Member Secretary

The internal administration and organisation of the library and documentation is supervised by Dr. P. Visakhi, Librarian under Guidance of Dr. P.K. Malhotra, Head & Prof. of Division of Computer Applications as Scientist-In-Charge, Library.

During the year, the Library provided following services to its users through its website: <http://lib.iasri.res.in>

- Reprographic Service (Manual)
- Indian Journals - 54 ( Print)
- Foreign Journals - 60 ( Print)



Home page of library information system

- Computerized Services
  - Computerized Circulation
  - Bibliographical Database - On-line Catalogue
  - Archival Database (Digitized Thesis and old & Fragile Journals)- 2
  - On-line Journals - 49 (through Internet)
  - On-line Database - 7 (through Internet)
  - CD-ROM Database ( on-line and off-line)-15
  - Current Content Service (JCC) - 1
  - Internet Search
  - On-line Enquiry (OPAC)
  - Current Awareness Service (New Arrivals)
  - On-line Reservation of Documentation
  - On-line User Profile Service

The following Computer Activities were done:

- All resources added in the library have been bar-coded and updated in the bibliographical database.
- Library users were given Hands-on training whenever necessary on the use of library computerized services/resources.
- New bonafide members were issued electronic, bilingual and bar coded membership cards with photo.

- 47 e-journals were subscribed for on-line access in the Institute.
- All trainees of the Institute were given lectures and Hands-on-Training on “On-line Library Information System”.
- Library subscribed/renewed the following Bibliographical, Statistical and Abstracting on-line portals during the period:
  - MathSciNet (<http://www.ams.org/mathscinet.com>)
  - Ingenta (<http://www.gateway.ingenta.com>)
  - Indiatat.com (<http://indiatat.com>)
  - Developing Library Network (<http://delnet.nic.in/>)
  - Indian Harvest (<http://www.cmie.com>)
  - Economic Intelligence Service (<http://www.cmie.com>)
  - State Analysis Services (<http://172.16.1.239/sas>)
  - Sciencedirect (<http://www.sciencedirect.com/>)
- NSSO data on CD's of 61 round schedule 1.0 for consumer expenditure, and employment and unemployment were added/renewed by the Library during the period.

#### Statistics Relating to the Library

Item	Number
Number of books added (English)	564
Number of books added (Hindi)	359
Number of grey literature added	219
Number of Indian journals subscribed	54
Number of Foreign journals subscribed	60
Number of On-line journals subscribed (Indian and Foreign)	49
Number of electronic and printed thesis added	22
Number of publication issued from the library	13,000
Number of users visited library website	32,500
Number of articles (E+P) received from DELNET	70
Number of books received on Inter-library loan through DELNET	33
Number of outside users accessed e-services in library premises (NARS)	1,389
Number of publication lent out on inter-library loan	52
Number of readers visited and consulted the library	12,500
Number of scientific and technical papers reprographed (pages)	15,883
Number of CD-ROM databases added	1
Number of CD-ROM added	127
Internet/databases access searches	60,000



# 5



## Technology Assessed and Transferred

### National Research Centre on Rapeseed and Mustard

In 2007-08, 24 initial varietal trials were conducted using  $\alpha$ -designs. The parameters of these designs are

- (i)  $v = 12, b = 12, r = 3, k = 3$ , A-efficiency = 0.9241;
- (ii)  $v = 15, b = 15, r = 3; k = 3$ , A-efficiency = 0.9067;
- (iii)  $v = 24, b = 12, r = 3, k = 6$ , A-efficiency = 0.9699;
- (iv)  $v = 28, b = 12, r = 3, k = 7$ , A-efficiency = 0.9603 and
- (v)  $v = 36, b = 12, r = 2, k = 6$ , A-efficiency = 0.9074.

The data were analyzed. It was observed that in 8 trials there were transcription errors such as exchange of treatments. In 3 trials blocks within replication differences were found to be significant and in other 10 of the trials, CV% reduced in comparison to a RCB design.

The data from initial varietal trials conducted by National Research Centre on Rapeseed and Mustard, Bharatpur was analyzed and it was seen that in all the

trials location  $\times$  genotype interactions were highly significant. Therefore, a single strain cannot be promoted for all the locations in a given zone. Hence, the strains promoted may be different for different subset of locations. Further, the entries giving 10% higher yields than the best performing check may not be significantly different from the best performing check. Therefore, it was suggested that an entry should be promoted only when it is statistically significant from the best performing check. It was also shown that variability in plant population also play a role in the variability in yield. If analysis of covariance was performed using plant population as covariate, there might be an improvement in the precision of treatment comparisons.

Following  $\alpha$ -designs for 30 entries were recommended for initial varietal trials to be conducted by AICRP on Rapeseed and Mustard at 22 research centres. Separate randomized layouts for all the centres were provided. Centres may choose a design

depending upon the nature of variability in the experimental units.

- i)  $v = 30, b = 15, r = 3, k = 6$ , A-efficiency = 0.9536, D-efficiency = 0.9778
- ii)  $v = 30, b = 18, r = 3, k = 5$ , A-efficiency = 0.9478, D-efficiency = 0.9745
- iii)  $v = 30, b = 9, r = 3, k = 10$ , A-efficiency = 0.9683, D-efficiency = 0.9857

Web Material on “Lattice Designs” was developed and deployed at Institute’s website ([http://iasri.res.in/Lattice\\_designs/main.htm](http://iasri.res.in/Lattice_designs/main.htm)).

This web page contains list of Lattice designs. These designs have been constructed using various methods available in the literature, compiled and made online for easy accessibility of the experimenters. The number of treatments ( $v$ ), number of blocks ( $b$ ), number of replications ( $r$ ), block size ( $k$ ) and average efficiencies along with the layout of these designs have been presented for  $v$  up to 150 and  $r$  not exceeding 10. The steps for randomization and analysis (using SPSS & SAS) have also been described.

Square Lattice (Balanced) Design with parameters  $v = 8, b = 12, r = 4, k = 3$

Replication	Block No.	Block Contents
I	1	1 2 3
	2	4 5 6
	3	7 8 9
II	4	1 4 7
	5	2 5 8
	6	3 6 9
III	7	1 5 9
	8	2 6 10
	9	3 7 11
IV	10	1 8 6
	11	4 9 9
	12	7 10 11

### Web Material on “Circular Designs”

Circular designs [http://iasri.res.in/Circular\\_Designs](http://iasri.res.in/Circular_Designs). A web page has been developed that generates layout plan of Circular designs that form an important class of incomplete block designs and is available for all number of treatments with smaller number of replications. The randomized layout of these designs can also be generated, if required. Circular designs are particular types of Partially Balanced Incomplete Block (PBIB) designs. A special case of Circular designs form a series of Balanced Incomplete Block (BIB) designs. These designs offer more flexibility in terms of their availability for any block size.

The Parameters of Circular Design are  $v = 20 (4 \times 5), b = 5, r = 3, k = 12$

Block Number	Block Contents
1	1 2 3 4 5 6 7 8 9 10 11 12
2	5 6 7 8 9 10 11 12 13 14 15 16
3	9 10 11 12 13 14 15 16 17 18 19 20
4	13 14 15 16 17 18 19 20 1 2 3 4
5	17 18 19 20 1 2 3 4 5 6 7 8

Randomized Layout of the Generated Design

Block Number	Block Contents
1	1 4 18 17 19 3 20 15 2 14 16 13
2	12 11 10 14 13 7 5 6 9 8 16 15
3	9 8 6 10 12 5 2 1 4 7 3 11

### Developing Remote Sensing Based Methodology for Collection of Agricultural Statistics in Meghalaya

The study was taken up in collaboration with Space Application Centre (SAC), Ahmedabad and North East Space Application Centre (NE-SAC), Shillong. The main objective of this study was to develop methodology for estimation of area and production of the crops for Meghalaya. Initially, only Rhi-bhoi district was selected for development of the methodology. This methodology was validated in the same district as well as Jantia hills. The methodology for estimation of area under paddy crop developed in the project was implemented in the whole State by NE-SAC and accepted by the State Government.

### Adoption and Impact of Resource Conservation Technologies (RCT) on Farm Economy in Indo-Gangetic Plains of India

Under the study, it was found that the RCTs had advantage over conventional techniques in terms of time saving, increase in the number of tillage saved, water saving, decrease in the incidence of weeds and decrease in yield losses. Regarding impact of adoption of RCT on environment, most of the adopters in Punjab, Rajasthan, Bihar and Haryana were of the opinion that the soil temperature decreased due to adoption of RCT, and there was also an increase in the ground water level.

### Impact Assessment of Fisheries Research in India

Under the study, fish farmers of Punjab State were apprised about the benefits of fresh water prawn culture technology over traditional fish farming.



## Education and Training

### DEGREE COURSES

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

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

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

The eligibility qualification for admission to Master's degree in Agricultural Statistics is a Bachelor's degree with atleast 60% marks or its equivalent overall grade

point average (OGPA) in Agriculture/Horticulture/Forestry/Agroforestry/Sericulture/Agricultural Marketing/B.Sc. (10+2+3 System). For admission to Master's degree in Computer Application, the eligibility qualification is a Bachelor's degree with atleast 60% marks or its equivalent overall grade point average (OGPA) in Agriculture/Computer Science/Agricultural Engineering/B.Sc. (Horticulture), Veterinary Science, Home Science, B.Sc. (Forestry)/B.Sc. with Maths./Statistics/Physics/Biology/B.Sc. (10+2+3 System).

Further for, admission to Doctor's degree in Agricultural Statistics the eligibility qualification is a Master's degree with atleast 60% marks or its equivalent overall grade point average (OGPA) in Agricultural Statistics/Statistics/Mathematical Statistics/Bio-Statistics of IVRI/Professional Statisticians' Certificate Course (PSCC) from IASRI.

Number of students admitted/completed various courses are:

(a) **Ph.D. (Agricultural Statistics)**

Three students were admitted and 7 students completed the Ph.D. (Agricultural Statistics) degree.

(b) **M.Sc. (Agricultural Statistics)**

Five students were admitted and five students completed the M.Sc. (Agricultural Statistics) degree.

(c) **M.Sc. (Computer Application)**

Four students were admitted and seven students completed the M.Sc. (Computer Application) degree.

Details of students completed various courses during 2007-08 is as follows:

**Ph.D. (Agricultural Statistics)**

**i) Pardip Kumar Nandi**

**Design and analysis for multi-response experiments**

Experiments in which data on several responses are measured from an experimental unit corresponding to the application of a treatment are known as multi-response experiments. Multi-response experiments are of two types viz. complete multi-response experiments (all the response variables are recorded from each experimental unit) and incomplete multi-response experiments (recording of all the responses variables from each experimental unit is not feasible). A stepwise procedure of performing multivariate analysis of variance (MANOVA) of data from complete multi-response experiments conducted in block designs has been developed. If the treatments are found to be significantly different through MANOVA, then the experimenter is interested in testing the hypothesis regarding some treatment contrasts, particularly making all the possible pair wise treatment comparisons. To answer this question, the procedure of carrying out multivariate treatment contrast analysis has been developed. A method based on Euclidean distance from null vector and J-plot based on the singular value decomposition (SVD) of the treatment effects matrix (treatment means/ adjusted treatment means for all the response variables) have been recommended for identification of best treatment.

In a designed experiment, when one experimental plot is heavily infested with pests, disease and/or weeds, the response observed from this plot would be markedly different from the response from all other plots. This response may be abnormally high or abnormally low. Such responses are termed as outlier(s). To tackle the problem of outlier(s) in multi-response experiments, a test statistic has been developed for detection of a single outlier vector in complete multi-response experiments run in a block design. Proposed test statistic has been illustrated with the help of an example.

Besides the analysis of data, the designing of multi-response experiments is also of paramount importance. It has been shown that designs efficient for single response experiments are also efficient for complete multi-response experiments. The only requirement is that the number of response variables should be less than the error degrees of freedom. A method of construction of designs for incomplete multi-response experiments is also obtained using a combination of Randomized Complete Block (RCB) designs and Balanced Incomplete Block (BIB) designs. To accommodate more number of response variables, one can use singular group divisible design as response-wise design instead of a BIB design. The designs obtainable from this method are economical from resource point of view.

The above relates to the discussion on the problems associated with comparative experiments. A large number of experiments are conducted for establishing a relationship between the levels of input factors and several response variables. These experiments are usually conducted in response surface designs to perform simultaneous optimization of several responses. Simultaneous optimization procedures of several responses for both complete and incomplete multi-response experiments have been considered. Two situations of incomplete multi-response experiments are considered. The procedure of estimation of parameters from linear multi-response models for incomplete multi-response experiments has been developed for both the situations. It has been shown that the parameter estimates are consistent and asymptotically unbiased. Using these parameter estimates, simultaneous optimization of incomplete multi-response experiments is attempted following the generalized distance criterion.

**Guide: Dr. Rajender Parsad**

## ii) Kankure Ajay Krishanrao

### On some aspects of spatial ranked set sampling

Ranked Set Sampling (RSS) as suggested by McIntyre (1952) when applied to spatially-correlated areal population fails to take into account the spatial correlation. Arbia (1990) suggested Dependent Unit Sequential Technique (DUST), a sample selection procedure for selection of areal units from spatially correlated population in which spatial correlation among the population units has been incorporated into sample selection procedure. In this thesis attempt has been made to propose a sample selection technique named as Spatial Ranked Set Sampling (SRSS) in which desirable features of both RSS and DUST have been incorporated. SRSS has characteristics of RSS such as randomization technique for better representation of population and additional information about ranking of units within a set in the sample selection process. Also, the proposed SRSS incorporated spatial correlation as in case of DUST in the sample selection process. Four strategies of sample selection are proposed viz. (1) Ranked set sampling based on Spatial Clusters formed by DUST (RSCD), (2) Ranked set sampling based on Spatial Clusters formed by SRS (RSCS), (3) Ranked set sampling based on Spatial Sets formed by DUST (RSSD) and (4) Ranked set sampling based on Spatial Sets formed by SRS (RSSS). A spatial simulation study was carried out to empirically test the performance of SRSS with respect to the traditional sampling techniques. It has been found that SRSS always performs better in terms of efficiency with respect to SRS and there is sufficient gain in efficiency with respect to RSS in case of smaller set size which is generally recommended to avoid ranking errors. Among the four strategies of sample selection by SRSS, it has been observed that RSSD was the most efficient strategy as it had the lowest sampling variance. The availability of cheap and reliable data on a highly correlated auxiliary variable (NDVI) was put to use to carry out ratio estimation in all the four estimators. As expected, ratio estimator showed more gain than the corresponding estimator used earlier. Maximum gain was found for the ratio estimator of RSCS among all four ratio estimators considered. The results of the study point out that, in spatial surveys, a considerable gain in efficiency of the estimators could be achieved by using distance based sample selection strategies even when applying these for complex sampling schemes

such as Ranked Set Sampling. The complex algorithms involved in the selection procedure of distance based sampling strategies could be solved with the use of advanced computing and software.

Guide: Dr. Anil Rai

## iii) Jitender Singh Tomar

### Design and analysis of agricultural experiments under interference and dependent observations

In agricultural field experiments, blocks are often formed using adjacent plots within a field. The experimental plots occurring close together within blocks may, therefore, be correlated. Further, the treatment applied to one plot in a block may affect the response on the neighbouring plots. As a result, the estimates of treatment differences may deviate because of interference from neighbouring units and correlated or dependent observations. Neighbour balanced designs have been developed in the literature to deal with the interference effects, while spatial designs are used to deal with the dependent observations. Considerable amount of work has been done separately on these two aspects. The present work deals with the situation when both these effects are present in the same trial. Two types of models (non-directional and directional) have been considered based on how the neighbour effects of treatments are taken into account under different error correlation structures. Some definitions and properties of block designs with neighbour effects and dependent observations have been given. Series of strongly neighbour balanced/ neighbour balanced complete/ incomplete block designs, permitting the estimation of direct and neighbour effects, under non-directional and directional neighbour effects model and dependent observations have been obtained. The optimality aspects of these designs have been studied, and A- and D- efficiencies for direct and neighbour effects have been worked out. The designs constructed have also been compared with the existing neighbour balanced block designs under uncorrelated structure. The performance of some series of existing neighbour balanced designs has also been studied under the situation of correlated error structure. A catalogue of all the designs giving parameters and efficiencies for direct as well neighbour effects under NN and AR(1) error structures has been prepared for different values of correlation coefficient. Further, the model

incorporating the effect of interference from adjacent neighbouring units and dependent observations from an experiment conducted in randomized complete block design has been defined. Semi-variograms have been used to visualize the nature of spatial correlation and the average location effects of a particular plot are predicted. The procedure is illustrated through a data from an agricultural field experiment.

**Guide: Dr. Seema Jaggi**

#### iv) Rama Krishna Singh

##### **Study of fuzzy and artificial neural network methodologies in agriculture**

Theory of fuzzy sets and Possibilistic regression analysis is discussed. Three methods, viz. Minimization, Maximization, and Conjunction are considered. The methodology is applied to employ farmers' estimates at block level for modeling cotton crop yield at block levels of Sirsa district, Haryana. It is found that Conjunction method performed the best. Possibility and Necessity measures for obtaining reliable fuzzy estimates of crop yield are thoroughly studied. Estimation of parameters is carried out using "Fuzzy least-squares" procedure. As an illustration, the methodology is applied to pearl millet crop yield data in order to build block level estimates for Bhiwani district, Haryana based on farmers' estimates. A modified fuzzy least-squares approach for estimation of parameters is thoroughly studied. Relevant computer program is developed in SAS/IML software package. Performance evaluation criterion based on "Difference in membership functions" is adopted for computation of error in estimation. As an illustration, the methodology is applied for Pearl Millet crop yield estimation at Block level. Superiority of present approach over Possibility fuzzy least-squares approach is demonstrated for data under consideration. Fitting of fuzzy von Bertalanffy growth model is carried out when response variable is reported in intervals corresponding to various values of explanatory variable. An efficient two-stage procedure based on fuzzy least squares is employed. The methodology is thoroughly discussed and, for its application, relevant computer programs are developed in "Nonlinear programming solver LINGO, Version 8" software package. Finally, an illustration to pearl oyster age-length data is discussed.

Multilayered feedforward artificial neural network (MLFANN) is thoroughly studied. In order to train such

a network, two types of learning algorithms, namely Gradient descent algorithm and Conjugate gradient descent algorithm, are described. The methodology is illustrated by considering maize crop yield data as response variable and total human labour, farm power, Fertilizer consumption, and pesticide consumption as predictors. The data is taken from Division of Agricultural Economics, IARI., New Delhi. To train the neural network, relevant computer programs are written in MATLAB software package using Neural network toolbox. An important model from this class, viz. Adaptive Neuro-fuzzy inference system is implemented on Fuzzy Logic Toolbox of MATLAB. As an illustration, the methodology is applied for development of a forecasting model for secondary data of yield of 100 banana plants on the basis of data at six different stages of growth using several biometrical characters, like plant height, plant girth, and leaf length as predictors.

**Guide: Dr. Prajneshu**

#### v) Mir Asif Iquebal

##### **A study of some nonlinear time-series models in agriculture**

Basic concepts of various statistical modeling techniques are described. Gaussian mixture transition distribution, Mixture autoregressive (MAR), and MAR-Autoregressive conditional heteroscedastic (MAR-ARCH) models are thoroughly studied and applied to weekly wholesale onion price data. Estimation of parameters is carried out using Expectation-Maximization algorithm. It is concluded that a two-component MAR-ARCH is best for modeling as well as forecasting purposes.

Threshold Autoregressive (TAR) family of models for describing cyclical fluctuations in time-series data are also investigated. Two-regime Self-exciting TAR (SETAR) models are studied and applied to country's lac export data. Three-regime SETAR models are applied to describe country's Shellac production data. Fitting of the models is carried out using Genetic algorithm (GA) technique. Finally, forecasts for out-of-sample data are made.

Methodology for estimation of parameters using GA is developed for Nonlinear Richards growth model. As an illustration, the same is applied for modeling and forecasting of country's foodgrain production data. As the conventional estimators for ordinary least squares

variance-covariance matrix estimation in respect of linear regression models under heteroscedasticity are biased and inconsistent, GA-based estimators are proposed. Their properties are thoroughly studied by Monte Carlo methods for various sample sizes. It is shown that GA-versions of estimators are superior to corresponding non-GA versions as there are significant reductions in total relative bias as well as total root mean square error.

**Guide: Dr. Prajneshu**

#### vi) Sarika

##### **Some investigations on response surface designs**

Response surface methodology explores the relationship between response variable and several explanatory variables with the motive to obtain an optimal response using a set of designed points. In response surface analysis, it is generally assumed that the observations are independent and there is no effect of neighbouring units. But under certain situations, the experimental units may experience neighbour or overlap effects from adjacent units. Hence, it is important to include the neighbour effects in the model to have the proper specification. First and second order response surface models with neighbour effects from immediate left and right neighbouring units have been considered and the conditions for the estimation and rotatability of these models have been derived. The variance of estimated response has also been obtained. Method of constructing designs for fitting response surfaces in the presence of neighbour effects has been developed. The response surface analysis, incorporating the neighbour effects from adjacent units, has been illustrated through constructed/ real data sets and the competition coefficient from neighbours is estimated such that the residual sum of squares is minimum. The results have shown substantial reduction in residual sum of squares and increase in precision of estimates of the parameters of the model. Further, in many experimental situations, particularly in field experiments, the observations are correlated through some systematic pattern of environmental variations. Some methods of constructing designs for fitting first order and second order response models with correlated errors (equi-correlation and autocorrelation structure) have been obtained. Also the performance of some existing second order response surface designs viz. central composite and Box-Behnken, that

are efficient for fitting response surfaces under uncorrelated situation, have been studied under correlated error structure. Response surface methodology in the presence of neighbour effects as well as correlated error structure has been developed. Some aspects of designs for fitting response surface models with quantitative-cum-qualitative factors have been studied under neighbour effects/correlated error structure. Various SAS codes under different experimental situations for studying response surfaces have been developed.

**Guide: Dr. Seema Jaggi**

#### vii) Baidya Nath Mandal

##### **Combinatorics and its applications with special reference to sample surveys**

Balanced sampling plans excluding adjacent units (BSA (m) plans) are useful for sampling from populations in which the nearer units provide similar observations due to natural ordering of the units in time or space. For BSA (m) plans, first order inclusion probabilities of all units are same and second order inclusion probabilities for pairs of adjacent units are zero and constant for other pairs of units. BSA (m) plan can be obtained by assigning equal probability of selection to the blocks. A computer algorithm has been developed and a computer aided search of polygonal designs using this algorithm gave all the existent polygonal designs in the literature in the parametric range of  $v \leq 40, b \leq 400, k \leq 7$  and  $m \leq 4$  along with 75 new designs. The algorithm developed has also been modified to generate BSA (m) plans directly comparatively in a short time. The linear programming has also been exploited to obtain both circular and linear BSA (m) plans by minimizing the probabilities of selection of samples containing adjacent units. This method is quite useful for obtaining smaller sampling plans and takes very less time.

BSA (m) plans suffer from the drawback that the unbiased estimation of variance of Horvitz-Thompson estimator of population mean is not possible. To tackle this problem, a family of distance balanced sampling plans (DBSP) with the property that the second order inclusion probabilities are non-decreasing function of distance between the two concerned units is developed. Unbiased estimation of variance of Horvitz-Thompson estimator of population mean for DBSP is considered. The conditions for DBSP to be more

efficient than simple random sampling without replacement (SRSWOR) and BSA (m) plans have been obtained. It has been shown that if the assumption of decreasing correlation between the units as the distance between the units increases holds then the proposed plans are more efficient than other alternative sampling plans such as SRSWOR and BSA (m) plans. A class of incomplete block designs, called as distance balanced incomplete block (DSBIB) designs is introduced, whose blocks can act as a support of the DBSP. Existence and construction of DSBIB designs has also been given.

IPPS plans excluding adjacent (IPPSEA plans) units have been developed by making use of binary, proper and unequireplicated block designs and linear programming approach. It has been shown that proposed IPPSEA plans perform better than alternative sampling plans such as SRSWOR, BSA (m) plans, probability proportional to size with replacement, Hartley and Rao' strategy, Rao, Hartley and Cochran's strategy and Sampfords' IPPS plan using a real life population.

Stratified sampling is often used to draw a representative sample from a population. Stratification based on geographical contiguity may yield strata which are heterogeneous due to some other factors affecting characteristic under study. To deal with this, nested stratified sampling in which there are secondary strata within each primary stratum has been developed for the estimation of finite population total and its variance. Optimum allocation of sample size in a particular primary stratum to secondary strata within that primary stratum and optimum allocation of total sample size to primary strata in the population was discussed in detail. A condition for nested stratified sampling with arbitrary allocation to be more efficient than usual stratified sampling with arbitrary allocation was obtained. Feasibility of application of doubly nested incomplete block designs to nested stratified sampling was discussed in this context. Application of doubly nested block designs was also shown to obtain designs for tetrallel crosses.

**Guide: Dr. Rajender Parsad**

### **M.Sc. (Agricultural Statistics)**

#### **i) Vinayanand Kandala**

#### **A study of forecast models using resampling methods**

The study deals with comparing the performance of

resampling based methods with conventional methods for estimation of nonlinear models. For this, productivity of wheat and proportional area under HYVs of maize over time were studied by fitting non-linear growth models viz. Logistic and Gompertz at various locations by employing two estimation procedures; the first one being the conventional Marquardt's nonlinear estimation procedure and the other one is the resampling based Jackknife estimation procedure. A simulation study has also been done to compute the variances of the parameter estimates. The fitted models have been utilized for forecasting the crop statistics considered for subsequent periods not included in model fitting. The parameter estimates obtained by employing the resampling based method have consistently lesser biases than those obtained using the conventional method without increase in their corresponding estimated variances. When the goodness of fit and forecast performance measures of these models were compared, the models using resampling based method came out to be either at par or slightly better with those using conventional method for most of the locations in case of both the crop statistics considered. In the light of these results, Marquardt's estimation procedure can be recommended for the estimation of Logistic and Gompertz models.

**Guide: Dr. Ranjana Agrawal**

#### **ii) Sonawane Maheshkumar Namdevrao**

#### **A study on experimental designs for bioequivalence trials**

Bioequivalence is the degree to which clinically important outcomes after receiving a new formulation resembles a well established formulation. Evaluation of veterinary medicinal products is one of the important areas where bioequivalence trials are conducted. In bioequivalence trials, the main interest of the experimenter lies in making test vs. reference formulation comparisons with as much precision as possible and comparisons within test formulations are not of much interest. Hence, designs that give estimates of test vs. reference formulations comparisons with maximum precision are a smart choice for bioequivalence trials.

Some series of balanced/partially balanced designs for bioequivalence trials in incomplete sequences have been presented for experimental situations in which



the experiment can not be continued for more number of periods. Further, some series of balanced/partially balanced designs for bioequivalence trials in complete/incomplete sequences assuming the presence of residual effects have also been proposed. In experimental situations where a set of test formulations are to be compared with another set of reference formulations, two classes of designs for bioequivalence trials have been constructed assuming residual effects of formulations to be present. Variance of the estimates of contrasts pertaining to test vs. reference formulations have been calculated using SAS programs developed. All the proposed designs give better estimates for comparisons between test vs. reference formulation comparisons and hence can be recommended for their application in bioequivalence trials. Lists of all proposed designs have been prepared for a practical range of parameter values.

**Guide: Dr. Cini Varghese**

### iii) Lokesh Dwivedi

#### Some investigations on change over designs

Designs in which each experimental unit receives some or all of the treatments, one at a time, in successive periods are known as change over designs (CODs). The distinguishing feature of these designs is that the treatments applied in a particular period influence the responses of the experimental units not only in that period but also leaves residual effects in the succeeding periods. These designs are of special importance when the experimenter finds it difficult to obtain homogeneous experimental units or when the experimental units are expensive. These designs have been advantageously used in animal nutrition experiments, clinical trials in medical research, long-term fertilizer experiments in agriculture, educational studies, bioequivalence trials, etc.

In many experimental situations, it is often required to measure the effect of response from two unrelated factors in the presence of first order residual effects of both the factors. Three series of CODs with two non-interacting factors out of which two are symmetric factorial and one is asymmetric have been proposed. The symmetric factorial designs are partially variance balanced for levels of each factor based on circular association scheme and the levels of first factor in the asymmetric factorial CODs follows Group Divisible

association scheme. To meet experimental situations involving simultaneous application of levels of two factors when one of the factors exhibits residual effects while the other does not, two classes of uniform strongly balanced CODs with two factors balanced for residual effects of levels of one factor have been obtained. These designs are variance balanced in the sense that the contrasts pertaining to direct effects of treatment combinations consisting of various levels of both the factors are always estimated with a constant variance. SAS programs have been developed to calculate variances of estimates of contrasts pertaining to direct effects of various treatment combinations of levels of two interacting as well as non-interacting factors.

**Guide: Dr. Cini Varghese**

### iv) Subrat Keshori Behera

#### Study of heritability of threshold character

There are many characters of economic importance in animal & plant breeding which are polygenic in inheritance but their phenotypic expressions show discontinuities. The characters whose inheritance is multifactorial but exhibit all-or-none or one-or-the-other kind phenotypic expression are called threshold characters. Intraclass correlation coefficient  $r$  provides a quantitative measure of similarity between individuals within groups.

Mastitis or inflammation of the mammary gland, is one of the most common disease of dairy cattle throughout the world which causes heavy economic loss to the farmers. Here we have studied the heritability of mastitis disease in sahiwal breed of cows by estimating its heritability through estimation of intraclass correlation based on different methods. SAS programs have been developed for estimating intraclass correlation and for estimation of heritability. Also heritability of mastitis disease is estimated following beta-binomial method. Comparison of the methods developed using intraclass correlation and beta-binomial method done on the basis of standard errors as well as on the basis of estimate values. The estimates of heritability based on  $\rho_{AOV}$ ,  $\rho_{AOV}^*$ ,  $\rho_{FC}$ ,  $\rho_{KPR}$ ,  $\rho_{KPR}^*$ ,  $\rho_{PPR}$  estimators and beta-binomial heritability estimate  $\hat{h}_f^2(\beta)$  showed similar performance as reported in literature. These heritability estimates have less standard error as compared to other estimates. On the other hand, beta-binomial family heritability estimates  $\hat{h}_f^2(\beta)$ ,  $\hat{h}_f^2(\Delta p|\beta)$  are

found to be greater than and other estimates based on intraclass correlation coefficient.

**Guide: Dr. A.K. Paul**

**v) Yogita Gharde**

**A Study on cross-over designs in the presence of first order residual effects**

In cross-over designs (CODs) each experimental unit receives a sequence of several treatments, one treatment at a time over successive periods and observations are recorded in each period. These designs have been advantageously used in several fields of research, notably in nutrition experiments with dairy cattle, clinical trials in medical research, psychological experiments, long-term agricultural field experiments, bioequivalence trials and bio-assays.

In the present study, two new classes of minimal strongly balanced CODs have been developed assuming the presence of first order residual effects. Designs in the first class are minimal strongly balanced circular CODs for  $v$  treatments using  $v/2$  experimental units for  $2v$  periods. The second class of designs deals with minimal strongly balanced CODs for  $v$  treatments using  $2v$  experimental units for  $v/2$  periods. Both the classes of designs are partially variance balanced with  $m$ -associate classes based on a circular association scheme. These designs are useful for the situations where experimental units or periods are scarce or expensive.

Moreover, a class of two-period totally balanced trend-free CODs considering presence of first order residual effects has been developed. Conditions for a variance balanced cross-over design to be trend-free have been obtained. A method of construction and analysis of these designs have been given along with an illustration. Universal optimality of these two-period totally balanced trend-free designs have been established for the estimation of contrasts among direct effects and among first order residual effects.

**Guide: Dr. V.K. Sharma**

**M.Sc. (Computer Application)**

**i) Sumit Sharma**

**Information system for dissemination of ready to adopt agriculture technologies**

ISDAT (Information System for Dissemination of Ready

to Adopt Agricultural Technologies) is a web based user-friendly, information system for ready to adopt agricultural technologies of ICAR. It is developed as comprehensive information system for ready to adopt agricultural technologies. ISDAT acts as a transfer agent for dissemination of ready to adopt technologies. The information, which is available in the form of books, journals, popular magazines, etc., is beyond the reach to each and every person across the world. Therefore, in the electronic era the ISDAT may help progressive farmers, industrialists, researchers, students and extension workers for rapid dissemination of knowledge and benefit humankind.

It has a three-layered architecture. Client Side Interface Layer is implemented in HTML and JavaScript. Server Side Application Layer is implemented in Java Server Pages and Java Database Connectivity. Database Layer is implemented in Microsoft SQL Server (MSSQL). ISDAT can be implemented as a network-based system so that information is available on-line. The software has one level of authentication i.e. Administrator; which has the privilege to add, modify or delete the information from the database.

**Guide: Dr. S.D. Sharma**

**ii) Itri Jha**

**Software for stability analysis using AMMI and SREG models**

Yield stability as a selection trait in plant breeding programmes and evaluation trials is constantly gaining importance over yielding ability. Some of the common techniques as an alternative to additive ANOVA model are Additive Main effects and Multiplicative Interaction (AMMI), Sites Regression (SREG), Factorial regression, Joint regression etc. Biometricians that are interested in stability analysis are aware of the specialized software packages like SAS, SPAR 2.0 etc. that can handle this analysis. Though SAS is a statistical software package, it requires programming knowledge for writing the program syntax codes to analyze data for analysis purposes. SPAR 2.0 (developed at IASRI) has a module on stability analysis, in which stability analysis can be performed using the three models, Eberhart and Russell (1966), Perkins and Jinks (1968) and Freeman and Perkins (1971). However, it cannot perform stability analysis using AMMI and SREG Models.

Keeping in view the above problems, software package for stability analysis is developed using AMMI and SREG models and integrated with SPAR2.0. It has been developed using VC++ and VB, which is more flexible, user-friendly and economic. Data files can be ASCII file and Excel file as well. There is no restriction on the number of response variables and observations. This module of SPAR2.0 calculates environment-wise ANOVAs, pooled ANOVA, percentage explained by each Principal Component Analysis (PCA), Gollob test for AMMI analysis and also the biplots of Mean vs. First PCA and First PCA vs. Second PCA. It has been provided with an extensive Help document, regarding statistical concepts involved, how to use the software, example data file, example of input files and output files. It has also the options like favorites and search through contents and index. Thus SPAR2.0 has been further strengthened for stability analysis by the inclusion of two more modules on AMMI and SREG.

**Guide: Dr. P.K. Malhotra**

### iii) Nongmaithem Uttam Singh

#### **Some statistical modules for analysis of breeding data**

With the introduction of programmable computers, several tailor made programs for statistical analysis were written. They were modified to statistical packages by integrating the tailor made programs as mankind progressed in Information Technology. It is difficult to find, which the first statistical package is but first version of SPSS was released in 1968 by Norman H. Nie, C. Hadlai (Tex) Hull and Dale H. Bent and after this, many packages were developed. Besides these, there are statistical packages like GENUP, Pedigree, SPAB 1.0 etc. for animal breeding data analysis. There is always a scope to improve the packages by making them more user friendly, better architected with more programs as no software is ever complete.

Keeping in view of the above mentioned requirements and to fulfill some needs in breeding data analysis, the present software for analysis of breeding data has been developed. The programs of the package are also integrated with SPAB 2.0, a package existing in IASRI. Present package has the programs for analysis, namely, Homogeneity testing of variance-covariance matrices by likelihood ratio test, Mahalanobis  $D^2$  analysis, Distance analysis by Iterative Minimax and Oblique Axes procedures. Further, two programs viz., calculation of

expected responses to recurrent and reciprocal recurrent selections are also included. The package is built using Java Swing to create window based editor and Core Java to develop the statistical modules.

The user is also provided with the information needed to make data and parameter files. This information is available in the help as well as the module's window. Data files can be text or notepad or Excel file. There is no restriction on the number of variables and observations. However, it should be text tab delimited ASCII file. Outputs can be displayed, saved and printed using appropriate menus. The help document is extensive and also contains relevant statistical formula and references. Further, the way of using the software is provided with processed examples.

The overall architecture of this windows based software can be regarded as two tier with Java Swing as front end and Core Java as back end.

**Guide: Dr. I.C. Sethi**

### iv) Sandip Shil

#### **Critical evaluations of Indian web-portals on agriculture**

Like other fields, web portals have also a major role to play in agricultural field. Agricultural web portals are expected to make farm families more productive, keep farmlands fertile, strengthen rural infrastructure support and help promote a healthy business and social environment through providing the agricultural communities timely and updated information/services. There are many web portals addressing different sectors of agriculture such as research, development, input supply, protection against pests and diseases, weather, prices and marketing, export/import, farmer associations, government policies, taxation *etc.*, but there are no evaluating tools that could help evaluate the existing agricultural web-portals, guiding the farmers/users in selecting appropriate web portal in their domain of interest and also to suggest for better designing of web portals in agriculture which are farmers / end users oriented. This research work has been carried out with the objective to study and review some popular web portals, followed by identification of the indicators for discrimination among the web portals using Delphi technique and lastly the development of an online evaluation system for evaluating all Indian agro-web portals. Finally, the online evaluation system, named

Evaluation System for Agricultural Web Portals (ESAP), that evaluates agricultural web portals and generates automated evaluation reports with proper charts after an interval of seven days, has been implemented using HTML, Java, JSP, PL/SQL and Oracle 9i technologies.

**Guide: Dr. S.D. Sharma**

#### v) Dibyendu Deb

##### **Software for stability analysis using factorial regression**

Yield stability as a selection trait in plant breeding programmes and evaluation trials is constantly gaining importance over yielding ability. Some of the common techniques as an alternative to additive ANOVA model are Additive Main effects and Multiplicative Interaction (AMMI), Sites Regression (SREG), Factorial regression, Joint regression etc. Whenever the information on external environmental characteristics such as weather parameters and soil characteristics is available, it may be accommodated in the basic ANOVA model mentioned above in an attempt to interpret the interaction using the technique called Factorial Regression. Biometricians that are interested in stability analysis are aware of the specialized software packages like SAS, SPAR 2.0 etc. that can handle this analysis. Though SAS is a statistical software package, it requires programming knowledge for writing the program syntax codes to analyze data for analysis purposes. SPAR 2.0 (developed at IASRI) has a module on stability analysis, in which stability analysis can be performed using three models, Eberhart and Russell (1966), Perkins and Jinks (1968) and Freeman and Perkins (1971). However, it cannot perform stability analysis using Factorial regression.

Keeping in view the above problem, the software for stability analysis using Factorial regression has been developed and integrated with SPAR 2.0. It has been built using Visual C++ 6.0 and Visual Basic 6.0 which is more flexible, user-friendly and economic. Data files can be text or notepad or Excel files. There is no restriction on the number of response variables and observations. It has been provided with an extensive Help document, regarding statistical concepts involved, how to use the software, example data file, example of input files and output files. It has also the options like favorites and search through contents and index. Thus SPAR2.0 has been further strengthened for stability analysis by the

inclusion of one more module on factorial regression.

**Guide: Dr. P.K. Malhotra**

#### vi) Chayana Jana

##### **Information system on herbicide use in field crop**

The present era has seen an exponential growth and diversification in all forms of information, sometimes called, an information explosion. It has been made possible due to the impact of computer technology on the modern society. Computerized information systems have influenced nearly all domains. The domain of agriculture is no exception.

Now, the country has made impressive progress in the field of agriculture but, it is one enterprise that faces uncertainty at every stage. In the field of agriculture, crops must be protected from different enemies such as weeds, insects & pests etc. Regarding weeds, it is becoming a major problem day by day. Every crop is exposed to severe competition from weeds. So, proper weed management is a pre-requisite for obtaining higher input efficiency. Weed management is done through the mechanical, cultural and chemical means i.e. herbicides. Use of herbicides is an important method in the modern concept of weed management-technology. Farmers, of course, are using herbicides for controlling the growth of weeds but their use is limited to few crops and few regions. The lack of awareness, information about the availability and the application of herbicides is one of the main reasons for their limited use. Sometimes, the farmers may not know the right dose, time of application and the procedures for the application of herbicide. Because of this, farmer doesn't get expected results inspite of its use. Hence, proper selection of the herbicides and its right dose and time of application are very important for good weed control and for preventing crop damage.

Information System on Herbicide use in Field Crops (ISHUFC) is a Web-based Information System to provide information to extension personnel, farmers, students, researchers etc. for proper herbicide recommendations in field crops. CIS (Computer based Information System) has great importance in agriculture as experts are not always available to answer farmers' query. ISHUFC has a simple query and report generation module to provide the information about crops, weeds, herbicides, herbicide recommendations etc. even in the printable formats.

The software has one level of authentication i.e. Administrator. Administrator has the privilege to add, modify or delete information from the database. Users are free to get information from the software. They can also ask questions regarding any information or about the software to the concerned experts by sending an e-mail; this facility is included in the software itself. Users can also view some frequently asked questions (FAQs).

ISHUFC is developed using ASP.NET. It is a new web-based technology in the scenario. It is an easy and effective tool to develop web based applications. Database part is developed using SQL Server 2000. It is the database widely used for its simplicity and ease in operation.

**Guide: Dr. V.K. Mahajan**

#### vii) Mukesh Kumar Vishal

##### **Web based decision support system for watershed management**

Web based decision support system for watershed management is web-enabled information system to provide information to farmers, NGO's, teaching community on watershed management. CIS (Computer based Information System) has great importance in agriculture as experts are not always available to answer farmers query. In this regard, this DSS is very meaningful to provide the alternate decision scenarios for watershed management. It has five modules for making decision on Soil and Water Conservation Measure, Land based Activities, Solution to Specific Watershed Problems, Crop Selection and Potential Employment Information. The design consideration of Engineering (Structural) and Vegetative (Agronomical) measure are also considered in the DSS.

This software has one level of authentication i.e. Administrator. Administrator has the privilege to "Add", "Modify" or "Delete" the information or records from database. Other features such as "Ask Us", "FAQ", "Contact Us", " Useful Links", are available as modules of the of the DSS which makes this software more flexible and interactive. Users can also ask questions regarding the software to the concerned experts by sending an e-mail and can view some important questions in FAQ (Frequently Asked Questions).

This DSSWM has been developed using recent technologies viz. ASP.NET, SQL Server 2000, HTML,

XHTML and Java Script. The developed DSSWM has been successfully validated for the different watersheds such as Datia, Kheda, and Saliyur and other regions in India. Nonetheless, the developed DSS is flexible enough to incorporate activities of other region in India.

**Guide: Dr. R.C. Goyal**

#### **NATIONAL/INTERNATIONAL TRAINING PROGRAMME**

##### **Senior Certificate Course in Agricultural Statistics and Computing**

Senior Certificate Course in Agricultural Statistics and Computing was organised for the benefit of research workers engaged in handling statistical data collection, processing, interpretation and employed in Research Institutes of the Council, State Agricultural Universities and State Government Departments, etc. and foreign countries including SAARC countries. The main objective of the course was to train the participants in the use of latest statistical techniques as well as use of computers and software packages.

The course was organised during the period 03 July 2007 to 29 December 2007. The course comprised of two independent modules of three months duration each. Eight participants including one departmental and two foreign nationals from Afghanistan participated in both the Modules. Module-I was organized during 03 July 2007 to 29 September 2007. Two participants including one departmental participated in Module-I only.



**A participant receiving the certificate after completing 'Senior Certificate Course in Agricultural Statistics and Computing'**

Module-II was organised during 09 Oct 2007 to 29 December 2007. The course covered under both the modules included Statistical Methods and Official Agricultural Statistics, Use of Computers in Agricultural Research, Sampling Techniques, Econometrics and Forecasting Techniques, Design of Experiments and Statistical Genetics.

The Valedictory Function for the course was held on 29 December 2007 in which Dr. SD Sharma, Director, IASRI distributed the certificates to successful participants.

#### Programme under Centre of Advanced Studies

- A 21 days training programme on “**Spatial and Non-Spatial Information Management and Mining in Agriculture**” was organized during 13 November 2007 to 3 December 2007 under aegis of Centre of Advanced Studies in Agricultural Statistics and Computer Applications. Dr. Anil Rai was the Course Director for the training programme.

The training programme was aimed at familiarizing the participants with the concepts of spatial and non-spatial information management and mining in context of agriculture. It acquainted the participants with the technologies and tools of spatial and non-spatial information management and mining in reference to agriculture and gave exposure to applications of tools and techniques of spatial and non-spatial information management in the field of agriculture. The training programme was attended by 8 participants from various ICAR Institutes (5) and State Agricultural Universities (3). The entire course for this programme was structured in a series of four modules namely (i) Data Base Management System (ii) Remote Sensing and GIS (iii) Data Warehousing System and (iv) Data Analysis and Mining.

The Course material was distributed to the participants in the form of Reference Manual and CD. The course contents were completed in 48 lectures, and 15 practicals. 23 faculty members from the Institute and 7 guest speakers ( Dr. A.K. Choubey, Senior Technical Director, Prof. Navneet Goyal, Department of Computer Science & Information systems, Shri. Ramesh Singh, Senior Technical Director, Dr. Sesha Sai MVR, National Remote Sensing Agency (NRSA), Dr. Girish K. Jha, IARI, Dr. R.P. Sahoo, IARI, Sh. Vipin Dubey, IBM ) delivered the lectures.

- A 21 days training programme on “**Advances in Quantitative Techniques for Policy Analysis in Agricultural Economics**” was organized during 06 to 26 December 2007 under aegis of Centre of Advanced Studies in Agricultural Statistics and Computer Applications. Dr. Ashok Kumar was the Course Director and Dr. Prawin Arya, Dr. D.R. Singh were course Coordinators for the training programme.

The training programme was aimed at familiarizing the participants with the concepts of advances in the field of econometric tools in agriculture and to acquaint the participants with advanced techniques in econometrics for policy analysis enhancing research, teaching and training skills of the participants.

The training programme was attended by 12 participants from various ICAR Institutes (5) and State Agricultural Universities (7). The entire course for this programme was structured in a series of three modules namely (i) Orientation to Statistical Packages for Econometrics Research, (ii) Analytical Econometric Techniques and (iii) Policy Analysis.

The Course material was distributed to the participants in the form of Reference Manual in two volumes. The course contents were completed in 55 lectures, and 7 practicals. 21 faculty members from the Institute and 14 guest speakers ( Dr. N.P. Singh, IARI, Dr. R.N. Padaria, IARI, Dr. Alka Singh, IARI, Dr. B.R. Atteri, IARI, Dr. Bal Raj Singh, IARI, Dr. G.K. Jha, IARI, Dr. Shiv Kumar, IARI, Dr. S. Mauriya, ICAR, Dr. Seema Bathla, JNU, Dr. Pratap S. Birthal, NCAP,



Inauguration of training programme of ‘Advances in Quantitative Techniques for Policy Analysis in Agricultural Economics’

Dr. Shinoj, NCAP, Dr. Suresh Pal, NCAP, Prof. P. Kumar, NCAP, Prof. Ramesh Chand, NCAP delivered the lectures.

- A 21 days training programme on “**Advances in Biometrical Techniques**” was organized during 08 to 28 February 2008 under aegis of Centre of Advanced Studies in Agricultural Statistics and Computer Applications. Dr. Amrit Kumar Paul was the Course Director and Shri S. D. Wahi was Associate Course Director for the training programme.

The training programme was aimed with the objective to familiarize the participants with the recent advances in the field of Biometrics and other useful statistical and computational tools applied in the areas like Plant/Animal Breeding, Genomics and Bioinformatics, to acquaint the participants with the statistical software packages used in the analysis of data, to help upgrade the research and teaching skills of the participants. The training programme was attended by 19 participants from various ICAR Institute and State Agricultural Universities.



Inauguration of training programme on 'Advances in Biometrical Techniques'

The training was structured under five modules (i) Some Preliminaries, (ii) Introduction to Computers and Use of Statistical Software Packages for Data Analysis, (iii) Advanced Statistical Methods in Breeding and Genetics, (iv) Advanced Statistical and Computational Techniques in Genomics and Bioinformatics and (v) Statistical Modeling in Biological Phenomena.

The Course material was distributed to the

participants in the form of Reference Manual and CD. The course contents were completed in 65 lectures, and 23 practicals. 22 faculty members from the Institute and 12 guest speakers delivered the lectures.

- A 21 days training programme on “**Development of Web Applications for Knowledge Dissemination in Agriculture**” was organized during 04 - 24 March 2008 under aegis of Centre of Advanced Studies in Agricultural Statistics and Computer Applications. Mohammad Samir Farooqi was the Course Director for the training programme.

This training programme offered sufficient practical knowledge to design, develop and host a web application using Microsoft .NET technology on IIS web server with MS-SQL server as database. The training programme was attended by 16 participants from various ICAR Institutes (3) and State Agricultural Universities (13). In brief the practical was divided into five modules (i) Hypertext Mark-Up Language (HTML), (ii) Internet Information Server, (iii) SQL Server, (iv) Asp.NET and (v) Knowledge Dissemination. Major areas covered were Web applications for knowledge dissemination, Role of information communication technology in taking scientific knowledge/technologies to the end users, Data warehouse and its applications in agriculture, On line library information system, web application architecture, Introduction to .NET framework, Working with HTML (Structure, Formatting, Tables and Images), Demo of training site for HTML controls, VB.NET language concepts, OOPS concepts using VB.NET, Introduction to Web Web Server (IIS), Configuration & development of web application, Concepts of RDBMS, Structured query language, Overview of SQL server, Creation of tables, Views using SQL server enterprise manager, Introduction to Visual Studio.NET, Introduction to ASP.NET, ASP.NET Web application, Web controls, Accessing database with ADO.NET, Manipulating data with ADO.NET, Securing ASP.NET Web application etc.

Guest lectures on topics of interest were also organised. The Course material was distributed to the participants in the form of Reference Manual and CD. The course contents were completed in 39 lectures and 19 practicals. 18 faculty members from the Institute and 4 guest speakers (Mr. Vipin Kumar, IBM, Mr. Tarun Sharma, IBM, Mr. Rajat Nayyar, TCS, Mr. Anil Kumar Jha, NIC) delivered the lectures.



A participant receiving the certificate after completing training programme on 'Development of Web Applications for Knowledge Dissemination in Agriculture'



Inauguration of training programme on 'Research Methodology for scientists of ICFRE'

### OTHER TRAINING PROGRAMMES

Organized and conducted a two weeks training programme on **Research Methodology** for scientists of Indian Council of Forestry Research and Education (ICFRE) from 07 to 18 January 2008. Dr. Seema Jaggi was the Course Director.

This training programme was specially designed for scientists of ICFRE undertaking forestry research to equip them with the art of collection, analysis of data and drawing valid interpretation of their results.

There were in all 19 scientists from various disciplines of forestry and representing nine different Institutes of ICFRE who attended this training.

All the topics useful for forestry research starting with basics to some advanced topics covering Statistical methods, Experimental designs, Sample surveys, Biometrics and Spatial statistics were covered. The practicals were done using statistical software, mainly SPSS.

Concepts were explained largely without using much of mathematics using computer software and the course emphasized on understanding which analysis is appropriate to use and correct interpretation of the results.

Course material in the form of Reference Manual and Electronic Manual was provided to all the participants.

A "study tour for the two participants of Senior Certificate Course from Afghanistan" was conducted

which comprised visit to CSWRI, Avikanagar, Jaipur and National Research Centre on Seed Spices (NRCSS), Ajmer during 19-24 November 2007 and visit to CIRG, Makhdum, Mathura, and State Department of Agriculture, Anga during 10-12 December 2007.

A FAO sponsored "study visit of participants from Afghanistan" was organised during 10-29 December, 2007. The participants were very senior people from Afghanistan. The participants were taken to almost all the offices related to Indian Statistical System for acquiring them the details of the Indian Statistical System.

The detailed discussions on the subject were held with the Experts in India. The topics covered were Statistical system in India; Area, yield and production statistics; Horticulture statistics; Market information system; Role of Directorate of Economics and Statistics, Ministry of Agriculture, Govt. of India in Planning; Livestock statistics; Livestock census; Land utilisation statistics; Agricultural census; Cost of cultivation; Official crop forecasting; GDP estimation for agriculture and allied activities; Management and organization of agricultural data base, Role of NSSO in agricultural statistics system. As a part of the Study Visit the participants were also demonstrated the Indian Agricultural Statistical System in two States, one having land records and the second not having land records. For the purpose, participants were taken to Kerala State during 16-19 December 2007 where land records are not available and a complete demonstration was given to them by Director,



Directorate of Economics and Statistics, Kerala State regarding the statistics being generated in that State. Regarding States having land record system, the participants were taken to Directorate of Economics and Statistics, Hyderabad (A.P.) during 25-27 December, 2007.



A participant from Afghanistan receiving the certificate after completing 'Senior Certificate Course'

A complete demonstration of the agricultural statistical system covering all the relevant aspects was given to them. To know, how the research institutions like Indian Agricultural Statistics Research Institute help in further development of the statistical system in the country, the topics of current interest on which the Institute has undertaken projects on the request of different organizations were explained to them. One more topic on 'Vital statistics' was added and an expert from Registrar General of India was invited to explain them the system. The participants have been provided printed material for all the topics covered.

A winter school on **Sample Survey Techniques in Agricultural Research** was organised at the Institute during 16 January to 05 February 2008. The participants were Assistant/Associate Professors from State Agricultural Universities (SAUs) and Scientists from ICAR Institutes. Dr KK Tyagi was the Course Director. The broader objective was to provide exposure to the participants about the different sample survey techniques in agricultural research as well as to help to upgrade their capabilities in research, teaching and

training. A total of 21 participants participated in the winter school. The main topics covered were overview of survey sampling in relation to agricultural research, various concepts in sample survey, different procedures of sample selection, simple random sampling, stratified sampling, cluster sampling, sampling on successive occasions, multi-stage sampling, multi-phase sampling, systematic sampling, use of auxiliary information in sample surveys, determination of sample size, non-sampling errors and quality of data, role of models in survey sampling, regression analysis from survey data, variance estimation techniques, small area estimation techniques in relation to national agricultural insurance scheme, use of remotely sensed data and GIS in survey sampling, simulation techniques, survey data analysis packages, planning and organisational aspects related to conduct of sample surveys, some recent agricultural surveys related to crops, livestock, farm mechanization etc. In addition, participants were exposed to various divisional activities including the types of surveys conducted by the Institute. Participants were also given a practical demonstration of how to conduct crop cutting experiments, in a village Mitraun in Najafgarh Community Development Block of Delhi State. A number of lectures/practicals on different topics relating to the broader objectives of the Winter School were delivered. The resource persons were from among the Institute Faculty as well as senior level Officers from other Organizations. The participants were very much satisfied with the course content, the material prepared in the lecture notes and the presentations made by the faculty in the lectures. The course was relevant to their needs. Fairly good number of participants indicated that the



A participant receiving the certificate after completing the winter school on 'Sample Survey Techniques in Agricultural Research'

material covered was worth while and the expectation out of the course was fully met. The participants were of the view that practical session should be lengthier so that they themselves could do the practical exercises. The training material supplied during the course was quite useful. The participants interacted with the faculty, however they suggested keeping a lecture per week free for the purpose. Overall, the feedback of participants was worth appreciating.

An International Training Programme on “**Biometrics in Agricultural Research**” was organized during 3 October – 01 December 2007 for one trainee of NARC, Nepal under ICAR – NARC, Work Plan for the year 2006-07. Dr. Prajneshu was the Course Director and Shri Pal Singh was Associate Course Director.

The training programme was conducted with the following objectives: (i) to familiarize NARC participant with Biometrical techniques in the field of agricultural research, (ii) to acquaint participant with statistical software packages used in analysis of data, (iii) to help upgrade research skills of the participant.

This training course was structured in a series of seven modules with class room lectures and practicals on computers, including demonstration of software packages. The modules were : (1) Some preliminaries in Biometrics, (2) Statistical software packages for data analysis, (3) Statistical methods in breeding and genetics, (4) Statistical modelling of biological phenomena (5) Statistical planning of agricultural field



A participant receiving the certificate after completing the training programme on ‘Biometrics in Agricultural Research’

experiments, (6) Analysis of sample survey data and (7) Field visits.

There were 70 theory classes and 25 practical classes, taught by 30 IASRI faculty. This training also included several study tour and visits to National Agricultural Science Museum, National Gene Bank, National Phytotron Facility, NCMRWF, and NIC, etc.

A 10 days winter school on “**Agri-business and Market Intelligence**” was organised during 06-15 October 2007. Dr S.P. Bhardwaj was the Course Director. This training provided knowledge about supply and demand analysis for agribusiness, sampling and forecasting techniques as well as other econometric/statistical techniques applied in agribusiness with the objectives, i) to familiarize the participants with the latest developments in agribusiness in the country, ii) to acquaint the participants with advanced techniques used in market intelligence, and iii) application of computer software in agribusiness and market Intelligence studies.

The training had been designed in a series of three modules, namely; Agribusiness, Market Intelligence and Computer Software in Agribusiness & Market Intelligence, having classroom lectures on agribusiness and market intelligence with practical application of software on computers. Module-I(Agribusiness) covered Concepts, scope, nature and significance of agribusiness; Supply and demand analysis in agribusiness; Sampling and forecasting techniques for agribusiness; Trade related issues in agriculture and Contract farming-theories and related issues. Module-II (Market Intelligence) covered Terminology, role and importance of agricultural marketing: Marketing functions, market margins and its measurement techniques etc; Marketing intelligence concepts, functions and needs of marketing integration and Role of marketing intelligence and dissemination of information. Under Module-III (Computer Software in Agribusiness & Market Intelligence), Use and application of Minitab, R software, SAS and SPSS were covered.

This training programme made the participants aware of the recent trends in agribusiness and marketing and equipped them to assess the impact of prevailing marketing strategies as well as to suggest new policy measures based on inferences drawn from empirical data using sophisticated econometric/statistical technique.

### Research Fellowship

During 2007–08, 8 Ph.D. and 22 M.Sc. students received research fellowship. 7 Ph.D. students received IARI Scholarship at the rate of Rs. 7,000 p.m. in addition to Rs.10,000 per annum as the contingent grant. 01 Ph.D. student received CSIR Scholarship at the rate of Rs. 8,000 p.m. in addition to Rs.15,000 per annum as the contingent grant. 14 M.Sc. students received ICAR Junior Research Fellowship at the rate of Rs. 5,760 p.m. besides Rs. 6,000 per annum as the contingent grant and 8 M.Sc. students received IARI Scholarship at the rate of Rs. 5,040 p.m. besides Rs. 6,000 per annum as the contingent grant.

#### FACULTY MEMBERS OF P.G. SCHOOL, IARI IN AGRICULTURAL STATISTICS

S. No.	Name	Year of induction
1.	Dr. VK Gupta, National Professor	1984
2.	Dr. Prajneshu, Principal Scientist	1984
3.	Dr. VK Bhatia, Professor (Agricultural Statistics)	1987
4.	Dr. VT Prabhakaran, Principal Scientist	1987
5.	Sh. SD Wahi, Principal Scientist	1987
6.	Dr. Ranjana Agrawal, Principal Scientist	1988
7.	Dr. HVL Bathla, Principal Scientist	1991
8.	Dr. UC Sud, Principal Scientist	1995
9.	Dr. KK Tyagi, Principal Scientist	1995
10.	Dr. Rajender Parsad, National Fellow	1995
11.	Dr. Anil Rai, Senior Scientist	1995
12.	Dr. Seema Jaggi, Senior Scientist	1995
13.	Dr. Chandrahas, Principal Scientist	1996
14.	Dr. PK Batra, Principal Scientist	1996
15.	Dr. Jagbir Singh, Principal Scientist	1996
16.	Mrs. Asha Saksena, Principal Scientist	1998
17.	Dr. Alope Lahiri, Senior Scientist	1998
18.	Dr. Amit Kumar Vasisht, Principal Scientist	1998
19.	Dr. Lal Mohan Bhar, Senior Scientist	1998
20.	Dr. Amrit Kumar Paul, Senior Scientist	1998
21.	Dr. Tauqueer Ahmad, Senior Scientist	1998
22.	Dr. AR Rao, Senior Scientist	1998
23.	Dr. Ramasubramanian V, Senior Scientist	1999

S. No.	Name	Year of induction
24.	Dr. Girish Kumar Jha, Senior Scientist (at IARI)	1999
25.	Dr. Cini Varghese, Senior Scientist	2000
26.	Dr. Prachi Misra Sahoo, Scientist (Sr. Scale)	2002
27.	Dr. RL Sapra, Principal Scientist (at IARI)	2002
28.	Dr. Krishan Lal, Senior Scientist	2003
29.	Sh. Hukum Chandra, Scientist (Sr. Scale)	2003
30.	Sh. Amrender Kumar, Scientist (Sr. Scale)	2003
31.	Md. Wasi Alam, Scientist (Sr. Scale)	2003
32.	Dr. Prawin Arya, Scientist (Sr. Scale)	2003
33.	Dr. Himadri Ghosh, Senior Scientist	2004

#### FACULTY MEMBERS OF P.G. SCHOOL, IARI IN COMPUTER APPLICATION

S. No.	Name	Year of induction
1.	Dr. SD Sharma, Director	1996
2.	Dr. PK Malhotra, Professor (Computer Application)	1991
3.	Dr. RC Goyal, Principal Scientist	1995
4.	Dr. IC Sethi, Principal Scientist	1995
5.	Dr. VK Mahajan, Principal Scientist	1996
6.	Dr. DK Agarwal, Principal Scientist	1999
7.	Sh. Harnam Singh Sikarwar, Scientist (SG)	1997
8.	Md. Samir Farooqi, Scientist (Sr. Scale)	2001
9.	Ms. Alka Arora, Scientist (Sr. Scale)	2001
10.	Ms. Shashi Dahiya, Scientist (Sr. Scale)	2001
11.	Ms. Sangeeta Ahuja, Scientist	2002
12.	Sh. Sudeep, Scientist (Sr. Scale)	2002
13.	Sh. KK Chaturvedi, Scientist (Sr. Scale)	2002
14.	Sh. SN Islam, Scientist (Sr. Scale)	2004
15.	Sh. SB Lal, Scientist (Sr. Scale)	2004
16.	Ms. Anshu Dixit, Scientist (Sr. Scale)	2004
17.	Ms. Anu Sharma, Scientist (Sr. Scale)	2004
18.	Ms. Rajni Jain, Sr. Scientist (at NCAP)	2007

**COURSES TAUGHT DURING THE ACADEMIC YEAR 2006-07**

Code	Title	Course Instructors
<b>Trimester – III Agricultural Statistics</b>		
AS-103	Elementary Sampling & Non-parametric Methods (2+1)	Asha Saxena & Prachi Misra
AS-163	Statistical Inference (4+1)	Rajender Parsad & L.M. Bhar
AS-164	Design of Experiments-I (3+1)	Seema Jaggi & V.K. Gupta
AS-166	Statistical Genetics-I (3+1)	V.T. Prabhakaran & A.K. Paul
AS-302	Advanced Design of Experiments-II (2+1)	R. Srivastava & P.K. Batra
AS-306	Advanced Statistical Genetics-II (2+1)	A.K. Paul
AS-307	Forecasting Techniques (1+1)	Chandrasah & Ramasubramanian V.
AS-370	Recent Advanced in the Field of Specialisation	V.K. Gupta
AS-299	Seminar (1+0)	Seema Jaggi
<b>Computer Application</b>		
CA-131	Data Base Management System (2+2)	R.C. Goyal, Anu Sharma & KK Chaturvedi
CA-132	Data Structures and Algorithms (2+1)	Shashi Dahiya & K.K. Chaturvedi
CA-134	Modeling and Simulation (2+1)	P.K. Malhotra & Samir Farooqi
CA-135	Computer Networks (2+1)	S.N. Islam
CA-299	Seminar (1+0)	S.N. Islam

**COURSES TAUGHT DURING THE ACADEMIC YEAR 2007-08**

Code	Title	Course Instructors
<b>Agricultural Statistics Trimester – I</b>		
AS-101	Elementary Statistical Method (2+1)	K.K.Tyagi & G.K. Jha
AS-150	Mathematical Methods (4+0)	Cini Varghese & Himadri Ghosh
AS-160	Probability Theory (2+0)	P.K. Batra
AS-161	Statistical Methods-I (2+1)	V.T. Prabhakaran & Seema Jaggi
AS-167	Applied Multivariate Analysis (2+1)	Ranjana Agrawal & A.R. Rao
AS-168	Econometrics (2+1)	V.K. Sharma & A.K. Vasisht
AS-169	Planning of Surveys/Experiments (2+1)	R.S. Khatri & Aloke Lahiri
AS-200	Design of Experiments-II (1+1)	Rajender Parsad & Cini Varghese
AS-201	Sampling Techniques-II (1+1)	K.K. Tyagi & Prachi Mishra
AS-202	Statistical Genetics-II (1+1)	A.K. Paul & S.D. Wahi
AS-203	Regression Analysis (1+1)	L.M. Bhar & Ramasubramanian V.
AS-204	Linear Models (2+0)	V.K. Sharma & Krishan Lal
AS-206	Optimization Techniques (1+1)	Prajneshu & U.C. Sud
AS-370	Recent Advances in the Field of Specialisation (1+0)	V.K. Bhatia
AS-299	Seminar (1+0)	Seema Jaggi
<b>Trimester – II</b>		
AS-102	Elementary Design of Experiments (2+1)	P.K. Batra & Krishan Lal
AS-151	Mathematical Methods in Statistics-II (4+0)	N.K. Sharma & Cini Varghese
AS-162	Statistical Methods-II (2+1)	V.T. Prabhakaran & G.K. Jha
AS-165	Sampling Techniques-I (3+1)	Tauqueer Ahmad & Anil Rai
AS-170	Statistical Modeling (2+1)	Prajneshu
AS-205	Advanced Statistical Inference (1+1)	Krishan Lal & U.C. Sud
AS-207	Stochastic Processes (3+0)	Himadri Ghosh
AS-301	Advanced Design of Experiments-I (2+1)	L.M. Bhar & V.K. Gupta
AS-303	Advanced Sample Survey-I (2+1)	H.V.L. Bathla & Jagbir Singh
AS-299	Seminar (1+0)	Seema Jaggi
<b>Computer Application Trimester – I</b>		
CA-100	Introduction to Computer Application (1+1)	V.H. Gupta & Balbir Singh
CA-111	Computer Organization and Architecture (3+0)	Anil Rai & Shashi Dahiya
CA-112	Fundamentals of Computer Programming in C (2+1)	K.K. Chaturvedi & Pal Singh
CA-114	Mathematical Foundations in Computer Application (4+0)	P.K. Batra, N.K. Sharma & H.S. Sikarwar
CA-211	Compiler Construction (2+1)	S.B. Lal
CA-212	Computer Graphics (2+1)	Pal Singh & H.S. Sikarwar
CA-213	Artificial Intelligence (2+1)	Rajni Jain & Anshu Dixit
CA-214	Internet Technologies & Applications (2+1)	Alka Arora & S.N. Islam
CA-215	Software Engineering (1+0)	Anu Sharma
CA-299	Seminar (1+0)	S.N. Islam
<b>Trimester – II</b>		
CA-101	Computer Fundamentals & Programming (3+1)	S.N. Islam & Pal Singh
CA-121	Object Oriented Programming & Design (2+1)	S.B. Lal
CA-122	Operating System (2+1)	H.O. Agarwal
CA-124	System Analysis & Design (2+1)	I.C. Sethi & M.S. Farooqi
CA-221	Data Warehousing and Data Mining (2+1)	Anil Rai, K.K. Chaturvedi & Rajni Jain
CA-222	Multimedia and Applications (1+1)	Shashi Dahiya
CA-224	GIS and Remote Sensing Techniques (1+0)	Prachi Mishra & M.S. Farooqi
CA-225	Data Analysis in Agriculture (1+2)	V.K. Mahajan & M.S. Farooqi
CA-299	Seminar (1+0)	S.N. Islam

Note: Figures in the parentheses indicate the number of credits (Lectures + Practicals)



## Awards and Recognitions

### AWARDS

- Dr. Sushila Kaul was awarded “Life Time Education Achievement Award 2006” by Health and Education



Dr. Sushila Kaul receiving  
“Life Time Education Achievement Award 2006”

Development Association, New Delhi. The award included a Trophy, Certificate and a Gold Medal, was presented by Sh. Bhai Mahavir Singh, former



Dr. Rajender Parsad receiving the  
“NAAS-Associateship”

Governor of M.P. and Sh. Mangat Ram Singhal, Minister of Labour & Industry, Govt. of Delhi during National Seminar held at India Habitat Centre on 14 May 2007.

- Dr. Rajender Parsad received the “NAAS-Associateship” on 04 June 2007 in the 14<sup>th</sup> Annual General Body Meeting of NAAS. The Associateship was conferred by Dr. M.S. Swaminathan.
- Dr. Cini Varghese received the “Lal Bahadur Shastri Young Scientist Award” for the Biennium 2005-2006 in the field of Social Sciences. An ad-hoc research scheme entitled “Experimental Designs for Agricultural Research Involving Sequences of Treatments” has been sanctioned under Lal



Dr. Cini Varghese receiving the 'Lal Bahadur Shastri Young Scientist Award'



Dr. P. Visakhi, receiving the 'Young Information Scientist Award'

Bahadur Shastri Young Scientist Award for a period of 2 years at a cost of Rs. 5,49, 560/- .

- Dr. P. Visakhi, Librarian was awarded a prestigious award of “Young Information Scientist for 2006” by Society for Information Science (SIS) for her outstanding contribution to her profession as well as best paper presentation in SIS. This award was issued in the memory of Late Sh. A.S. Raizada, Information Science Professional & Founder Secretary of SIS. This event was hosted by NISTADAS, CSIR and she was felicitated by Dr. S.K. Basu, Director, MDI, Gurgaon at Lal Bahadur Shastri Institute of Management, R.K. Puram, New Delhi.
- शोध पत्र “बाजार में आगमन के आधार पर दिल्ली में मुख्य फूलों का उत्पादन” द्वारा ए.के. गुप्ता, वी.के. जैन, एम.एस. नारंग, यू.सी. सूद एव के.के. त्यागी को भारतीय कृषि अनुसंधान पत्रिका 21(1): 34-44, 2006 में प्रकाशित उत्कृष्ट लेखों में प्रथम स्थान प्राप्त हुआ ।
- Dr. Hukum Chandra got the best paper award of the 2007 in “Young Researchers/Student Paper Competition” of the Survey Research Methods, Social Statistics and Govt. Statistics Sections of the American Statistical Association, 2007 as a part of his Ph.D. research.

**(a) Affiliation with Professional Societies/ Institutions**

Many scientists and technical personnel are members of the following Professional Societies/ Institutions

- Indian Society of Agricultural Statistics
- Society of Statistics, Computer and Applications
- Indian Society of Agricultural Sciences
- Indian Science Congress Association
- Indian Dairy Association
- Indian Society of Agricultural Economics
- Indian Society of Agricultural Marketing
- Computer Society of India
- Indian Statistical Association
- Indian Econometric Society
- Agricultural Economics Research Association
- Indian Society for Medical Statistics
- Farming System Research and Development

- Association
- Indian Society for Sheep and Goat Production and Utilization
- Indian Association of Statistics and Applied Research
- Indian Society of Genetics and Plant Breeding
- Andaman Science Association
- Indian Society of Geometrics
- Indian Economics Association
- Bhoovigyan Vikas Foundation
- Indian National Science Association
- IARI Alumini
- Calcutta Mathematical Society
- Allahabad Mathematical Society
- Ramanujan Mathematical Society
- Indian Academy of Mathematics
- Indian National Science Academy for Indian Journal of Pure and Applied Mathematics
- Sankhya
- International Biometric Society (Indian Region)
- Statistical Publishing Society
- Association of Commonwealth Universities
- Indian Society of Extension Education
- Indian Society of Ornamental Horticulture
- Haryana Economic Association
- NAARM Alumini
- Forum for Interdisciplinary Mathematics
- Indian Society of Agricultural Engineering
- Swadeshi Science Movement of Delhi

#### (b) Offices in Professional Societies

##### Indian Society of Agricultural Statistics

Dr. VK Gupta	Vice President
Prof. SD Sharma	Honorary Secretary Member, Executive Council Member, Editorial Board
Dr. VK Bhatia	Honorary Joint Secretary Member, Executive Council Member, Editorial Board
Sh. RS Khatri	Honorary Joint Secretary Member, Executive Council
Dr. Rajender Parsad	Honorary Joint Secretary Member, Executive Council Member, Editorial Board

Dr. HVL Bathla	Member, Executive Council
Dr. Prajneshu	Member, Editorial Board
Dr. PK Malhotra	Member, Executive Council Member, Editorial Board
Dr. VK Sharma	Member, Executive Council Member, Editorial Board

##### Society of Statistics, Computer and Applications

Dr. VK Gupta	Vice President Member, Executive Council
Dr. VK Bhatia	Member, Editorial Board
Dr. Alope Lahiri	Joint Secretary Member, Executive Council
Dr. Rajender Parsad	Joint Secretary Member, Editorial Board Member, Executive Council
Dr. LM Bhar	Joint Secretary Member, Executive Council

##### International Statistical Institute, Netherlands

Dr. VK Gupta	Elected Member
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##### Journal of Statistical Planning and Inference

Dr. VK Gupta	Associate Editor
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##### Journal of Statistical Theory and Practice

Dr. VK Gupta	Associate Editor
Dr. Prajneshu	Member, Editorial Board

##### Statistics and Applications

Dr. VK Gupta	Managing Editor
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##### Bureau of Indian Standards, New Delhi

Dr. VK Gupta	Member, Management and Systems Division Council
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##### National Centre of Agricultural Economics and Policy Research, New Delhi

Dr. VK Gupta	Member, Institute Management Committee
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##### Ministry of Statistics & Programme Implementation Statistics

Dr. VK Gupta	Member, Screening Committee for Awards and Fellowship for Outstanding and Meritorious Research Work in Statistics
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**Broad Subject Matter Area Committees (BSMA),  
 Statistical Sciences, ICAR**

Dr. VK Gupta                      Chairman  
 Dr. VK Bhatia                      Member

**Indian Journal of Agricultural Science**

Prof. SD Sharma                  Member, Editorial Board

**Aligarh Journal of Statistics**

Dr. Tauqueer Ahmad          Member, Editorial Board

**Farming Systems Research and Development  
 Association**

Dr. Anil Kumar                      Joint Secretary,  
    Member, Executive Council  
 Dr. VK Sharma                      Member, Editorial Board

**Indian Society of Agricultural Sciences**

Dr. Rajender Parsad          Member, Editorial Board  
 (Basic Sciences) for Annals  
 of Agricultural Research

**Brassica News, Mustard Research and Promotion  
 Consortium (MRPC)**

Dr. Seema Jaggi                      Member, Editorial Board

**Institute of Applied Statistics and Development  
 Studies**

Prof. SD Sharma                  Member, Governing Body  
 Dr. VK Gupta                      Member, Governing Body  
 Dr. Prajneshu                      Member, Governing Body

Dr. Rajender Parsad          Member, Governing Body  
 Dr. VK Bhatia                      Member, Governing Body

**Journal of IARI, PG School**

Dr. Rajender Parsad          Member, Editorial Board

**Journal of Econometric Application and Theory**

Dr. Rajender Parsad          Member, Managing Editor

**Forum for Interdisciplinary Mathematics**

Dr. Rajender Parsad          Joint Secretary

**IARI Alumni Association**

Dr. Rajender Parsad          Member, Executive Council

**Indian Society of Agricultural Marketing**

Dr. AK Vasisht                      Member, Executive Council

**Board of Studies of Department of Statistics at  
 NEHU, Shillong**

Dr. Prajneshu                      Member

**International Journal of Agricultural and  
 Statistical Science**

Sh. Anil Kumar                      Member, Editorial Board

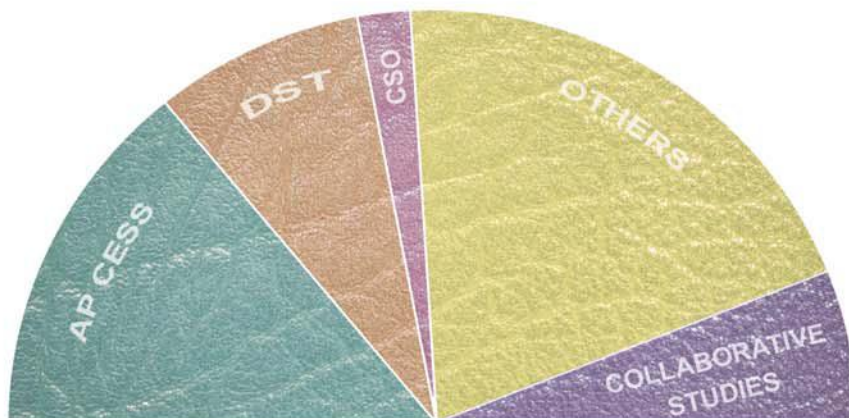
**Computer Society of India**

Dr. PK Malhotra                      Member, Managing  
 Committee  
 Ms. Alka Arora                      Member, Managing  
 Committee

**Swadeshi Science Movement of Delhi**

Dr. Sushila Kaul                      Member, Executive Council





## Linkages and Collaboration in India and Abroad including Outside Funded Projects

S. No.	Title	Collaborative/ Funding Agency	Date of Start	Date of Completion
1.	Planning, designing and analysis of experiments planned ON-STATION under PDCSR	Project Directorate of Cropping System Research, Modipuram	01 April 2002	Continuing
2.	Planning, designing and analysis of ON-FARM experiments under PDCSR	Project Directorate of Cropping System Research, Modipuram	01 April 2002	Continuing
3.	Planning, designing and analysis of data relating to experiments conducted under AICRP on LTFE	Project Coordinator (LTFE) IISS, Bhopal	01 April 2002	Continuing
4.	Planning, designing and analysis of experiments relating to AICRP on Soil Test Crop Response (STCR) correlation	Project Co-ordinator (STCR), Indian Institute of Soil Science (ICAR), Bhopal	March 2000	Continuing
5.	Design and analysis of experiments for spatially correlated observations	Department of Science and Technology (DST)	27 September 2004	26 September 2007
6.	Statistical and algorithmic approach for improved estimation of treatments effects in repeated measurements designs	Department of Science and Technology (DST)	18 May 2004	17 April 2007
7.	Combined analysis of experiments on long-range effect of continuous cropping and manuring on soil fertility and yields stability	ICAR AP Cess Fund	01 May 2004	30 April 2007

S. No.	Title	Collaborative/ Funding Agency	Date of Start	Date of Completion
8.	Outliers in designed experiments	ICAR AP Cess Fund	01 August 2004	31 July 2007
9.	A pilot study to develop an alternate methodology for estimation of area and production of horticultural crops	CSO, MOS & PI, New Delhi	01 May 2005	30 April 2007
10.	Statistical investigation on the performance of non-parametric stability measures when the genotype x environment data is non-normal	ICAR AP Cess Fund	01 August 2004	31 July 2007
11.	Study to investigate the causes of variation between official and trade estimates of cotton production	Ministry of Agriculture, Department of Agriculture & Cooperation, DES, New Delhi	01 October 2006	30 September 2008
12.	Adoption and impact of resource conserving technologies on farm economy in Indo-Gangetic plains, India	IARI, ICAR AP Cess Fund	01 August 2004	31 July 2007
13.	Impact assessment of fisheries research in India	IARI, ICAR AP Cess Fund	01 April 2006	31 March 2009
14.	Long term manurial and fertilizer experiment on potato based cropping systems	CPRS, Modipuram	01 April 2004	31 March 2009
15.	National Information System on Agricultural Education Network in India (NISAGENET)	ICAR AP Cess Fund	01 January 2005	31 December 2007
16.	Some investigations on stable and robust clustering procedures	ICAR AP Cess Fund	01 September 2004	31 August 2007
17.	Developing remote sensing based methodology for collecting agricultural statistics in Meghalaya	SAC, Ahmedabad and NESAC, Shillong	01 October 2007	31 March 2010
18.	Pilot study on small area crop estimation approach for crop yield estimates at the Gram Panchayat level	DES, DOAC, MOA, GOI, New Delhi	01 September 2007	31 August 2008
19.	Stochastic process modeling and forecasting through discrete nonlinear time series approach	Department of Science and Technology (DST)	01 March 2008	28 February 2011
20.	Visioning, Policy analysis and Gender(V-PAGE) - Sub-Programme II : Technology forecasting	NCAP , New Delhi NAARM, Hyderabad; NAIP Funded	01 June 2007	31 May 2012
21.	Visioning, Policy Analysis and Gender (V-PAGE) Sub-Programme III : Policy analysis and market intelligence	NCAP, IARI, NAARM, NRCWA, Yes Bank, Agri-Watch; NAIP Funded	01 June 2007	31 May 2012
22.	Weather based models for forecasting potato yield in Uttar Pradesh	Deptt. of Agri. Statistics & Crop Insurance, Directorate of Agri., U.P., Lucknow	01 November 2007	30 April 2009
23.	Computational analysis of SNPs at functional elements of rice genome	NRC on Plant Biotechnology, IARI, New Delhi	01 September 2007	31 August 2009
24.	Stochastic process modelling and forecasting through discrete non-linear time series approach	Department of Science and Technology (DST), New Delhi	01 March 2008	28 February 2011
25.	Strengthening, refining and implementation of expert system on wheat crop management	DWR, Karnal/IARI, New Delhi	25 August 2007	24 February 2010



## Research Coordination and Management Unit

Research Coordination and Management Unit (RCMU) is responsible for documentation and dissemination of scientific output of the Institute through IASRI News and Annual Report etc. It also organises National Conferences of Agricultural Research Statisticians once in three years and conducts meetings of Senior Officers (SOM) every month. The Unit also assists the Research Advisory Council (RAC) and Quinquennial Review Team (QRT) and is responsible for correspondence with ICAR, ICAR Institutes, SAUs and other organisations in India and abroad. The other functions of the Unit are: to examine the new research project proposals before these are considered by the Institute Research Committee (IRC) in respect of importance of problem, its design and final requirements; to monitor the progress of on-going research projects and to bring out Half Yearly Monitoring Progress Reports; to prepare Annual Action Plan, Activity Milestones, SFC Memo, Monthly Targets and Progress of the Institute, Half Yearly Scientific Targets and Achievements, Quarterly Performance

Review, Zero Based Budgeting, to maintain the Research Project Files (RPF), revision of combined SFC Memo of IASRI and NCAP; Monthly Progress of Identified Thrust Areas and also their submission to ICAR. The Unit also provides help in Art, Photography and Reprographic Services. The following activities were undertaken by the Unit during the year under report:

### Publications

- Annual Report of the Institute for the year 2006–07.
- IASRI Newsletters.
- Monitoring Progress Reports: Half-yearly summary of progress of on-going research projects ending 31 March 2007 and 30 September 2007.

### Communication of Research Material to

#### (i) Indian Council of Agricultural Research

- Material for preparation of DARE/ICAR Annual Report for the year 2007–08.

- Copies of Annual Report of the Institute, for review of Annual Report 2006–07 for getting the Trophy to the Best Annual Report.
- Half yearly information regarding programme of Conferences, Seminars, Symposia, Workshops, Meetings, etc. in Agricultural and Allied Sciences proposed to be held during July-December 2007 and January–June 2008.



Releasing the Annual Report of the Institute during the Annual Day Function

- Action taken report on the proceedings of Annual Meeting of Directors of ICAR Institutes held from 03-04 November 2006 at New Delhi and Agenda notes for next Directors Meeting.
- Action taken report on the proceedings of the Annual Meeting of Directors of ICAR Institutes held from 16-18 July 2007 at New Delhi.
- Information for organization of Summer School/ Winter School/Short Course at the Institute during 2008-09.
- Financial and Research Achievements for the year 2007-08 and Financial and Research Targets for the year 2008-09 of the Institute.
- Filled-in questionnaire for baseline information of the Institute for Component-I of Monitoring and Evaluation System for NAIP, ICAR.
- Filled-in proforma for IP Data Base at ICAR Headquarter.
- Information for the project 'Consultancy Services for Business Planning and Development (BPD) Units.
- Regarding publishing the Circulars/Orders/ Instructions issued by Work Study Unit on ICAR

website.

- Regarding updating of list of contents of Institutes' website.
- Other miscellaneous correspondence with respect to Institute.
- Correspondence regarding IV Regional Committees of the ICAR.
- Material for quarterly publication, 'ICAR Newsletter' and 'ICAR Reporter'.
- Monitorable targets Annual/Five yearly in respect of various programmes being implemented at the Institute.
- Information of different Research Project Files (RPF I, II, III) of various Divisions of the Institute.
- Quarterly/Half-yearly Performance Review (QPR/ HPR) of Central Schemes by Planning commission.
- Monthly targets and progress of the Institute.
- Half-yearly scientific targets and achievement.
- Quarterly/Half-yearly Progress Report (QPR/HPR).
- Monthly progress of identified thrust areas required by Planning Commission.
- Various drafts for revised Perspective Plan: Vision 2025 of the Institute.

**(ii) Department of Personnel and Training, Ministry of Personnel, Grievances and Pensions, New Delhi**

Information for 'Compendium of training programme for the year 2007'.

**(iii) Information Supplied to CSO**

- Quarterly information for CSO Newsletter.
- Miscellaneous correspondence with respect to the Institute.

**(iv) Department of Science and Technology (DST), New Delhi**

Filled-in questionnaire on 'National Survey on Resources Devoted to Scientific and Technological (S&T) Activities - 2005-06.

**(v) Central Soil Salinity Research Institute, Karnal**

Follow up Action Taken Report on the recommendation made at the XVIII Meeting of the ICAR Regional Committee No. IV held at ICAR Research Complex for NE Region, WALMI Complex, Patna (Bihar) during 01-02 September 2006.

### Organisation of Conferences

RCM Unit organised XV National Conference of Agricultural Research Statisticians of the ICAR Institutes, Project Directorates, State Agricultural Universities and Central/State Departments of Agriculture, Animal Husbandry and Fisheries was organised by the Institute at Birsa Agricultural University (BAU), Ranchi (Jharkhand) from 03-04 December 2007. The theme of the Conference was "National Priorities in Agricultural Statistics and Computer Application".



A view of Inaugural Function of XV National Conference of Agricultural Research Statisticians at BAU, Ranchi

### Organisation of Meetings

The Unit organised:

- Two meetings of Institute Research Committee (IRC) on 17-18 August 2007 and 22-23 February 2008 under the Chairmanship of Director of the Institute.
- One meeting of Dr. PV Shenoy, Chairman, Common Research Advisory Committee (RAC) with Director and all Heads of Divisions on 26 November 2007.
- Three meetings of QRT on IASRI for the period 2001-05 on 12-13 April 2007, 17 May 2007 and 27 July 2007.
- Six meetings of Consultancy Processing Cell (CPC) on 17 April, 18 May, 04 June, 09 October and 17 October 2007 were held for finalizing the consultancy and training proposals. A meeting was also held on 08 January 2008 to finalize the honorarium for the Scientists and Technical Officers associated with the consultancy project 'Study for

assessment of Survey Capabilities of Private Sector.

- Thirteen Senior Officers Meetings (SOM) of the Institute to discuss the monthly achievements, shortfalls, if any, and obstacles in achievements in terms of various activities of the Institute including research, teaching, training, projects, publications, library, administrative, financial and others were organized on 09 April, 08 May, 08 June, 09 July, 07 August, 12 September, 05 October, 03 November, 11 December, 2007; 01 and 08 January, 14 February and 07 March, 2008. The meetings were chaired by the Director, IASRI.

### Art, Photography and Reprography

RCM Unit assisted the scientists in preparing and updating diagrams, charts, histograms and maps, photographs for research publications and also visual display of research findings in the Exhibition Room. It also caters the need of reprography of the Institute. It assisted in transcribing the lectures write-ups on transparencies. A Sony Handy Cam DCR PC 350E and a Digital Still Camera of Sony Model No. MVC-CD 500 are available for covering important events organised at the Institute. More than 1000 photographs and video films of important occasions of research and extension activities of the Institute were undertaken and also some slides were prepared. The photocopy needs of the Institute were fulfilled by 07 photocopy machines installed at the Reprographic Lab working under the Unit. Unit has Gestetner Copy Printer 5327, Rex Rotary Copy Printer 1560, Toshiba Estudio 352, Panasonic DP 4510 and two Godrej G 2238 photocopy machines and a colour photocopier Canon iRC 3170i and about 4.3 lakhs black and white and 6482 coloured copies were multi-copied and supplied to various users of the Institute. A HP Scanjet 4070 Photosmart Scanner is also available. A lab of Senior Artist for Graphic Designing with Macintosh Computer system is also maintained.

### Miscellaneous Activities

In addition to the above, the Unit is involved in the following work:

- Miscellaneous correspondence for the 15<sup>th</sup> National Conference of Agricultural Research Statisticians held at BAU, Kanke, Ranchi (Jharkhand) during 03-04 December 2007.

- Supplying the information about training programmes/research activities received from ICAR and various organisations from time to time among the HDs and Scientists of the Institute.
- Proposals for deputation of scientists of the Institute for various conferences/symposia/workshops etc.
- Correspondence/Initiation for procuring various useful softwares and other equipments at the Institute.
- Making availability of Annual Report, Newsletters, Perspective Plan Vision and other important material on the website of the Institute.
- Arrangement of demonstration of procured and other software packages.
- Installation of video projector in the Committee Room of the Institute.
- Reply of various Audit para raised by External Audit Party.
- Reply of various Parliament Questions raised from time to time.
- Captured important moments of various functions organized at the Institute/NASC/NCAP in the Digital Still Camera/ Video Camera and also make arrangements for inclusion of these moments at the website of the Institute.



## List of Publications

### Research Papers

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- Jaggi, Seema and Tomar, Jitendra Singh (2005). Robustness of neighbour balanced complete block designs for correlated observations. *Ind. J. Appl. Statist.*, **9**, 41-52.
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#### Lesson Series

- Jaggi, Seema and Prajneshu. Sampling Distributions and Testing of Hypothesis. Lessons for BA programme of University of Delhi available at University's website (<http://www.du.ac.in/course/material/ug/ba/basicstat/index.html>).

#### Seminar Write-Ups

- A web page (<http://www.iasri.res.in/seminar/AS-299/new1.html>) containing the seminar write-ups of M.Sc. and Ph.D. students of Post Graduate School, IARI pursuing their study at IASRI in the discipline of Agricultural Statistics has been designed and developed for easy accessibility of the readers. These write-ups of the seminars delivered by the students during different academic sessions (2005-06, 2006-07, 2007-08) are a part of their course curriculum (AS -299).



## Consultancy and Advisory Services

### Consultancy/Advisory Services Provided

Sh. Nishant Kumar Sinha, M.Sc. (Agricultural Physics) student of P.G. School of IARI, New Delhi was advised on the development of soil index using the data on pH, electrical conductivity, bulk density, porosity, organic carbon, hydraulic conductivity, microbial biomass, dehydrogenase activity (active population of microbes), Nitrate 'N' (nitrogen in nitrate form),  $\text{NH}_4$  'N' (nitrogen in ammonia form), aggregate stability (mean weight diameter of soil particle which is important for plant growth), available water (difference between field capacity water and wilting point water) from soil in rice-wheat and maize-wheat cropping systems using principal component analysis. In most of the cases first principal component explained more than 75% of the variation and first principal component score was used as soil quality index for different management practices. He was also advised on the identification of treatment with highest soil quality index and testing the significance of differences in treatment effects. The experiment was

conducted during 2006-07.

Sh. Narendra Panwar from National Bureau of Plant Genetic Resources, New Delhi was advised on the combined analysis of data pertaining to the experiment conducted to study the genetic variability and stability analysis in *Ocimum species* at four locations using a randomized complete block design in 30 cultivars each replicated thrice. There were 16 characters on which data were collected.

Dr. Dharam Singh, Senior Scientist from NBSS& LUP, Delhi Centre was advised on the combined analysis of data pertaining to the experiment conducted to evaluate 4 cropping systems viz., Rice-Fallow, Rice-Pea, Rice-Potato and Rice-Mustard conducted in 2004 and 2005. The data were analyzed as rice equivalent yield and potato equivalent yield.

Dr. Yashbir Shivay, Senior Scientist from Division of Agronomy, IARI, New Delhi was advised on the analysis of data pertaining to the experiments 'Effect of zinc-

enriched urea on productivity, zinc uptake and efficiency of aromatic rice-wheat cropping system' conducted to study the effect of various concentrations of zinc-enriched urea on productivity of aromatic rice-wheat cropping system and on zinc concentrations of aromatic rice and wheat grain and straw and their uptake by the rice-wheat cropping system. He was advised on the use of Tukey's Honest Significant Difference and Duncan's Multiple Range Tests.

Sh. W Rungsung from Nagaland was advised on the analysis of data pertaining to an experiment conducted on 50 varieties of rice bean using a randomized complete block design with 3 replications conducted for 2004 and 2005 at three locations Patkai, SASRD and Kohima. He was advised on the analysis of data (both individual environment and combined over 6 environments) pertaining to 13 characters viz. flowering, maturity, plant height, pods per cluster, cluster per plant, pods per plant, pod length, seeds per pod, biomass per plant, protein content, carbohydrate content, 100-seed weight and seed yield per plant.

Dr. Jagmail Singh, Principal Scientist, Division of Genetics, IARI, New Delhi was advised on the analysis of data from complete diallel cross experiment pertaining to cotton (*Gossypium hirsutum* L.) conducted using randomized complete block designs. Three different sets of diallels were made to study genetics of fibre quality, especially fibre strength and its association, if any, with other characters. At Delhi, diallels were made involving 6 genotypes with medium staple (medium fibre length); at Dharwad, crosses were made involving 6 genotypes with long fibre length and at Nagpur, the crosses were made with 8 genotypes for seed oil contents as there is good scope for genetic improvement of seed oil content in cotton. The complete diallel crosses system ( $p$  parents,  $p(p-1)/2$  crosses and  $p(p-1)/2$  reciprocals) were tried at all the three locations to understand the influence of environment and cytoplasm on expression of these characters. Two traits selected for the study are at present very important in the context of suitability for high speed spinning by textile industry and for increasing oil content in our cultivars. The data was analyzed for individual location separately and combined over all the three locations for all the 3 sets of crosses.

Provided statistical consultancy to Directorate of Wheat Research, Karnal for analysis of varietal trials (IVT-I,

IVT-II) and resource management trials planned under All India Coordinated Research Project on Wheat and Barley during 2006-07. Besides, analysis of nearly 1000 trials was carried out location-wise and agro-climatic zone-wise as per the design adopted. The pooled analysis was also carried out at national level. The results were prepared in suitable format for inclusion in their reports.

Provided consultancy to sweet-potato scientist of International Potato Center (CIP), South West and Central Asia for combined analysis of the data of three locations, two seasons with four replications of six varieties of sweet-potato and interpretation of results.

Two collaborative studies namely; (1) Survey of Agricultural Accidents for the year 2004-05 in a large sample of villages selected on the basis of statistical consideration with AICRP on ESA (Ergonomics & Safety in Agriculture), (2) Assessment of post harvest losses of crops/commodities with AICRP on PHT were initiated.

Manual preparation on "Fishery Statistics" as a consultancy project funded by CSO, MOS&PI, GOI, New Delhi.

Three M.Sc. students of P.G. School of IARI from Agriculture Engineering, Agriculture Physics and Genetics Division were provided consultancy services for their thesis analysis and interpretation of results.

Statistical analysis of research work of M.Sc. student Bhupender Kumar, Division of Genetics, IARI, New Delhi was done and helped for proper inference.

Provided consultancy services for Methodological Development of India Protection Quotient, NCAER, New Delhi.

Provided consultancies on sampling design of survey related to women empowerment and development of data base on women in agriculture.

Library of the Institute provided consultation to Library, IGFRI, Jhansi to computerize the house keeping activities of library including specification of hardware, library management software and designing (Layout) for library with the help of Division of Computer Applications and assisted ICAR H.Q. in revamping of its Library in step wise procedure, proposals, cost estimation etc. in the form of report.



12

## QRT, RAC, Management Committee and IRC

### Quinquennial Review Team (QRT)

A Quinquennial Review Team (QRT) to review the work done by Indian Agricultural Statistics Research Institute (IASRI), Pusa, New Delhi for the period 2001–05 constituted by the Director General, Indian Council of Agricultural Research (ICAR), New Delhi had number of meetings. The composition of the QRT was as under:

- |   |          |  |        |
|---|----------|--|--------|
| 1. Prof. A.K. Nigam,<br>Director,<br>Institute of Applied Statistics &<br>Development Studies (IASDS),<br>B-16/1, First Floor, Rajajipuram,<br>Lucknow-226 017 (U.P.) | Chairman | Policy Research (NCAP),<br>Library Avenue, Pusa Campus,<br>New Delhi-110 012   |        |
| 2. Dr. P.K. Joshi,<br>Coordinator (IFPRI), NASC,<br>Pusa, New Delhi-110 012   | Member   | 3. Dr. A.P. Gore,<br>Professor,<br>Department of Statistics,<br>University of Pune,<br>Ganeshkhind,<br>Pune-411 007                                  | Member |
| <b>Presently</b><br>Director,<br>National Centre for Agricultural Economics and   |          | 4. Dr. Rahul Mukerjee,<br>Professor,<br>Indian Institute of Management,<br>Joka Diamond Harbour Road,<br>P.O. Alipur, Kolkata-700 027<br>West Bengal | Member |
|   |          | 5. Dr. K.K. Bhardwaj,<br>Professor,<br>School of Computer Systems Sciences,<br>Jawaharlal Nehru University,<br>New Delhi-110 067                     | Member |

6. Dr. A.K. Srivastava, Member-Secretary  
 Ex-Joint Director of IASRI,  
 B-25/G-1, Dilshad Garden,  
 Delhi-110 095

The sixth meeting of QRT was held from 12-13 April 2007. In this meeting, all the committee members, *i.e.* Prof. A.K. Nigam, Dr. P.K. Joshi, Dr. A.P. Gore, Dr. Rahul Mukerjee, Dr. K.K. Bhardwaj and Dr. A.K. Srivastava were present. They first met the Director. The team then met Scientists of Division of Design of Experiments and Professor (Agricultural Statistics). They visited the Division of Computer Applications, the Remote Sensing and GIS labs and the Library of the Institute. They also visited the Students' Hostel and interacted with the students. The team also met separately the Technical staff of the Institute, and Administrative and Finance and Accounts Officers.

A Meeting of Member- Secretary, QRT with all the Heads of Divisions of the Institute was held on 17 May 2007.

The Chairman, QRT had an interactive meeting with IMC of the institute on 27 July 2007 for getting feedback from the members of the IMC.

Chairman, QRT on the advice of Director General of the Council gave the final report of QRT to the Director of the Institute on 02 August 2007 and Director, IASRI along with his comments submitted the same to the Council on 03 August 2007.

QRT has expressed some observations and also suggested seven recommendations for the improvement of research and teaching activities of the Institute. Besides recommendations on research component there are some general observations on administration, finance etc.

#### Research Advisory Committee (RAC)

The common Research Advisory Committee (RAC) of the Indian Agricultural Statistics Research Institute (IASRI) and National Centre for Agricultural Economics and Policy Research (NCAP) was constituted for a period of three years w.e.f. 29 January 2007 except the membership of non-official members at S.No. given below, 11 and 12, and 13 and 14, whose term will be upto 08 September 2007 and 07 December 2007 respectively. The composition of RAC is as follows:

- |  |          |
|--|----------|
| 1. Dr. P.V. Shenoi,<br>Former Special Secretary,<br>Ministry of Agriculture,<br>Govt. of India and Director, ISEC,<br>20-C, First Main Road,<br>RMV Extension, Stage-II, Block-I,<br>Bangalore-560 094         | Chairman |
| 2. Dr. S.S. Acharya,<br>Former Director,<br>Institute of Development Studies,<br>8-B, Jhalana Institutional Area,<br>D-95, First Floor, Krishna Marg, Bapu Nagar,<br>Jaipur-302015 (Rajasthan)                 | Member   |
| 3. Dr. Rahul Mukerjee,<br>Professor,<br>Indian Institute of Management,<br>Joka Diamond Harbour Road,<br>P.O. Alipur, Kolkata-700 027 (W.B.)   | Member   |
| 4. Dr. A.K. Nigam,<br>Director,<br>Institute of Applied Statistics and<br>Development Studies (IASDS),<br>B-16/1, First Floor, Rajaji Puram,<br>Lucknow-226 017 (UP)   | Member   |
| 5. Dr. A.P. Gore,<br>Professor,<br>Department of Statistics,<br>University of Pune,<br>Ganeshkhind, Pune-411 007   | Member   |
| 6. Dr. S.M. Jharwal,<br>Principal Advisor,<br>DAC, Ministry of Agriculture,<br>Krishi Bhawan, New Delhi-110 114  | Member   |
| 7. Dr. Rajeeva L. Karandikar,<br>Executive Vice-President-Analytics<br>Cranes Software International Limited,<br>4th Floor, Block I, Shankaranarayana<br>Building, 25 Mahatma Gandhi Road,<br>Bangalore-560001 | Member   |
| 8. Director,<br>Indian Agricultural Statistics Research<br>Institute (IASRI),<br>Library Avenue, Pusa Campus,<br>New Delhi-110 012   | Member   |
| 9. Director,<br>National Centre for Agricultural Economics<br>and Policy Research (NCAP),  | Member   |



Library Avenue, Pusa Campus,  
New Delhi-110 012

- |     |  |                  |
|-----|--|------------------|
| 10. | Assistant Director General (ESM),<br>Indian Council of Agricultural Research,<br>Krishi Bhawan, New Delhi-110 114  | Member           |
| 11. | Sh. Vijay Sardana,<br>Executive Director,<br>Centre for International Trade in<br>Agriculture and Agriculture based Industries,<br>82 & 83, Third Floor, Baikunth House,<br>Nehru Place, New Delhi-110019<br>(up to 08 September 2007) | Member           |
| 12. | Dr. S.K. Dorge,<br>81, Shivaji Housing Society,<br>Senapati Bapat Road,<br>Pune-411 016 (Maharashtra)<br>(up to 08 September 2007)   | Member           |
| 13. | Dr. R.S. Deshpande,<br>Professor and Head,<br>ADRT Centre,<br>Institute for Social and Economic Change,<br>Nagarabhavi Post,<br>Bangalore-560072 (Karnataka)<br>(up to 07 December 2007)   | Member           |
| 14. | Dr. Mahesh Pathak,<br>Hony. Director,<br>Agro Economics Research Centre,<br>Sardar Patel University,<br>Mangalam 7, Gayatrinagar Society,<br>Nana Bazar, Ballabh Vidhya Nagar-388 120<br>(up to 07 December 2007)                      | Member           |
| 15. | Dr. V.K. Bhatia,<br>Principal Scientist,<br>IASRI, New Delhi-110 012   | Member-Secretary |

The first meeting of the Joint Research Advisory Committee (RAC) of IASRI and NCAP was held on 26 November 2007 at the Institute under the Chairmanship of Dr. P N Sheno, former Special Secretary, Ministry of Agriculture and Co-operation, New Delhi. The meeting was attended by all the members except Dr. A.P. Gore, Dr. Rahul Mukerjee, Dr. Rajeev L. Karandikar and Dr. Mahesh Pathak. Dr. J.P. Mishra could not attend the meeting due to pressing engagements at Headquarters. National Professor, ICAR and National Fellow and HDs from IASRI and NCAP were also attended the meeting as special

invitees. Dr. Vijay Kumar attended the meeting on behalf of Dr. S.M. Jharwal.



A view of Joint RAC of IASRI and NCAP

Before initiating discussion on the agenda items Dr. S.D. Sharma, Director, IASRI, made a presentation about the achievements, functions, impact and future research programmes of IASRI. Subsequently, Dr. P.K. Joshi, Director, NCAP made a presentation on its Perspective Plan Vision 2025, On-going research projects and Plan for 2008-09. After these presentations, Chairman, RAC emphasized that the information including achievements may be updated regularly on their respective websites so that whosoever is interested may get useful information. On the request of Chairman, RAC all other members of RAC gave their comments and views. From the discussions, the following points emerged:

- i. Both the institutes have very strong research capabilities and thus should pursue rigorously to achieve their mandates looking into the national priorities. They may also formulate collaborative studies with strong statistical base for proper economic evaluation of agricultural research and policy implications.
- ii. IASRI may initiate different research programmes for different areas of agricultural development based on the concept of Small Area Statistics techniques.
- iii. IASRI may initiate its efforts in re-visiting and evolving suitable sampling methodologies for crop estimation surveys including cotton, sugarcane and horticulture.

- iv. IASRI and NCAP may also bring out working papers on the already developed methodologies for its wider publication among the stakeholders.
- v. Both the institutions may examine deeply into the output and outcomes achieved for possible impact studies of different methodologies developed.

### **Management Committee**

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

- |   |                     |
|---|---------------------|
| 1. Prof. S.D. Sharma,<br>Director,<br>IASRI (ICAR),<br>New Delhi-110 012  | Chairman            |
| 2. Director (Agriculture),<br>Government of Delhi, ITO,<br>New Delhi-110 001  | Member              |
| 3. Sh. V.K. Singh,<br>Director (Agriculture),<br>Government of Uttar Pradesh,<br>Lucknow, Uttar Pradesh   | Member              |
| 4. Dr. K.R. Kundal,<br>Joint Director (Research),<br>IARI, Pusa,<br>New Delhi-110 012   | Member              |
| 5. Sh. Vijay Sardana,<br>Executive Director,<br>International Business<br>Centre in Agriculture and<br>Agriculture Related Industries,<br>82-83, Third Floor,<br>Baikunth House,<br>Nehru Place,<br>New Delhi-110 019 | Non-Official Member |
| 6. Dr. S.K. Dorge,<br>81, Shivaji Housing Society,<br>Senapati, Bapat Road,   | Non-Official Member |

- |   |                  |
|---|------------------|
| Pune-411 016  |                  |
| 7. Sh. Radhey Shayam,<br>Senior Finance and Accounts Officer,<br>ICAR, Krishi Bhawan,<br>New Delhi-110 114                          | Member           |
| 8. Dr. P.K. Agarwal,<br>Head,<br>Division of Environmental Sciences,<br>IARI, Pusa, New Delhi-110 012                               | Member           |
| 9. Dr. Madhuban Gopal,<br>National Fellow,<br>Division of Agricultural Chemistry,<br>IARI, Pusa, New Delhi-110 012                  | Member           |
| 10. Dr. R.K. Mahajan,<br>Principal Scientist (Agril. Stat.),<br>Division of Germplasm Evaluation,<br>NBPGR, Pusa, New Delhi-110 012 | Member           |
| 11. Dr. R.L. Sapra,<br>Principal Scientist (Agril. Stat.),<br>Division of Genetics,<br>IARI, Pusa, New Delhi-110 012                | Member           |
| 12. Dr. S.K. Tandon,<br>Assistant Director General (Engg.),<br>KAB-II, ICAR, Pusa,<br>New Delhi-110 012                             | Member           |
| 13. Chief Administrative Officer<br>IASRI (ICAR),<br>Pusa, New Delhi-110 012  | Member-Secretary |

The 55<sup>th</sup> Meeting of the Management Committee was held on 07 May 2007 under the Chairmanship of



**55<sup>th</sup> Management Committee meeting is in progress**

Prof. S.D. Sharma, Director, IASRI. The following agenda items were discussed:

- Confirmation of proceedings of the 54<sup>th</sup> meeting of the Management Committee held on 15 December 2006
- Review of action taken on recommendations of the 54<sup>th</sup> meeting of the Management Committee held on 15 December 2006



56<sup>th</sup> Management Committee meeting is in progress

56<sup>th</sup> meeting of the Management Committee was held on 27 July 2007 under the Chairmanship of Prof. S.D. Sharma, Director, IASRI. The following agenda items were discussed:

- Confirmation of proceedings of the 55<sup>th</sup> meeting of the Management Committee held on 07 May 2007
- Review of action taken on recommendations of the 54<sup>th</sup> meeting of the Management Committee held on 07 May 2007
- Consideration of Institutes Quinquennial Review Team(QRT) (2001-05)
- Institutes 11th Five Year Plan(2007-08 to 2011-12)
- Under the Medical Attendance Rules, 1944 employees(both in service and retired) residing in area of Najafgarh and Sonapat which are not covered in CGHS area, can take medical treatment from Authorised Medical Attendant

on conditional basis from 26-02-2007 to 25-02-2009- approval for

- Any other item with the permission of the chair

#### Institute Research Committee

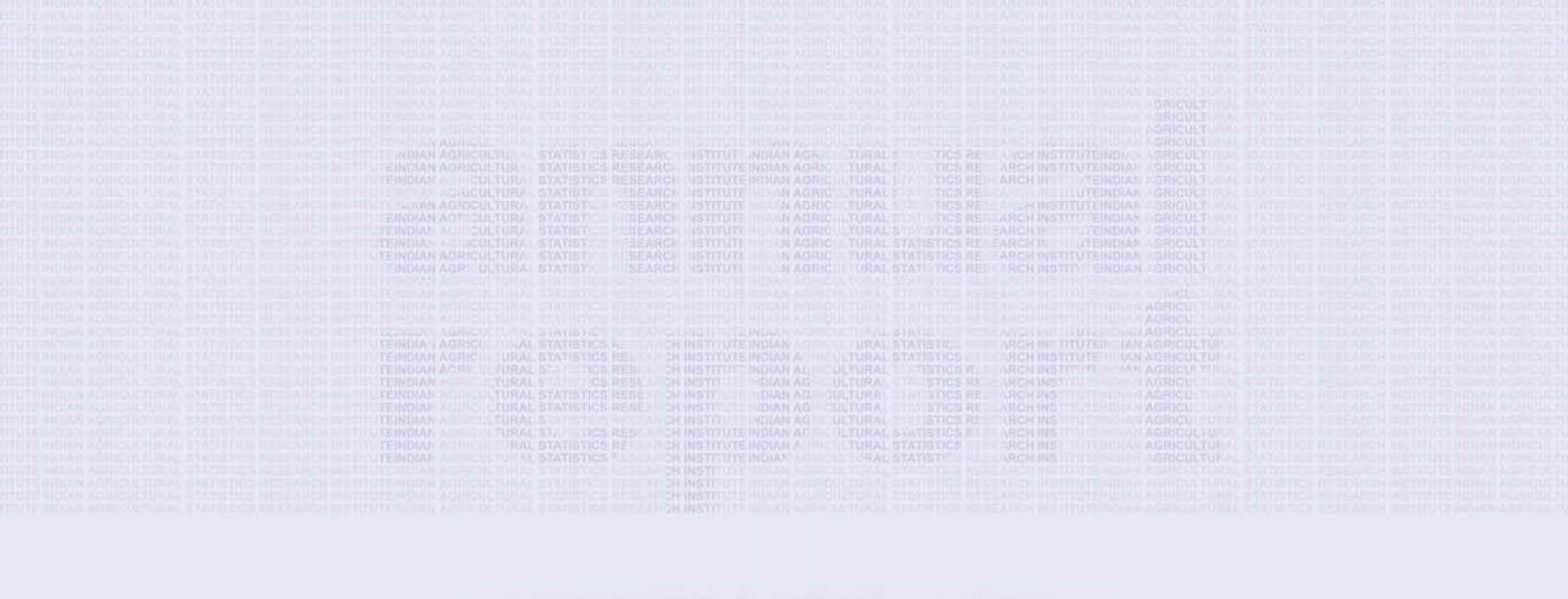
The Institute Research Committee (IRC) formerly known as Staff Research Council (SRC) of the Institute (renamed as per Council's O.O. No. 5 (1) / 2004- Gov.



A view of Institute Research Committee meeting

Cell dated 25 August 2006) is an important forum to guide the scientists in the formulation of new research projects and to review the progress of on-going research projects periodically. It also monitors the follow up action on the recommendations of the Quinquennial Review Team (QRT), Research Advisory Committee (RAC) in respect of technical programmes of the Institute. Dr. S.D. Sharma, Director is the Chairman and Dr. V.K. Bhatia, Principal Scientist and In-charge (RCMU) is the Member Secretary of the IRC. New guidelines of IRC for monitoring progress of new and ongoing research projects were finalised.

Two meetings of the Institute Research Committee (IRC) were held during 17–18 August 2007 and 22–23 February 2008. In the first meeting 13 new research projects were approved and progress of 35 ongoing research projects were discussed. In the second meeting three Institute funded new research projects were approved and review of progress of 48 ongoing research projects were discussed.



# INDIAN AGRICULTURAL STATISTICS RESEARCH INSTITUTE

# 13



## Papers Presented and Participation of the Institute at the Conferences/Workshops, Etc.

### PAPERS PRESENTED

#### Workshop on Data Warehouse for Agricultural Sector organized by NIC at New Delhi on 04 April 2007

- Anil Rai. Implementing data warehouse: experience from IASRI

#### Conference of Central and State Statistical Organizations (COCSSO) organised by MOS and PI, CSO, New Delhi at NASC Complex, New Delhi during 10-11 April 2007

- Tauqueer Ahmad, HVL Bathla and SD Sharma. Methodological issues related to horticultural statistics

#### XXI International Conference on Computers, Electrical Systems Science, and Engineering (CESSE 2007) organized at Vienna, Austria during 25-27 May 2007.

- Punam Bedi and Sudeep Marwaha. Versioning OWL ontologies using temporal tags

#### III International Conference on Establishment of Surveys” organised by ASA at Canada during 19-21 June 2007

- UC Sud. Estimation of finite population mean using ranked set two stage sampling design

#### XIV Annual Group Meeting of AICRP-Rapeseed and Mustard at SKUAST, Jammu during 02-04 August 2007.

- Rajender Parsad and VK Gupta. Statistical issues in Rapeseed-Mustard varietal trials (Invited Talk)

#### Conference in the Honour of Professor Alope Dey at I.S.I. Delhi during 05-06 September 2007.

- Rajender Parsad, Ananta Sarkar, VK Gupta and Abhishek Rathore. Efficient designs for micro-array experiments under fixed/mixed effects model. (Invited Talk)

- VK Gupta, Rajender Parsad and LM Bhar. Some thoughts on fractional factorial plans. (Invited Talk)

**Economic Modeling Conference at Moscow during 12-14 September 2007**

- Sushila Kaul. Bio-economic modeling of climate change on crop production in India

**Hindi Poster Presentation Pratiyogita held at the Institute on 24 September 2007**

- डी के सहगल व यू सी बन्दूनी। फास्फोरस के दीर्घकालीन उपयोग का उपज की निरंतरता और मृदा पर प्रभाव
- प्रमोद कुमार, राजेन्द्र सिंह तोमर व राजिन्द्र कौर। द्विवार्षिक फसलचक्रों का सांख्यिकीय मूल्यांकन
- राजेन्द्र सिंह तोमर, राजिन्द्र कौर व प्रमोद कुमार। फसलक्रम बाजरा-गेहूं की धरणीय उपज का सांख्यिकीय अध्ययन
- राजिन्द्र कौर, राजेन्द्र सिंह तोमर व प्रमोद कुमार। जैविक खेती में फसलक्रम चावल-टमाटर-भिन्डी की उपज का अध्ययन
- ए के गुप्ता, एच वी एल बठला एवं विजय बिन्दल। खाद्यान्न फसलों के उत्पादन में कटाई एवं कटाई के पश्चात हुई हानियों का आकलन
- सत्यपाल, रामसुब्रमणियन वी, अमरेन्द्र कुमार, एवं सुभाष चन्द मेहता। सांख्यिकीय मॉडलों द्वारा दूध उत्पादन का पूर्वानुमान

**Annual Workshop of Soil Test Crop Response Correlations Project of AICRP at IISS, Bhopal during 28-29 September 2007**

- Alope Lahiri. Designing and analysis of the new STCR experiment (Invited paper)

**International Conference on Advances in Interdisciplinary Statistics at Greensboro, U.S.A. during 12-14 October 2007**

- Prajneshu. Nonlinear time-series modeling and forecasting for volatile onion price data

**Fourth International Conference on Agricultural Statistics at Beijing, China on 22 October 2007**

- VK Bhatia. Statistical evaluation of agricultural development in asian countries

**1<sup>st</sup> CIRIEC International Conference on Social Economy at Victoria, BC, Canada during 22-25 October 2007**

- Sushila Kaul. Implications of globalization on development of diary co-operatives in India

**National Seminar on the "Survey Results of NSS 61<sup>st</sup> Round" organized by National Sample Survey**

**Organization, Ministry of Statistics and Programme Implementation, Govt. of India at New Delhi during 29-30 October 2007**

- Jagbir Singh and HVL Bathla. A note on employment and unemployment situation in India – NSS 61<sup>st</sup> round

**Conference on Environmental and Livelihood Security through Resource Management in Northern India (ELSTRM-2007) at CSWCRT, Dehradun on 31 October 2007**

- Ashok Kumar. Role of micro credit and financial institutions in agricultural and rural development

**67<sup>th</sup> Annual Conference of Indian Society of Agricultural Economics at BIRD, Lucknow, U.P. during 05-07 November 2007**

- AK Vasisht, S Sujith Kumar, PK Aggarwal, N Kalra, H Pathak, HC Joshi and RC Choudhary. An Integrated evaluation of trade-offs between environmental risk factors and food production using interactive multiple goal linear programming – A case study of Haryana
- Sushila Kaul. Analytical study of marketing of milk through cooperatives in India

**Tractor and Farm Machinery Manufacturers Meet at CIAE, Bhopal during 16-17 November 2007**

- KK Tyagi. Presentation on the long term mechanization strategies

**10<sup>th</sup> Annual Conference of Society of Statistics, Computer and Application at ST. Thomas College, Pala, Kerala during 16-18 November 2007**

- Rajender Parsad, Ananta Sarkar, VK Gupta and Abhishek Rathore. Computer aided search of efficient designs for 2-colour microarray experiments (Invited Talk)
- VK Gupta, Rajender Parsad and Lalmohan Bhar. Some considerations on fractional factorial designs (Invited Talk)
- Lalmohan Bhar, Rajender Parsad and VK Gupta. A robust method for experimental data analysis (Invited Talk)
- Alope Lahiri, MN Das and Mukti Kanta Sukla. A convenient algorithm for extraction of any root of any number
- Dinesh Kumar Pateria, Seema Jaggi, Cini

Varghese and MN Das. A series of complete non-circular block designs in presence of competition effects

**8<sup>th</sup> International Conference of the Asian Fisheries Forum at CMFRI, Kochi during 20-23 November 2007**

- AK Vasisht and DR Singh. An analysis of capital formation of fisheries sector in India

**National Conference on 'Corporate Strategies and Innovations in the Emerging Global Economy' Computing for Nation Development organized at University School of Management Studies, GGS-IP University, New Delhi during 23-24 November 2007**

- Kavita Srivastava, Sanjay Kumar Malik, SAM Rizvi and Sudeep Marwaha. A scheme for e-business knowledge management through semantic web

**Bhartiya Vigyan Sammelan 2007 at Samanvay Karyalaya, Bhopal, MP during 23-25 November 2007**

- A Rakshit, SK Kaushik, AK Paul, J Singh and SR Bhat. Correlation and path coefficient analysis among different traits contributing to fiber quality in upland cotton (*Gossypium hirsutum*)

**61<sup>st</sup> Annual Conference of Indian Society of Agricultural Statistics on Statistics and Informatics in Agricultural Research at Birsa Agricultural University, Kanke Ranchi during 30 November to 02 December 2008**

- VK Bhatia. QTL detection in drought stress in maize
- Krishan Lal, VK Sharma, PK Batra and LM Bhar. Some investigations on mixture experiments in agriculture
- UC Sud, Hukum Chandra and IC Sethi. A note on Baye's estimator in finite population sampling.
- UC Sud. Small area estimation- theory and some application in agriculture
- Jagbir Singh. A note on estimates of women workforce in India – NSS 61<sup>st</sup> round
- Ranjana Agrawal and Amrender Kumar. Modeling for forecasting crop yield using weather parameters and agricultural inputs
- SC Mehta, Satya Pal and Amrender Kumar.

Weather based forecast models for potato

- T Rai. Rainfall based forecast model for rice yield
- Sushila Kaul. A study of marketing of milk through cooperatives in India
- AR Rao, SD Wahi, SK Choudhary and VT Prabhakaran. An index for selecting genotypes simultaneously for high yield and stability under incomplete genotype x environment data
- SD Wahi, AR Rao, SK Choudhary and VT Prabhakaran. A study on performance of simultaneous selection indices against missing observations
- SK Choudhary, AR Rao, SD Wahi and VT Prabhakaran. Application of clustering technique on AICRP trial of groundnut data for sub-zonalization
- SN Islam, Hari Om Agarwal, MS Farooqi, KK Chaturvedi, Kirti Sharma, AK Sharma, Randhir Singh, RK Sharma and HS Sikarwar. Expert System on wheat crop management: An IT based tool for Transfer of Technology

**XV National Conference of Agricultural Research Statisticians at Birsa Agricultural University, Kanke, Ranchi during 03-04 December, 2007**

- Rajender Parsad and VK Gupta. Agricultural statistics research: current status and future challenges. (Invited Talk)
- VK Bhatia. Priorities in agricultural statistics: current status and future challenges
- Prajneshu, Himadri Ghosh and Seema Jaggi. Some priorities for post-graduate teaching in agricultural statistics
- PK Malhotra. Teaching and training in computer application in the NARS-priorities

**International Conference on Computational Intelligence and Multimedia Applications (ICCIMA'07) organized at IEEE Conference, Sivakasi, India during 13-15 December 2007**

- Sudeep Marwaha, Mohit Gupta, Manisha Bansal and Punam Bedi. Semantic web enabled resource scheduler: An approach using temporal extensions to ontologies

**3<sup>rd</sup> Indian International Conference on Artificial Intelligence at NIA, Pune during 17-19 December 2007**

- Amrender Kumar, Ramasubramanian V and

Ranjana Agrawal. Forecasting rice yield using neural networks

- Ramasubramanian V, Ranjana Agrawal, SB Lal, Anil Rai, Amrender Kumar, Syed Moonis Raza and GK Jha. Evaluation of neural network applications for data editing
- SB Lal, Ramasubramanian V, Ranjana Agrawal, Syed Moonis Raza and GK Jha. A software for imputing missing values using neural networks
- Anu Sharma and Rajni Jain. Applying decision tree for automatic classification of agricultural web documents
- SN Islam, Hari Om Agarwal, MS Farooqi, KK Chaturvedi, Kirti Sharma, AK Sharma, Randhir Singh, RK Sharma, and HS Sikarwar. Knowledge engineering for an expert system on wheat crop management

**2<sup>nd</sup> Asian Congress of Mycology and Plant Pathology at Osmania University, Hyderabad during 19-22 December 2007**

- Ranjana Agrawal and Amrender Kumar. Models for forewarning diseases in crops (invited talk)
- Karuna Faujdar, Amrender Kumar, Ranjana Agrawal, C Chattopadhyay and AP Mathur. Epidemiology and forecasting models of alternaria blight for indian mustard

**7<sup>th</sup> National Symposium on Plant Protection Options-Implementation and Feasibility organized at National Chemical Laboratory, Pune during 20-21 December 2007**

- SN Islam. Kirti Sharma, Samir Farooqi, KK Chaturvedi and Hari Om Agarwal. Interdisciplinary approaches for pest management through IT technology

**21<sup>st</sup> National Conference on Agricultural Marketing at Agricultural College and Research Institute, Madurai during 20-22 December 2007**

- SP Bhardwaj and AK Vasisht. Policy support for contract farming in lac cultivation – An alternative marketing model
- SP Bhardwaj. Conceptual reforms to improve marketing efficiency

**IUPAC sponsored First International Conference on Agrochemicals Protecting Crop, Health and Natural Environment at Division of Agricultural Chemistry, IARI, New Delhi during 08-11 January 2008**

- Rajender Parsad, VK Gupta, Jitendra Kumar and NA Shakil. Significance of statistical tools for agrochemical research (Invited Talk)

**2<sup>nd</sup> National Conference INDIA.Com-2008, Computing For Nation Development organized at Bharati Vidyapeeth's Institute of Computer Applications and Management, New Delhi during 08 - 09 February 2008**

- Ramprakash, Sanjay Kumar Malik, Nupur Prakash, SAM Rizvi and Sudeep Marwaha. Role of search engines in intelligent information retrieval on web

**International Meet on 'Mapping the Scientific Consciousness: National and International Efforts' organized by National Institute of Science, Technology and Development Studies (CSIR) and National Council for Science and Technology Communication (DST) at Nehru Memorial Museum and Library, New Delhi during 07- 08 March 2008**

- Anil Rai and Seema Jaggi. Modeling of categorical data in public understanding of science (PUS) survey
- Anil Rai, AR Rao and Seema Jaggi. Statistical tools for public understanding of scientific research
- SD Sharma. Multivariate analysis of data in Public Understanding of Science (PUS) Surveys.

**Discussion Seminar Experiments with Mixtures: Theoretical Advances and Applications at IASRI, New Delhi during 17-18 March 2008**

- Krishan Lal, VK Gupta, PK Batra and LM Bhar. Designs for mixture experiments in agriculture

**Dissemination Workshop on Fractional Factorial Designs for Experiments with Scarce Resources at IASRI, New Delhi on 18 March 2008**

- Krishan Lal and Susheel Kumar. Linear trend - free designs for two level fractional factorial experiments

**National Workshop-cum-Training Program on 'Bioinformatics and Statistics in Aquaculture Research' organized at CIFA, Bhubaneswar during 24-26 March 2008**

- Anil Rai, KK Chaturvedi and PK Malhotra. Design and development of fisheries data mart in India



## PARTICIPATION

- दिनांक 18 अप्रैल 2007 में एन आर सी रेपसीड मस्टर्ड, भरतपुर द्वारा आयोजित हिन्दी कार्यशाला एवं प्रशिक्षण कार्यक्रम 'कम्प्यूटर तकनीकों के अनुप्रयोगों से अनुसंधान एवं कार्यालय कार्यों में हिन्दी का प्रयोग बाधाएं' पर व्याख्यान ।
- Developing winning research proposals in agricultural research at NAARM, Hyderabad during 20-25 April 2007
- International Congress on "Advances in zoo and wild animals health and management" and symposium on "Impact of diseases on conservation of wild animals" at Sher-e-Kashmir University of Agril. Science and Technology, Jammu during 26-27 April 2007
- ICAR and USDA Indo US agriculture knowledge initiative joint workshop on contract farming: methods and experiences during 05-06 May 2007
- One-day seminar on strategy for accelerated and inclusive agricultural growth in the XI Plan at New Delhi on 11 May 2007
- National symposium on "Agriculture cannot wait: New horizons" organised by National Academy of Agricultural Sciences at NASC Complex, New Delhi on 05 June 2007
- दिनांक 18-22 जून 2007 तक केन्द्रीय हिन्दी प्रशिक्षण संस्थान, नई दिल्ली द्वारा आयोजित "307 वीं गहन हिन्दी कार्यशाला"
- Launching workshop of Visioning, Policy Analysis and Gender(V-PAGE) at NCAP, New Delhi during 26-27 June 2007
- National workshop on improvement of agricultural statistics" at NASC Complex, New Delhi during 05-06 July 2007
- Brainstorming workshop on "Mainstreaming gender in agricultural research and education" at NCAP, New Delhi on 10 July 2007
- ICAR foundation day and Director's conference at NASC Complex, New Delhi during 16-18 July 2007
- Dissemination workshop on outliers in designed experiments at IASRI, New Delhi on 26 July 2007
- International seminar on Conventional and biotechnological approaches for sustainable development in sub-himalayan region (CBSAD-07) at IVRI, Mukteswar during 28-29 July 2007
- National symposium on 'Agriculture cannot wait: new horizons' at New Delhi on 06 August 2007
- Times India strategy summit on "The future creates the present" at New Delhi on 07 August 2007
- Two days workshop on M&E activities for the benefit of consortium leaders and PI of approved consortia by PIU NAIP at NAARM Hyderabad on 09-10 August 2007
- Policy dissemination workshop on Agricultural science and technology indicators for India at NCAP, New Delhi on 13 August 2007
- Indian animal industry expo-2007 at New Delhi on 16 August 2007
- Model based design for embedded signal processing systems at New Delhi on 23 August 2007
- 46<sup>th</sup> All India wheat and barley research workers meet at College of Agriculture, Pune during 24-27 August 2007
- One day workshop on SAS Enterprises at IASRI, New Delhi on 25 August 2007
- Brainstorming sessions for bringing out edited document on existing/pipeline technologies for wheat crop and rice crop under NAIP project "Visioning, Policy Analysis and Gender (V-PAGE), Sub Programme II-Technology Forecasting" at Directorate of Wheat Research, Karnal on 31 August 2007, CRRRI, Cuttack during 26-28 September 2007 and IIPR, Kanpur on 26 October 2007 respectively
- National conference on emerging platforms for agricultural marketing at FICCI, New Delhi during 20-21 September 2007
- Workshop on higher education management information system at National University of Educational Planning and Administration (NUEPA), New Delhi during 20-21 September 2007
- Seminar on Prospects of food and dairy processing industries in eastern region at Banaras Hindu University, Varanasi during 28-29 September 2007
- Seminar on "Where hunger rules, peace cannot prevail – a road map for a hunger free nutrition secure India" at NASC Complex, New Delhi on 03 October 2007

- Fourth workshop of AICRP on ergonomics and safety in agriculture (ESA) at OUAT, Bhubaneswar during 04-06 October 2007
- Seminar on 'Oracle Technology Summit' at New Delhi on 11 October 2007
- 27<sup>th</sup> World food day celebration 2007 organized by Department of Agricultural Research and Education, Ministry of Agriculture at New Delhi on 16 October 2007
- Brainstorming workshop on Networking for agricultural economics and policy research under the project V-PAGe of NAIP at UAS, Dharwad on 24 October 2007
- 29<sup>th</sup> Foundation day at Central Avian Research Institute, Izatnagar, Bareilly on 02 November 2007
- 34<sup>th</sup> ASRB Foundation day, New Delhi on 05 November 2007
- Tenth national convention on knowledge, library and information networking (NACLIN-2007) on library without boundaries: Reaching the unreachable in knowledge era during 20 - 23 November 2007
- Inception workshop of the regional programme on "Pro-poor policy formulation dialogue and implementation at the country level", a FAO initiative collaboration with IFAD at New Delhi during 14-15 December 2007
- Project Inception workshop on exploring market opportunities for fisheries sector in India, sponsored by National Fisheries Development Board at NCAP, New Delhi on 03 January 2008
- Procurement and M&E activities under the NAIP project at NAARM, Hyderabad during 03-06 January 2008
- Vice Chancellor's conference at New Delhi during 19-20 January 2008
- International conference on commodity futures market: riding the growth phase at ASSOCHAM, New Delhi on 22 January 2008
- Ninth ESRI India user conference held at Noida during 22-23 January 2008
- National symposium on bio-entreprenurship and bio-business opportunities at New Delhi during 28-29 January 2008
- National workshop on impact assessment of new agricultural technologies at NCAP, New Delhi during 30-31 January 2008
- National conference on distance education to animal farmers with emphasis on women self-help groups at BHU, Varanasi during 01-03 February 2008
- Women empowerment and rights organized by ICAR in support with women's studies programme, JNU, New Delhi on 04 February 2008
- Workshop-cum-training on bioinformatics applications in agricultural research at Unit of Simulation and Informatics, IARI, New Delhi on 25 February 2008
- Conference on science-based agricultural transformation towards alleviation of hunger and poverty in SAARC countries jointly organized by Ministry of Agriculture, Govt. of India; ICAR, New Delhi and IFFCO Foundation, New Delhi during 05-07 March 2008
- Golden jubilee celebrations of the Dairy Science College at NDRI, Karnal during 12-13 March 2008
- National seminar on children communal harmony and museum at conference hall, National Museum, New Delhi on 14 March 2008
- Discussion seminar experiments with mixtures: theoretical advances and applications at IASRI, New Delhi during 17-18 March 2008
- Dissemination workshop on fractional factorial designs for experiments with scarce resources at IASRI, New Delhi on 18 March 2008
- World water day conference of Ministry of Water Resources, GOI at New Delhi on 20 March 08
- Dissemination workshop on design resources server at IASRI, New Delhi on 26 March 2008
- Platinum jubilee celebrations of the Institute of Agricultural Sciences, Banaras Hindu University, Varanasi during 28-29 March 2008
- Training workshop on technology foresight methodologies in agricultural innovation system JNU, New Delhi during 31 March to 10 April 2008

**MEETINGS**

- Board of Post-graduate studies meeting at N.E.H. University, Shillong on 16 April 2007
- Meeting with DDG (Engg) for discussing ICAR inspection report on non-utilisation of scientific manpower on 24 April 2007
- Task force meeting for the Study on Assessment of Survey Capabilities of Private Sector at CSO, New Delhi on 30 April 2007
- Task force meeting of the project entitled "Assessment of survey capabilities for the private sector" under the Chairmanship of DG, CSO at New Delhi on 30 April 2007. The report on Consultancy Wing was presented in the meeting
- NCAP annual day special lecture by Dr. VS Vyas 01 May 2007
- Meeting regarding a project on "Forecasting yields using remotely sensed data" on 04 May 2007.
- Meeting pertaining to the project on "Assessment of harvest and post-harvest losses on 08 May 2007
- The first meeting of Central Steering Committee for Agricultural Census(AC) and Input Survey Scheme in X (AC 2005-06) and XI(AC 2010-11) Plan at Krishi Bhawan on 9 May 2007
- 78<sup>th</sup> Annual General Meeting of ICAR Society at New Delhi on 12 May 2007
- The brain storming session on soybean growth and sustainability in India at New Delhi with DG ICAR in chair on 15 May 2007
- Inauguration of Indo US agriculture knowledge initiative workshop on strengthening of indian libraries and information system at New Delhi on 16 May 2007
- Meetings on 17 May 2007, 1 and 5 June 2007 at Ministry of Food Processing Industries, New Delhi on E-Monitoring and Disbursement of grant by the Ministry of Food Processing Industries
- Meeting with Dr. Greg Johnson, Horticulture for Development, visiting India as a part of AVRDC programme to prepare an overview of vegetable sector in India during 19-25 May 2007
- Meeting with Company Secretary and Officers from CSO regarding the project entitled "Assessment of survey capabilities for the private sector" on 21 May 2007
- The Empowered Committee for implementation of "Awards and Fellowships" and for Outstanding and Meritorious Research Studies in Statistics and related matters with Dr. Pronob Sen Secretary, Statistics & Programme Implementation, GOI in Chair at CSO on 24 May 2007
- Meeting at Institute of Social and Economic Change, Bangalore for finalization of a project report during 25-26 May 2007
- Meeting with Mr. Yagyesh Gautam from FAO Afghanistan for arranging SCC training for two Afghan participants from Ministry of Agriculture and CSO in Afghanistan on 01 June 2007
- Sensitization meeting for the NAIP project on VPAGe, IASRI component on 02 June 2007
- Meetings with Engineers Consultancy Services (India) Pvt. Ltd. as M&E Consultant for NAIP regarding M&E in NAIP at PIU, NAIP, New Delhi on 07 June, 14 June and 10 July 2007
- Presentation by Dr TP Trivedi, PD, DIPA at IASRI on Information on agriculture technology in user friendly modes- Role of DIPA on 08 June 2007
- Meeting of Empowered Committee to discuss Prof. CR Rao award with Dr. Pronab Sen in Chair at CSO on 14 June 2007
- Meeting with Dr. PC Sabharwal, Director, AMITY for survey data analysis on 18 June 2007
- Meeting with VPAGe group of IASRI for finalising the presentations of technology forecasting and market intelligence on 20 June 2007
- Meeting with Dr. PK Joshi, Director NCAP for discussing the technical program of NAIP VPAGe project on 22 June 2007
- Meeting to study the existing database called Diseases Information System and discuss the requirements of the new system on 05-06 July 2007 at IASRI, Avikanagar
- Meeting with Shri Ashok Gupta, Doordarshan Narrowcasting program for 150 Years of Indian

- History with Agriculture as one of the subjects for covering National Agricultural Science Museum and got an interview recorded for Doordarshan on 19 July 2007
- Inter-ministerial meeting convened under the chairmanship of Shri A.N.P. Sinha, Sr. Adviser (PC) on 24 July 2007 at New Delhi on behalf of Department of Agricultural Research & Education, ICAR
  - Meeting to discuss the issues regarding pilot study on small area crop estimation – a project for crop yield estimates at gram panchayat level under the Chairmanship of Joint Secretary, Department of Agriculture & Cooperation (DOAC), Ministry of Agriculture, Govt. of India at Krishi Bhavan, New Delhi on 25 July 2007
  - Meeting at DOAC, Krishi Bhavan, New Delhi regarding Crop yield estimation at small area level during 25-26 July 2007
  - The Mission 2007: Every Village a knowledge center: National Alliance : Grameen Gyan Abhiyan meeting at IGNOU from 01-03 August 2007
  - Meeting with Principal Secretary, Planning and Development, Shri RN Bahidaar IAS, Orissa Government relating to Crop Statistics of principal crops on 21 August 2007
  - Meeting of CAPE/FASAL implementation team at Space Application Center, Ahmedabad on 22 August 2007
  - 'FASAL and NWIA project flag meeting' at SAC Ahmedabad on 22 August 2007
  - Participated in the IASDS Annual Meet at the Institute of Applied Statistics & Development Studies at Lucknow on 27 August 2007
  - MSSRF and ASSOCHAM National Round table on Farmers issues and agriculture policies: Ag Today: at New Delhi on 29 August 2007
  - Planning Commission, GOI Technical Advisory Committee on secondary agriculture meeting with Prof. DPS Verma in Chair during 15-19 September 2007
  - Empowered Committee meeting for selection of awardees for innovation in rural development at CSIR Science Centre, New Delhi on 18 September 2007
  - Meeting with officials of NESAC, State Government related to estimation of agricultural statistics for the estimation in case of multiple crop in the state on 19 September 2007
  - Karnataka High Level Coordination Committee Meeting for improvement of agricultural statistics at Bangalore on 24 September 2007
  - SAS Enterprise workshop at for IASRI New Delhi on 25 Sept 2007
  - Meetings with Director CRRI, Cuttack and other scientists for technology forecasting issues related to rice crop during 26-28 September 2007
  - Meeting to discuss NAIP project under Component III with Dr Padam Singh, Member National Statistical Commission and Mr. Vimarsh Jaiswal on 29 September 2007
  - Meeting with Director, NRC on R&M, PC AICRP R&M and other R&M scientists for sorting out statistical issues in the R&M experiments on 03 October 2007
  - The Commemoration of International Day of Non-Violence-Consultation on where hunger rules, peace cannot prevail-a road map for hunger free, nutrition secure india (Mahatma Gandhi's Birth Anni). Hon'ble PM Dr Manmohan Singh inaugurated and remarks by Smt. Renuka Chaudhary, Hon. MOS, WCD at NAAS, New Delhi on 03 October 2007
  - HRD Review Committee meeting on Educational Statistics with Shri K. Satyam IAS, Dr. JBL Srivastava, Dr HS Bhargava and others at UGC, New Delhi on 04 October 2007
  - Review Committee Meeting constituted by Ministry of HRD for Educational Statistics on 04 and 08 October 2007 at New Delhi to examine the existing system of data collection/ compilation/publication
  - Andhra Pradesh State Level Coordination Committee meeting for improvement of agricultural statistics at Hyderabad on 06 October 2007
  - Meeting in 'Central Coconut Development Board (CDB)' Kochi, on 08 October 2007 as an expert member for evaluation of a project related to remote sensing and GIS
  - Meeting with state officials of Meghalaya on 11 October 2007 for planning of project for

- estimation of multiple crop acreage using remote sensing and GIS
- Technical Committee of Direction (TCD) meeting for improvement of Animal Husbandry Statistics at Shillong during 11-12 October 2007
  - Meeting for M&E baseline survey discussions with Mr. AK Aggarwal and Mr Vinay Rathi from CES on 17 October 2007
  - Meeting with Shri VK Jain, ICFRE Dehradun for conducting training programs on statistical methodology for Forestry officers on 18 October 2007
  - Meeting of Center-State Statistical organisations (COCSSO) of New Delhi on 22-23 October 2007, and at Gandhinagar, Gujrat 07-08 February 2008
  - Meeting with Dr. JS Parihar, Space Application Center, ISRO Ahmedabad for remote sensing relating issues at IASRI on 23 October 2007
  - Discussions with Project Director, DWR for VPAGE technology forecasting for wheat at Karnal on 25 October 2007
  - Discussions with Dr. Masood Ali, Director, IIPR for technology forecasting for pulse crops at Kanpur on 26 October 2007
  - DG, ICAR's interaction with ICAR Directors through video conferencing facilities at IARI Director Board Room on 30 October 2007
  - Meeting with NAIP VPAGE associates for reviewing the progress of VPAGE -Sub Prog 2:Technology Forecasting and Sub Prog 3: Market Intelligence and decided the measurable output indicators on 03 November 2007
  - Meeting with Shri D. Chaudhuri, Director Fishery Statistics, Department of Animal Husbandry, Dairying and Fishery, Ministry of Agriculture for Technical Monitoring Committee on Fishery Statistics on 07 November 2007
  - Technical Monitoring Committee for Fishery Statistics (TMC) at CIFNET, Kochi during 12-13 November 2007
  - Meeting with Ms. Sabrina Advani SAS and Ashit Panjwani Director Marketing SAS Institute for SAS related issues on 15 November 2007
  - Annual Seminar of Fertilizer Association of India at Ashoka Hotel, New Delhi on 06 December 2007
  - FAO and IFAD supported Inception Workshop for Regional Program for pro-poor policy formulation dialogue and implementation at NCAP on 14-15 December 2007
  - Meetings of expert group on 'Development of Gender Data Base in Agriculture' in NRC-WA, Bhubaneswar during 17-18 December 2007 and 24 March 2008
  - Participated in the Interaction with NRC Women in agriculture at Bhubaneswar for database on gender 17-19 December 2007
  - Steering Committee meeting for preparation of manuals under the Chairmanship of D.G., CSO at Sardar Patel Bhawan, New Delhi on 20 December 2007
  - EFC Meeting on the Plan Scheme "Assisting States/UTs or conduct of 18 Livestock Census under DAHD&F, New Delhi on 26 December 2007
  - Meeting for Statistical software requirement for NARS at NAIP on 02 January 2008
  - Meeting with Dr. Rajiv Mehta Adviser (Horticultural Statistics) and Shri Ramesh Kolli (Additional DG, CSO) for Horticultural Census and Agricultural Census on 08 January 2008
  - 79<sup>th</sup> AGM meeting of ICAR Society at New Delhi on 23 January 2008
  - Meeting with Dr. Dave Hoisington Global Theme Leader-Biotechnology International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) for Chief Biometrician at ICRISAT on 24 January 2008
  - Meeting of Directors and Project Coordinators of Natural Resource Management Division of ICAR, New Delhi on 24 January 2008
  - One Day Interface with Village Agriculture Forum for promotion of Secondary Agriculture as a member of Planning Commission Technical Advisory Committee on Secondary Agriculture at SVBPU&T Modipuram, Meerut on 25 January 2008
  - Meetings of Technical Advisory Committee for promoting secondary agriculture during 28-31 January 2008

- Meeting on 'AICRP-Home Science (Extension Component)' in NRC-WA, Bhubaneswar during 15-16 February 2008
- Task Force Committee meeting to review the work of Project Management Consultant(M/s Price Waterhouse Coopers ) for preparation and implementation of FMS/MIS for NAIP/ICAR at PIU NAIP, New Delhi on 18 February 2008
- Meeting with Dr. Rajiv Mehta Adviser (Horticultural Statistics) and Shri Ramesh Kolli (Additional DG, CSO) for Horticultural Statistics Report finalization on 05 March 2008
- Workshop on Database Management on Irrigation, Ministry of Water Resources at Central Soil and Material Research Station New Delhi as invited guest on the dias in the inauguration and Chaired a session on Irrigation Statistics from Land Records with Shri VK Arora Additional DG & Chief Irrigation Census Commissioner on 14 March 2008
- Meetings of ICAR Vichar Manch, a forum for intellectual engagement on 24 March 2008
- Meeting with Shri Pyare Lal, Joint Secretary and Dr. Abhijeet, Director from Ministry of Information & Broadcasting, GOI for a visit to National Agricultural Science Museum and related queries on 25 March 2008
- Meeting with Dr. Rajiv Mehta Additional DG, SPD, NSSO for dovetailing the Horticultural Census with Agricultural Census on 26 March 2008
- The training program on technological forecasting for innovation in agriculture for NAIP VPAGe participants from IASRI at Jawaharlal Nehru University for VPAGe NAIP project, conducted by Dr. Pranav Desai on 31 March 2008

**(ii) Related to Agricultural Statistics Systems**

- Meeting held with Dr Greg Johnson regarding Vegetable Sector Statistics on 24 May 2007.

- Meeting on "Information on Agriculture Technology in User friendly Modes-role of DIPA", under the chairmanship of Director, IASRI on 08 June 2007
- Meeting with Advisor (Horticulture) regarding Data Base Horticulture Statistics on 13 June 2007
- Meeting relating to reviewing the draft of ARDB 2007, convened under the chairmanship of Hon. Dy DG (Engg), ICAR at New Delhi on 18 June 2007
- Meeting with the officers from CES regarding NAIP component -3 i.e. base line survey on 10 July 2007
- Coordination Committee Meeting of AICRP on Farm Implements & Machinery at CIAE, Bhopal during 02-04 August 2007
- HLCC meeting of Directorate of Agriculture at Chandigarh on 26 September 2007
- Meeting pertaining to Horticulture Census at Krishi Bhawan, New Delhi on 22 October 2007
- Technical Monitoring Committee meeting for strengthening of database pertaining to inland and marine fisheries at Cochi on 12 November 2007
- Meeting regarding modified NAIS and small area estimation methodology under the chairmanship of Secy (A&C), Krishi Bhavan, New Delhi on 01 January 2008
- Meeting at Directorate of Areca net and Spices at Kalicut on 22 January 2008
- Meeting with Dr (Mrs) Padmaja Mehta, Adviser (Marketing), DES, MOA, GOI on 15 January 2008 regarding incorporation of the comments on the Manual on Agricultural Prices & Marketing

**(iii) Related to Administrative Activities**

- Meeting of ICAR Standing Central Sports Promotion Committee held at Krishi Bhawan, Krishi Bhawan on 28 November 2007



## Workshops, Conferences, Meetings, Seminars and Annual Day Organized

### Conferences/Workshops

The XV National Conference of Agricultural Research Statisticians of the ICAR Institutes, Project Directorates, State Agricultural Universities and Central/State Departments of Agriculture, Animal Husbandry and Fisheries was organised by the Institute at Birsa Agricultural University (BAU), Ranchi (Jharkhand) from 03-04 December 2007. The theme of the Conference was "National Priorities in Agricultural Statistics and Computer Application". There were four Technical Sessions followed by a Plenary Session. The details of the technical sessions are as follows:

- Technical Session-I : Action Taken on the Recommendations made during the Last Conference
- Technical Session-II : Priorities in Agricultural Statistics Research: Current Status and Future Challenges
- Technical Session-III : Priorities in Computer Application in Agricultural Research

Technical Session-IV : Priorities for Teaching in Agricultural Statistics and Computer Applications

Plenary Session : Presentation of Reports by Rapporteurs of different Sessions and Summary of Recommendations

The Conference was inaugurated by Dr. N.K. Tyagi, Member, Agricultural Scientists' Recruitment Board. Dr. N.N. Singh, Vice Chancellor, Birsa Agricultural University, Ranchi presided over the Inaugural Function. Key Note Address was delivered by Prof. S.D. Sharma, Director, Indian Agricultural Statistics Research Institute. Dr. B.N. Singh, Director Research, Birsa Agricultural University, Ranchi delivered Welcome Address. Dr. K. Sinha, Professor and Head, Department of Agricultural Statistics delivered the Vote of Thanks. Dr. Nawab Ali, Deputy Director General (Engg.), I.C.A.R. was the Chief Guest at the Plenary Session and gave his valuable guidance, advice and support in finalising the recommendations of the Conference. The

Conference was attended by more than 60 Statisticians/ Scientists/ Research Workers of various organisations spread all over the country.



**Inaugural Function of XV National Conference of Agricultural Research Statisticians**

### Workshop

A dissemination workshop on Outliers in Designed Experiments was organized on 26 July 2007 at IASRI, New Delhi. The workshop was inaugurated by Dr. N.N. Goswami, former Vice-Chancellor, Chandra Sekhar Azad University of Agriculture and Technology, Kanpur. Dr. V.K. Gupta National Professor gave a brief outline on outliers and their presence in the experimental data. He also gave the motivation for taking up the project. Dr. Rajender Parsad, National Fellow made a



**A view of Dissemination Workshop on 'Outliers in Designed Experiments'**

presentation on Diagnostics in Designed Experiments. Dr. L.M. Bhar gave comprehensive presentation on the findings of the project. Both the technical sessions were chaired by Professor Aloke Dey, Indian Statistical Institute, New Delhi. An exposure of Design Resources Server was also given to the participants by Dr. Rajender Parsad and Dr. V.K. Gupta. Dr. Rajendra Prasad, Former ICAR-National Professor chaired the session on Design Resources Server. Several recommendations were made during this workshop. The proceedings are being published separately.

- A two days workshop on 'Implementation of Intelligent Reporting System (IRS)' was organized by M/s. CGS, Hyderabad at IASRI, New Delhi during 10-11 September 2007 for Nodal Officers of Permisnet project. One hundred and twenty delegates attended the training.

A meeting with Senior Plant Breeders of AICRP-RM was organized on 03 October 2007 to finalize the designs for the initial varietal trials and criteria of promotion of entries. The meeting was chaired by Dr. S.D. Sharma, Director, I.A.S.R.I., New Delhi. Dr. V.D. Patil, ADG (O & P) and Dr. Arvind Kumar, Director, NRC-RM, Bharatpur also participated in this meeting. Dr. Rajender Parsad made a presentation on Statistical Issues in Rapeseed-Mustard Varietal Trials. Based on the analysis of data generated from a-designs, he showed that the coefficient of variation reduced in 13 trials out of 24 trials. After long deliberations, following decisions were taken:

- The promotion of entries in initial varietal trials should be done on the basis of combined analysis of data and at 10% level of significance and for advanced varietal trials at 5% level of significance and not on the basis of 10% higher yields than the best performing check.
- If within a zone location-genotype interaction is significant, then promotion should be for a subset of locations.
- All IVTs with 30 or more entries should be conducted using a-designs only. The randomized layout will be provided by I.A.S.R.I. for all the 22 centres.

A meeting with Professor Bikas K. Sinha, Member, National Statistical Commission was organized under the guidance of Dr. V.K. Gupta, ICAR-National Professor on 31 October 2007



at I.A.S.R.I., New Delhi. During this meeting, following presentations were made:

Speaker	Title
Krishan Lal	Trend Free Nested Balanced Incomplete Block Designs with Applications in Designs for Diallel Cross Experiments
R. Srivastava	Robustness of Designs for Biological Assays
Lal Mohan Bhar	Robust Methods of Analysis of Experimental Data
Susheel Sarkar	Computer Added Search for Linear Trend-free Factorial Experiments
Cini Varghese	Some Aspects of Change Over Designs
B.K. Sinha	Some Thoughts on Experiments with Mixtures and Optimal Designs under Covariates in the model

From this meeting, following points were emerged:

- The conditions should be obtained for a nested block design to be trend free both at block and sub-block level. For doing this, two polynomials, one for block and another for sub-block positions may be defined. Efforts may also be made when the trend is different in different blocks/sub-blocks.
- The conditions for robustness of block designs for biological assays against missing blocks may be obtained. The possibility of obtaining/identifying robust designs against any two blocks missing may be explored.
- For a BIB design in  $b$  blocks. In the beginning of the experiment it is known that resources/funding is available only for  $b^* < b$  blocks and funding/resources for remaining  $b - b^*$  blocks is expected with probability  $a$ . For this situation, develop an algorithm for identification of  $b^*$  blocks out of  $b$  blocks such that the efficiency per observation is maximized.  $b^*$  may be just enough to have the design connected
- While handling outliers in the experimental data, whether the trend in residuals/studentized residuals and Cook-statistic is same or different may be explored. When we make use of robust methods of estimation, expressions for the

variance for the estimated treatment contrasts may be obtained after application of robust methods of estimation. Whether the tests of significance in case of robust estimation remain approximately valid in case of designed experiments like in case of regression needs to be investigated. The problem of outliers in case of change over designs/ designs for bioequivalence trials may also be attempted.

- The possibility of obtaining error functions in the context of change over designs may be explored.
- An Awareness Workshop on NISAGENET was organised at IASRI, New Delhi during 19-20 December 2007



A view of Awareness Workshop on 'NISAGENET'

- A discussion seminar on Experiments with Mixtures Theoretical Advances and Applications was jointly organised under the leadership of Dr. VK Gupta, National Professor at IASRI, New Delhi on 17-18 March, 2008. In this discussion Seminar presentations on Optimality Aspects of Mixture Experiments: New Directions were made by Professor Bikas K. Sinha, Member National Statistical Commission and Professor, Indian Statistical Institute, Kolkata, Dr. NK Mandal and Dr. Manisha Pal from Calcutta University, Kolkata and Dr. Premadhis Das, Kalyani University, Kalyani. Dr. Rajender Parsad made a presentation on Experiments with Mixtures: Some Applications. Dr. Krishan Lal Kalra presented some results on Experiments with Mixtures.

- A dissemination workshop on Fractional Factorials with Special Emphasis on Experiments with Scarce Resources jointly under the leadership of Dr. V.K. Gupta, National Professor at IASRI, New Delhi on 18 March, 2008. During this workshop following presentations were made:



**A Dissemination Workshop on 'Fractional Factorials with Special Emphasis on Experiments'**

Concepts, Applications and Evaluation criteria of Supersaturated designs Orthogonal Arrays and their Applications (V.K. Gupta\*, Rajender Parsad and L.M. Bhar, V.K. Gupta\* and Rajender Parsad)

Construction of Supersaturated designs for Asymmetrical Factorials (V.K. Gupta, Rajender Parsad, L.M. Bhar\* and Basudev Kole)



**A presentation during Dissemination Workshop on 'Fractional Factorials with Special Emphasis on Experiments'**

Columnwise Co-ordinate Exchange Algorithm for Generation of Two-levels Supersaturated designs Linear Trend Free Designs for 2-level Fractional Factorial Experiments (V.K. Gupta, Rajender Parsad\*, L.M. Bhar and Basudev Kole, Krishan Lal)

\*denotes the author who presented the paper

- A dissemination workshop on Design Resources Server on 26 March, 2008 at IASRI, New Delhi was organized by Dr. Rajender Parsad, National Fellow Research Unit jointly with Dr. V.K. Gupta, National Professor Research Unit. The workshop was inaugurated by the Dr. S.P. Tiwari, DDG (Education). Dr. B.S. Bisht, ADG (HRD-I) and Dr. H.S. Gaur, Dean and Joint Director (Education), IARI, New Delhi also participated along with other delegates. The participants of the workshop included the experimenters from IISS, Bhopal; ANGRAU, Hyderabad; NDRI, Karnal, NBPGR,



**Dissemination Workshop on 'Design Resources Server' is in progress**

New Delhi; Divisions of Soil Science, Agronomy, Post Harvest Technology, Agricultural Chemicals, Agronomy and Genetics of IARI, New Delhi. During the Introductory Session, Dr. Rajender Parsad made a presentation on Genesis and Main Features of Design Resources Server. Dr. S.P. Tiwari was quite appreciative of the efforts made and said that such workshops should be organized in different regions of the country. The practicing

statisticians and experimenters should use this server rigorously and send their comments for further improvements. subsequently two Technical Sessions, in which indepth discussions were made on the Design Resources Server. The Technical Sessions were chaired by Dr. B.M. Prasanna, National Fellow, IARI, New Delhi and Dr. R.C. Agrawal, Principal Scientist, NBPGR, New Delhi. The concluding session was chaired by Dr. S.D. Sharma, Director, IASRI, New Delhi. All the participants were highly impressed with the efforts made. After long deliberations, following points were emerged for wider dissemination and further improvement in the server:

1. Dissemination workshops should be conducted in different regions of the country.
2. Faculty Seminars may be delivered at IARI, New Delhi.
3. Efforts should be made to make one presentation in Design Resources Server in the foundation course of Agricultural Research Scientists at NAARM, Hyderabad.
4. The Server may be publicized through ICAR News and Reporter and by providing a link on ICAR Home Page and other ICAR institutes.
5. E-mails may be sent to all organizations in National Agricultural Research System.
6. A letter may be sent to all SAUs and ICAR Institutes through DDG (Education).

#### Suggestions for Improvements in the Server

1. The material on Server may be divided into two parts. Part I would be primarily useful to scientists in NARS in particular and to stakeholders throughout the globe in general. Part II would be useful for statisticians undertaking research in Design of Experiments. The scientists, however, can use either of the parts or parts of their choice. Part I would include E-learning and E-advisory, Network of scientists, Analysis of data, Designs for single factor experiments, Designs with nested classifications, Designs for multiple factor experiments including fractional factorials, Designs for bioassays, Multi-response experiments, Regression designs like response surface designs, experiments with mixtures, etc. Part II would mainly comprise of methods of construction of the above said designs, catalogues of the designs along with

their efficiency and bibliography on several topics. It would also have online generation of Hadamard matrices, Orthogonal arrays, Fractional factorials, Supersaturated designs, Mutually orthogonal Latin squares, Micro-array experiments and Computer experiments.

2. A disclaimer may be put on the Design Resources Server.
3. Pages of the Design Resources Server may be given a Water Mark.
4. Proper citation of Design Resources Server may also be included.
5. Name of the Server may be changed to Experimental Design Resources Server.
6. A mechanism should be developed for moderation of Discussion Board.
7. Reports for all the designs for which randomized layouts are provided by the Server should be made available automatically. These reports should include parameters of the design selected by the user, randomized layout of the design and EXCEL worksheet containing columns of design parameters for all the classifications so that user can enter the data generated.
8. In the analysis of data there should be some provision made for conversion factors and data entry as per field work book records.
9. Titles and abstracts of all the theses on Design of Experiments of IASRI may be provided on the Server.
10. The material on two Electronic books may be clubbed into one avoiding similarity and duplicacy.
11. On every page, date on which last updated may be provided.
12. Efforts should be made to explore the possibility of giving an IP address to the design resources server and also putting it exclusively on a separate server and a mechanism be developed for its maintenance

#### Seminars

Salient outcomes from the completed research projects undertaken in different aspects of Agricultural Statistics and Computer Application were presented in the seminars organized regularly at the Institute. Open seminars were also organized for new research projects proposals. Outline of Research Work (ORW) seminars, Course seminars and Thesis seminars were delivered by the students of M.Sc. and Ph.D. Agricultural Statistics

and M.Sc. Computer Application.

During the period under report, a total of 82 seminar talks were delivered. Out of these, 52 were student seminars, 21 by scientists of the Institute and 09 by guest speakers as follows.

- Dr. S. Mauria, ADG(IPR & Policy), ICAR on IPR issues and Indian Agriculture on 10 October 2007.
- Dr. A.K. Choubey, NIC, New Delhi on Meta Data Management on 21 November 2007.
- Dr. Ramesh Singh, NIC, New Delhi on Network security and recovery system on 21 November 2007.
- Dr. Navneet Goyal, BITS, Pilani on Spatio-Temporal Data Warehouse on 28 November 2007.
- Dr. Sessa Sai, Head (Agriculture), NRSA, Hyderabad on Integration of Remote Sensing and GIS on 01 December 2007.
- Two seminars on A Random Period for Describing Gene Expression of a Cell-cycle Gene and on Order Restricted Inference for Ordered Gene by Dr. Shyamal Peddada, Biostatistics Branch, NIEHS Alexander NC-27709 on 13 December 2007.
- Two seminars by Prof. J.N. Srivastava, CNS Research Professor (Emeritus) Colorado State University on Clinical Trials and on How Consciousness Arises in Logic Fields on 13 and 26 December 2007 respectively.

### Annual Day Celebrations

The Annual Day of the Institute was celebrated on 02 July 2007 in which Dr. JSP Yadav, Former Chairman, ASRB was the Chief Guest. Dr. Nawab Ali, DDG (Engg.), was the Guest of Honour, Dr. PV Dehadrai, Former DDG (Fisheries), ICAR delivered the Nehru Memorial Lecture entitled, "Modernity of Indian Aquaculture".

Nehru Memorial Gold Medal for the year 2003–06 was awarded to Km. Nisha Jha, M.Sc. (CA), student and for the year 2004–06 was awarded to Sh. Ranjit Kumar Paul, M.Sc. (Ag. Stat.), student .



Welcome of the Chief Guest during  
 'The Annual Day Function'



## Distinguished Visitors

### INDIAN

**Dr. Nawab Ali**

Deputy Director General (Engg.),  
Krishi Anusandhan Bhavan-II, Pusa, New Delhi

**Dr. SP Tiwari**

Deputy Director General (Education),  
Indian Council of Agricultural Research, New Delhi

**Dr. PV Dehadrai**

Former Deputy Director General (Fisheries),  
Indian Council of Agricultural Research, New Delhi

**Dr. JSP Yadav**

Former Chairman, ASRB, New Delhi

**Prof. MG Sardana**

Former Director General,  
Central Statistical Organisation, New Delhi

**Dr. Aloke Dey**

Professor, Indian Statistical Institute, New Delhi

**Dr. AK Nigam**

Director, IASDS,  
Lucknow, Uttar Pradesh

**Dr. AK Srivastava**

Former Joint Director,  
IASRI, New Delhi

**Prof. MN Das**

Ex-Director, IASRI, New Delhi

**Dr. BS Bisht**

Assistant Director General (HRD-I),  
Krishi Anusandhan Bhavan-II, Pusa, New Delhi

**Dr. S Mauria**

Assistant Director General (IPR and Policy)  
Indian Council of Agricultural Research, New Delhi

**Dr. SK Tandon**

Deputy Director General (Engg.),  
Krishi Anusandhan Bhavan-II, Pusa, New Delhi

**Sh. BK Tyagi**

Director (Ag. Census),  
Ministry of Agriculture, GOI, New Delhi

**Sh. VK Singh**

Joint Director (Agriculture)  
Govt. of Uttar Pradesh,  
Lucknow, UP

**Sh. Vijay Kumar**

Advisor, Directorate of Economics & Statistics, New Delhi

**Prof. Rajeve Karandikar**

Cranes Software International Limited, Bangalore

**Dr. Navneet Goyal**

Department of Computer Science & Information Systems, BITS, Pilani

**Dr. PK Joshi**

Director,  
 NCAP, New Delhi

**Dr. AP Gore**

Professor, Department of Statistics,  
 University of Pune, Ganeshkhind, Pune

**Dr. Rahul Mukerjee**

Professor,  
 Indian Institute of Management, Kolkata

**Dr. SS Acharya**

Former Director, Institute of Development Studies,  
 Jaipur, Rajasthan

**Sh. Vijay Sardana**

Executive Director,  
 Agriculture and Agriculture based Industries,  
 Nehru Place, New Delhi

**Dr. KK Bhardwaj**

Professor, School of Computer Systems Sciences,  
 Jawaharlal Nehru University, New Delhi

**Dr. PV Shenoy**

Former Special Secretary, Ministry of Agriculture,  
 Govt. of India and Former Director, ISEC, Bangalore

**Dr. SK Dorge**

81, Shivaji Housing Society,  
 Senapati Bapat Road, Pune

**Dr. RS Deshpande**

Professor and Head,  
 Agricultural Development & Rural Transformation Centre,  
 Institute for Social and Economic Change,  
 Bangalore

**Dr. Bikas Sinha**

Member, National Statistical Commission and Professor,  
 Indian Statistical Institute, Kolkata

**Dr. NN Goswami**

Former Vice-Chancellor,  
 Chandra Shekhar Azad University of Agriculture and  
 Technology, Kanpur

**Dr. CD Patil**

Assistant Director General (O & P),  
 Indian Council of Agricultural Research, New Delhi

**Dr. Arvind Kumar**

Director, NRC-RM, Bharatpur

**Dr. NK Mandal**

Calcutta University, Kolkata

**Dr. Manisha Pal**

Calcutta University, Kolkata

**Dr. Premadhish Das**

Kalyani University, Kalyani

**Dr. HS Gaur**

Dean & Joint Director (Education), IARI, New Delhi

**Dr. KR Koundal**

Joint Director (Research), IARI, New Delhi

**Dr. MV Rao**

Former Special DG,  
 Indian Council of Agricultural Research, New Delhi

**Dr. Sesha Sai**

Head (Agriculture), NRSA, Hyderabad

**Dr. AK Choubey**

NIC, New Delhi

**Sh. Ramesh Singh**

NIC, New Delhi

**FOREIGN**

**Prof. JN Srivastava**

CNS Research, Professor (Emeritus),  
 Colorado State University, USA

**Dr. Shyamal Peddada**

Bio Statistics Branch,  
 NIEHS, Alexander, NC- 27709, USA

**Mr. Nasarullah Bakhtani**

Director of Monitoring and Evaluation Department,  
 Afghanistan

**Mr. Eng. Ghalam Rabani Haqiqatpal**

Director of Statistics and Marketing, Afghanistan

**Mr. Abdul Razeq Wahedi**

Deputy Director of Program Development,  
 Afghanistan

**Mr. Dost Mohammad Akhtari**

Planning Officer of Planning Department,  
 Afghanistan

**Mr. Sayed Meskin Saifi**

Director of Provincial Directorate,  
 Afghanistan

**Mr. Mohammad Latif Rassooli**

Director of Media and Information, Afghanistan

**Mr. Abdul Rashid Fakhri**

Director of Central Statistics Organisation, Afghanistan

**Mr. Mohammad Sami Nabi**

Director of Operations of Central Statistics Organisation,  
 Afghanistan



16

## IASRI Personnel

### **DIRECTOR**

Dr. S.D. Sharma

### **NATIONAL PROFESSOR**

Dr. V.K. Gupta

### **NATIONAL FELLOW**

Dr. Rajender Parsad

### **DIVISION OF SAMPLE SURVEY**

Dr. H.V.L. Bathla,  
Principal Scientist and Head

#### **Principal Scientists**

Dr. K.K. Tyagi  
Dr. U.C. Sud  
Sh. R.S. Khatri  
Dr. Jagbir Singh

#### **Senior Scientists**

Dr. Ashok Kumar Gupta  
Dr. Tauqueer Ahmad

#### **Scientists (Selection Grade)**

Sh. D.C. Mathur

Sh. V.K. Jain

Sh. K.K. Kher

#### **Scientists (Senior Scale)**

Dr. (Smt.) Prachi Mishra Sahoo  
Sh. Hukum Chandra

### **DIVISION OF DESIGN OF EXPERIMENTS**

Dr. P.K. Batra,  
Principal Scientist and Head (A)

#### **Senior Scientists**

Dr. Alope Lahiri  
Dr. Krishan Lal  
Dr. (Smt.) Seema Jaggi  
Dr. L.M. Bhar  
Dr. (Smt.) Cini Varghese

#### **Scientists (Selection Grade)**

Sh. N.K. Sharma  
Sh. D.K. Sehgal  
Sh. O.P. Khanduri

**Scientist (Senior Scale)**

Sh. Anil Kumar

**Experimental Scientist**

Dr. S.M.G. Saran

**DIVISION OF BIOMETRICS**

Dr. Prajneshu,  
 Principal Scientist and Head

**Principal Scientists**

Dr. V.T. Prabhakaran

Sh. S.D. Wahi

Smt. Asha Saxena

**Senior Scientists**

Dr. Amrit Kumar Paul

Dr. A. Ramakrishna Rao

**Scientist (Selection Grade)**

Sh. S.C. Sethi

**Scientists (Senior Scale)**

Sh. Inder Singh

Md. Wasi Alam

Sh. Pal Singh

**DIVISION OF FORECASTING TECHNIQUES**

Dr. (Smt.) Ranjana Agrawal,  
 Principal Scientist and Head

**Principal Scientist**

Dr. Chandrahas

**Senior Scientists**

Dr. Ramasubramanian V.

Dr. Himadri Ghosh

**Scientists (Selection Grade)**

Sh. S.S. Walia

Sh. S.C. Mehta

Sh. Satya Pal

**Scientist (Senior Scale)**

Sh. Amrender Kumar

**DIVISION OF ECONOMETRICS**

Dr. A.K. Vasisht,  
 Principal Scientist and Head

**Principal Scientists**

Dr. S.P. Bharadwaj

Dr. Ashok Kumar

**Senior Scientist**

Dr. (Smt.) Sushila Kaul

**Scientist (Selection Grade)**

Sh. Mahender Singh

**Scientists (Senior Scale)**

Dr. Prawin Arya

Dr. Dharam Raj Singh

**Scientist**

Sh. Shivramane N. (on leave)

**DIVISION OF COMPUTER APPLICATIONS**

Dr. P.K. Malhotra,  
 Principal Scientist and Head

**Principal Scientists**

Dr. R.C. Goyal

Dr. I.C. Sethi

Dr. V.K. Mahajan

**Senior Scientist**

Dr. Anil Rai

**Scientists (Selection Grade)**

Sh. H.S. Sikarwar

Sh. Hari Om Agarwal

Sh. Balbir Singh

Sh. V.H. Gupta

**Scientists (Senior Scale)**

Smt. Alka Arora

Smt. Shashi Dahiya

Ms. Anshu Dixit

Sh. Sudeep

Md. S.N. Islam

Md. Samir Farooqi

Sh. Krishan Kumar Chaturvedi

Sh. Vipin Kumar Dubey

Sh. Shashi Bhushan Lal

Smt. Anu Sharma

Smt. Sangeeta Ahuja

**RESEARCH COORDINATION AND  
 MANAGEMENT UNIT**

Dr. V.K. Bhatia,  
 Principal Scientist and In-charge

**TRAINING ADMINISTRATION CELL**

Dr. V.K. Bhatia, Professor (Agricultural Statistics)

Dr. P.K. Malhotra, Professor (Computer Application)

**NATIONAL AGRICULTURAL SCIENCE MUSEUM**

Sh. R.S. Khatri, Principal Scientist and Nodal Officer

Sh. R.P. Jain, Scientist (SG) & Incharge

**LIBRARY**

Dr. (Smt.) P. Visakhi, Head

**ADMINISTRATION**

Capt. Mehar Singh, Chief Administrative Officer

Sh. A.K. Chaturvedi, Officer on Special Duty

Sh. Krishan Kumar, Finance and Accounts Officer





## Any Other Relevant Information

### National Agricultural Science Museum

National Agricultural Science Museum (NASM) is situated at NASC Complex, Dev Prakash Shastri Marg, Opposite Dasghara Village, Pusa Campus, New Delhi-110 012. A Central Management Committee comprised of

Dr. Nawab Ali	DDG (Engg)	Chairman
Dr. P. Chandra	ADG (PE)	Member
Sh. V.P. Kothiyal	Director (Works)	Member
Sh. H.C. Pathak	Director (Finance)	Member
Sh. P.K. Jain	Under Secretary (GAC)	Member
Dr. S.D. Sharma	Director, IASRI	Member Secretary

has been constituted to oversee the National Agricultural Science Museum at the ICAR level.

The management and maintenance of the Museum is looked after by the Indian Agricultural Statistics Research Institute (IASRI) through a Management Committee under the Chairmanship of Director, IASRI consisting of the following officers:

Dr. S.D. Sharma	Director, IASRI	Chairman
Dr. P.K. Malhotra	Head (C.A.)	Member
Dr. H.V.L. Bathla	Head (S.S.)	Member
Capt. Mehar Singh	C.A.O.	Member
Sh. Krishan Kumar	F. & A.O.	Member
Sh. R.S. Khatri	Pr. Scientist & Nodal Officer	Member
Sh. R.P. Jain	Scientist (S.G.) & In-charge	Convener

Under the able guidance of this Committee the day-to-day activity of the Museum is looked after by a team of Officers/Staff of IASRI deployed in the Museum.

During the period under report, many persons visited the Museum. The visitors included VVIPs, VIPs, farmers, students from various universities/colleges and schools in India and abroad. All the visitors, especially high dignitaries and foreign visitors appreciated this centrally air-conditioned unique Museum on Agriculture with an aesthetic ambience. Some of the distinguished visitors are

<b>Bhutan</b>	Sh. Trivendra Singh Rawat, Agril. Minister, Uttarakhand; Dueaga Namgay of Bindu Maya Tanang MOA, Thinghy, Bhutan; Nidup Pewor, A.K. Rinzin, Phub Dem & Dophu Dukpa (Four member delegation), Bhutan
<b>England</b>	Patrick Baddenley, 101 Kingston Road, Oxford, England
<b>India</b>	Sh. Oscar Fernandis, Hon. Minister for State for Labour & Employment, Govt. of India
<b>Japan</b>	Dr. Makoto Kawase, Gene Bank and Dr. Kuniaki Fukul, National Institute of Agro-Biological Science, Tsuduba, Ibraki, Japan
<b>Korea</b>	Mr. Raesan Kim, Korea National Gene Bank, Suwon G., Korea
<b>Maldives</b>	Ibrahim Shabal, Director, Deptt. of Agril., Maldives
<b>Pakistan</b>	Dr. Abdul Rashid, Director General, N.A.R.C., Islamabad, Pakistan; Mr. Amjad N. Azir, Joint Secy., Min. of Food and Agriculture Research Council, Islamabad, Pakistan
<b>Romania</b>	Sioiagl Luciagl, Director of Vegetable Research and Development Bacou, (Four Member delegation), Romania
<b>Russia</b>	Ivanov A.L., Vice President of Russian Agricultural Science, (R.H.A.S.) (Four member delegation), Moscow
<b>Sudan</b>	Mr. Galuak Deng Garang, Minister for Animal Husbandry and Fisheries, Republic of Sudan (Eight member delegation), Dr. Faysal Hassan Ibrahim, Governor of State, North Kordofan State, Republic of Sudan

All farmers and groups of students from Schools, Universities and other Educational Institutions were allowed free of charge and for others a nominal entry fee of Rs. 5 per head was charged. There is ample free parking space available for the public in the campus. The Museum is OPEN on all days (Except Monday) during 10.30 AM to 4.30 PM.

### Consultancy Processing Cell (CPC)

As per the 'ICAR Rules and Guidelines for Training, Consultancy, Contract Research and Contract Services, 1997' a Consultancy Processing Cell (CPC) was constituted at the Institute with the following composition:

Dr. H.V.L. Bathla, HD (SS)	Chairman
Dr. P.K. Malhotra, HD (CA)	Member
Dr. V.K. Bhatia, Principal Scientist and Incharge (RCMU)	Member
Officer on Special Duty and Head of Office	Member
Finance and Accounts Officer	Member
Sh. P.P. Singh, Technical Officer	Member-Secretary

The functions of the Cell are as follows:

- Give broad guidelines for consultancy work
- Bring out consultancy information system, catalogues periodically
- Identify and prepare list of consultants in different fields; the consultants could be retired Scientist/ Officer of proven experience
- Prepare a roster of available human resources on the basis of time schedule
- Identify team for specific consultancy assignments and periodic reviews of progress
- Prepare consultancy proposals as per prescribed flow chart

Five meetings on 17 April, 18 May, 04 June, 09 October and 17 October 2007 were held for finalizing the consultancy training proposals received at Consultancy Processing Cell as per ICAR Guidelines and getting approval of the Director. A meeting was also held on 08 January 2008 to finalize the honorarium for the Scientists and Technical Officers associated with the consultancy project "Study for assessment of survey capabilities of private sector".

### Planning, Monitoring and Evaluation (PME) Cell

To facilitate all activities related to priority setting, monitoring and evaluation a Planning, Monitoring and Evaluation (PME) Cell within the RCMU in the capacity as against their names is working at the Institute. The composition of the PME Cell is as given below:

Dr. P.K. Malhotra, HD (CA)	Nodal Officer
Dr. V.K. Bhatia, Principal Scientist and Incharge (RCMU)	Member
Dr. Rajender Parsad, National Fellow	Member
Dr. Ashok Kumar, Senior Scientist	Member
Dr. Tauqueer Ahmad, Scientist (SS)	Member
Dr. Ramasubramanian V., Scientist (SS)	Member
Sh. P.P. Singh, Technical Officer	Member Secretary

The Terms of Reference of the Cell are as follows:

- Sensitization of policy makers, managers, scientists and others about the need for research priority assessment
- Prioritization of Institute's programmes
- Tracking of current resource allocations
- Interface with ARIS, SREP, ATMA, IVLP, TAR and KVK for research, extension education and other services

- Facilitate monitoring and evaluation of research projects of the Institute/SAU
- Participation of monitoring and evaluation (site-level) activities of NATP/NAIP
- Impact analysis, especially that of research and extension activities

### Institute Technology Management Committee (ITMC)

As per the 'ICAR Guidelines for Intellectual Property Management and Technology Transfer/Commercialization' a Institute Technology Management Committee (ITMC; Short title for Institute Intellectual Property Management and Technology Transfer/Commercialization Committee, i.e. IIPM&TCC) has been constituted for addressing Intellectual Property (IP) related matters of the Institution as detailed in the ICAR Rules and Guidelines for Training, Consultancy, Contract Research and Contract Services, 1997. The composition of the ITMC is as given below:

Prof. S.D. Sharma, Director, IASRI (ICAR), Pusa, New Delhi-110 012	Chairman
Dr. Amit Kumar Vasisht, Head of the Division (Econometrics), IASRI (ICAR), Pusa, New Delhi-110 012	Member
Dr. Anil Rai, Senior Scientist, IASRI (ICAR), Pusa, New Delhi-110 012 (Technical Expert – A Scientist of the Institute)	Member
Dr. Seema Jaggi, Senior Scientist, IASRI (ICAR), Pusa, New Delhi-110 012 (Technical Expert – A Scientist of the Institute)	Member
Dr. Madhuban Gopal, Principal Scientist and National Fellow, Division of Agricultural Chemistry, IARI, Pusa, New Delhi-110 012 (IPR Expert – A Scientist from ICAR Institute in the Zone)	Member
Dr. V.K. Bhatia, Principal Scientist and Incharge (RCMU), IASRI (ICAR), Pusa, New Delhi-110 012 (Member Secretary, IRC and Incharge, ITMU)	Member Secretary

First Meeting of Institute Technology Management Committee (ITMC) was held on 22 September 2007.

### Institute Technology Management Unit (ITMU)

As per the 'ICAR Guidelines for Intellectual Property Management and Technology Transfer/ Commercialis-

ation' a Institute Technology Management Unit (ITMU; Short title for Intellectual Property Management and Technology Transfer Commercialization Unit at Institute level, i.e. IPM&TTU) for management of its IP/Deemed IP and transfer/commercialization of technologies has been constituted for pursuing all IP protection, maintenance and transfer/commercialization related matters at the institute level as per these guidelines and any other administrative or policy decisions taken in the ICAR from time to time. This will seek any specific, case-to-case basis advice/assistance from the Zonal Agro-Technology Management Centres (ZTMCs) at the zonal level or the Agro-Technology Management Centre (ATMC) at the ICAR headquarters. The composition of the ITMC is as given below:

Dr. V.K. Bhatia, Principal Scientist and Incharge (RCMU)	Officer Incharge
Dr. Tauqueer Ahmad, Scientist (SS)	Member
Sh. P.P. Singh, Technical Officer	Member

Dr. V.K. Bhatia attended the first training-cum-workshop on 'IP and Technology Management in ICAR System' held at NAARM, Hyderabad during 28-29 May 2007.

In order to make scientists acquaint with ICAR Guidelines for Intellectual Property Management and Technology Transfer/Commercialization, Dr. Bhatia gave a general seminar on 30 August 2007. This seminar is a follow up action of his attending the same workshop.

First Meeting of Institute Technology Management Committee (ITMC) was organized on 22 September 2007.

Miscellaneous correspondence were made with the Council regarding IP related issues.

### Joint Staff Council

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

The Joint Staff Council of the Institute is as under:

Prof. S.D. Sharma	Director	Chairman
<b>Official-side Representatives</b>		
Dr. P.K. Malhotra	HD (CA)	Member
Dr. V.K. Bathia	Principal Scientist/ Incharge RCMU	Member

Sh. R.S. Khatri	Principal Scientist and Welfare Officer	Member
Dr. K.K. Tyagi	Principal Scientist	Member
Sh. K.K. Hamza	F&AO (Ex-Officio)	Member
Sh. A.K. Chaturvedi	OSD	Member-Secretary
<b>Staff-side Representatives</b>		
Sh. Raj Pal	S.S.Gr.-II	Secretary
Sh. D.P.S. Mann	Assistant	Member
Sh. R.S. Tomar	Technical Officer	Member
Sh. Satya Pal Singh	Technical Officer	Member
Sh. K.B. Sharma	U.D.C.	Member
Sh. Ashok Kumar	SS Gr. II	Member

Three meetings of the Institute Joint Staff Council were held on 30 July, 30 October 2007 and 20 March 2008 under the Chairmanship of Prof. S.D. Sharma, Director, IASRI.

#### IASRI Employees Co-operative Thrift and Credit Society Limited

The Society which is registered with the Registrar, Co-operative Societies, Delhi Administration continue its activities during 2007–08 in the similar manner as during the past years by advancing regular and emergent loan to its members and looking after their welfare. The sources of funds of the society are share money (value of each share is Rs. 50 only) and compulsory deposits (Rs.100 only per month from each member). The present strength of the members of the society is 363.

The Management Committee of the Society for the year 2006–09 is as follows:

Sh. U.C. Bandooni	President
Ms. Vijay Bindal	Vice-President
Sh. Pratap Singh	Secretary
Sh. Pradeep Kumar	Treasurer
Sh. V.K. Mishra	Internal Auditor
Smt. Meena Nanda	Member
Smt. Satinder Pal	Member
Sh. Arbind Kumar	Member
Sh. G.M. Pathak	Member
Sh. Sudershan Sharma	Member
Sh. Parbhu Dayal	Member
Sh. Gabar Singh Rana	Member

- The society advanced Rs. 70,85,800 (Rupees seventy lakh eighty five thousand and eight hundred only) to its members as loan.

- An amount of Rs. 751 (Rupees seven hundred fifty one only) each was given as gift to members on their retirement from the Institute.
- The financial help of Rs. 5000 (Rupees five thousand only) to each was extended from member welfare fund of the society to the families of (Late) Sh. Balwant Singh, Sh. R.P. Gupta, Sh. Ramesh Chand, Sh. Satbir and Sh. Babulal after their death.

#### Grievance Committee

The Grievance Committee of the Institute (constituted as per ICAR rules) provides the employees a forum to ventilate their grievances relating to official matters and for taking remedial measures. The Grievance Committee of the Institute was reconstituted with the approval of the Management Committee of the Institute for a period of two years w.e.f. October 2007 as follows:

<b>Official-side Representative</b>	
Prof. S.D. Sharma	Chairman
Dr. Prajneshu	Member
Sh. A.K. Chaturvedi	Member
Sh. Krishan Kumar	Member
Sh. Narender Kumar	Member Secretary
<b>Staff-side Representative</b>	
Sh. Pal Singh	Member
Sh. Vijay Pal Singh	Member
Sh. Basant Kumar	Member
Sh. Charan Singh	Member

Two meetings of the Grievance Committee of the Institute were held on 27 February and 29 March 2008 under the Chairmanship of Prof. S.D. Sharma, Director, IASRI.

#### Benevolent Fund

The employees of the Institute have constituted a Benevolent Fund from their own contributions to provide relief to the families of the employees who die in harness and are left in an indigence condition and a gift of Rs. 600 is being given to the retiring employees of the Institute. During the year, a sum of Rs. 8650 was collected from members. This year, gifts of Rs. 9000 were distributed to fifteen retiring personnel of the Institute. A relief of Rs. 1500 each to the grieved families of (Late) Sh. RP Gupta, Sh. Ramesh Chand, Sh. Babulal, Sh. Satbir and Sh. Raj Pal Singh Sehrawat were provided on their untimely death.

### Women Cell

A Women Cell has been set up at the Institute on 27 January 2000. The cell functions for the welfare of women in general. It caters to the issues pertaining to the grievances of women employees. Women cell, reconstituted on 5 February 2004, comprises of the following members:

Dr. Ranjana Agrawal	Principal Scientist and HD (FT)	Chairperson
Dr. Seema Jaggi	Sr. Scientist	Member
Ms. Vijay Bindal	Tech. Officer	Member
Smt. Sushma Banati	Sr. PA	Member
Smt. Satyavati Tripathi	Asstt. Fin. & Account Officer	Convenor

### Complaint Committee

A Complaint Committee has been set up at the Institute on 18 August 2006 for the prevention of sexual harassment of women at work place. The committee comprises of the following members:

Dr. Ranjana Agrawal	Principal Scientist and HD (FT)	Chairperson
Smt. Meera Mathur	Technical Officer (CSIR)	Member (3rd Party)
Sh. S.K. Sublania	MTO (T-9)	Member
Smt. Satinder Pal	Technical Officer	Member
Sh. Fabian Minz	UDC	Member

### Hostel Activities

There are two well furnished hostels, viz. Panse Hostel and Sukhatme Hostel to cater the residential requirements of the trainees and students of M.Sc., Ph.D. courses and Senior Certificate Course (SCC) at the Institute within its premises. Officers and other trainees of the various other refresher, short-term and ad-hoc training courses organised at the Institute are also provided residential accommodation at the Panse Hostel-cum-Guest House. Boarding and lodging arrangements are made available for the guests who stay in Guest House from different departments/organisations. Ample facilities exist for the cultural activities and sports for the hostel inmates. Hostel mess is run by the students on co-operative basis. The general management of the hostels is vested with the Warden, who is assisted by the Prefect and other students.

On the eve of the Annual Day, a sports week was organised by IASRI in Sukhatme Hostel where students at IASRI participated in various sports like table-tennis, badminton and musical chair, etc.

### Recreation and Welfare Club

The Institute has a Recreation and Welfare Club, which provides facilities for indoor and outdoor games, promotes social and friendly relations among the members and general recreation and welfare of its members. The club organises sport tournaments annually at Institute level for different games/events. The functioning of the Recreation and Welfare Club is monitored by the following Executive Committee:

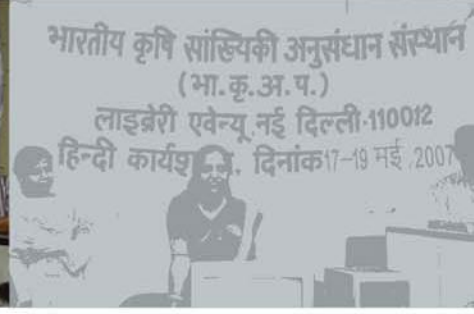
Prof. S.D. Sharma	President
Dr. K.K. Tyagi	Vice-President
Sh. K.B. Sharma	Secretary
Sh. Sunil Bhatia	Sports Secretary
Sh. Girish	Treasurer
Smt. Vijay Laxmi Murthy	Member
Smt. Satinder Pal	Member
Sh. Diwan Singh	Member

### Sports Activities

For organizing different activities relating to sports meets, Institute Sports Committee has been constituted as follows:

Prof. S.D. Sharma	Patron
Dr. V.K. Gupta	President
Dr. K.K. Tyagi	Vice President
Sh. R.S. Khatri	Member
Capt. Mehar Singh	Member
Sh. K.K. Hamza	Member
Dr. (Smt.) Seema Jaggi	Member
Sh. G.M. Pathak	Member
Sh. R.S. Tomar	Member
Smt. Vijaya Laxmi	Member
Sh. D.P.S. Mann	Member
Sh. Krishan Kumar	Member
Sh. Amar Singh	Member
Sh. Rambhool	Member
Sh. K.B. Sharma	Member
Sh. Ashok Kumar	Member
Sh. K.K. Hans	Member
Sh. A.K. Bhalla	Member
Sh. V.K. Mishra	Convenor





# 18

## भारतीय कृषि सांख्यिकी अनुसंधान संस्थान में राजभाषा के बढ़ते चरण

भारतीय कृषि सांख्यिकी अनुसंधान संस्थान में वर्ष-दर-वर्ष हिन्दी के प्रगामी प्रयोग में अभिवृद्धि हो रही है। राजभाषा नीति को संस्थान में सुचारु रूप से कार्यान्वित किया जा रहा है। राजभाषा विभाग द्वारा जारी वार्षिक कार्यक्रम में निहित लक्ष्यों को इस संस्थान में लगभग पूरा कर लिया गया है। संस्थान द्वारा समस्त प्रशासनिक कार्य शत-प्रतिशत हिन्दी में और यथाआवश्यक द्विभाषी हो रहा है। वैज्ञानिक कार्यों में भी हिन्दी के प्रयोग को प्रोत्साहित किया जाता है। न केवल मात्रात्मक रूप में बल्कि हिन्दी के प्रयोग में गुणवत्ता की ओर भी ध्यान दिया जा रहा है।

प्रतिवेदनाधीन अवधि में संस्थान में राजभाषा कार्यान्वयन समिति की तिमाही बैठकें नियमित रूप से आयोजित की गयीं। इन बैठकों में राजभाषा अधिनियम 1963 की धारा 3(3) के अनुपालन को सुनिश्चित करने, राजभाषा विभाग द्वारा जारी वार्षिक कार्यक्रम की विभिन्न मर्दों, हिन्दी पत्रिका के प्रकाशन, कार्यशालाओं के नियमित आयोजन, चेतनामास के आयोजन इत्यादि पर विस्तार

से चर्चा हुई। बैठकों का आयोजन 16 अप्रैल 2007, 20 जुलाई 2007, 23 अक्टूबर 2007 तथा 17 जनवरी 2008 को हुआ।

इस वर्ष में संस्थान के कर्मियों के लिए चार कार्यशालाएँ आयोजित की गयीं। पहली कार्यशाला 17 से 19 मई 2007 के दौरान “हिन्दी टंकण” पर आयोजित की गयी। इस कार्यशाला में संस्थान के उन कर्मियों ने सहभागिता की जो हिन्दी टंकण नहीं जानते थे परन्तु हिन्दी टंकण जानने के इच्छुक थे। इस कार्यशाला में राजभाषा विभाग, हिन्दी शिक्षण योजना, नई दिल्ली की सहायक निदेशिका (टंकण एवं आशुलिपि), सुश्री आशा ने 17 एवं 19 मई 2007 को तथा राजभाषा विभाग, हिन्दी शिक्षण योजना, नई दिल्ली की ही सहायक निदेशिका (टंकण एवं आशुलिपि), श्रीमती ऊषा शर्मा ने 18 मई 2007 को कम्प्यूटर पर हिन्दी टंकण का प्रशिक्षण दिया। द्वितीय कार्यशाला 29 तथा 30 अगस्त 2007 को “हिन्दी वर्तनी एवं व्याकरण” विषय पर आयोजित की गयी। इस कार्यशाला में केन्द्रीय हिन्दी संस्थान, आगरा की हिन्दी लोक

शब्दकोष परियोजना के प्रधान सम्पादक, श्री अरविन्द कुमार तथा संस्थान के पूर्वानुमान तकनीक प्रभाग की अध्यक्षता एवं तत्कालीन राजभाषा प्रभारी, डॉ. रंजना अग्रवाल ने “हिन्दी वर्तनी एवं व्याकरण” विषय पर व्याख्यान दिये। तृतीय कार्यशाला 14 तथा 15 दिसम्बर 2007 को संस्थान के वैज्ञानिक एवं तकनीकी वर्ग के लिए “वैज्ञानिक/तकनीकी सामग्री का हिन्दी अनुवाद” विषय पर आयोजित की गयी। इस कार्यशाला में केन्द्रीय अनुवाद ब्यूरो के निदेशक, डॉ. दंगल टी. झाल्टे ने “राजभाषा हिन्दी और अनुवाद” विषय पर तथा अलीगढ़ मुस्लिम विश्वविद्यालय, अलीगढ़ के हिन्दी विभाग के रीडर, डॉ. राजीव लोचन नाथ शुक्ला ने “प्रशासनिक एवं वैज्ञानिक कार्यों में अनुवाद की समस्याएँ” विषय पर व्याख्यान



हिन्दी कार्यशाला का एक दृश्य

दिये। चतुर्थ कार्यशाला 28 तथा 29 फरवरी 2008 को “राजभाषा नीति एवं कार्यान्वयन” विषय पर आयोजित की गयी जिसमें कार्मिक और प्रशिक्षण विभाग, नार्थ ब्लॉक, नई दिल्ली के उप-निदेशक (राजभाषा), श्री प्रेम सिंह तथा अलीगढ़ मुस्लिम विश्वविद्यालय, अलीगढ़ के हिन्दी विभाग के रीडर, डॉ. राजीव लोचन नाथ शुक्ला ने “राजभाषा नीति एवं कार्यान्वयन” विषय पर व्याख्यान दिये।

संस्थान में कार्यरत सभी हिन्दीतर भाषी अधिकारियों/कर्मचारियों द्वारा हिन्दी ज्ञान सम्बन्धी प्रशिक्षण पूरा किया जा चुका है। आज तक की स्थिति के अनुसार, संस्थान में अब कोई ऐसा हिन्दीतर भाषी अधिकारी/कर्मचारी शेष नहीं रह गया है जिसे हिन्दी ज्ञान सम्बन्धी प्रशिक्षण दिया जाना शेष हो। इसके अतिरिक्त, “हिन्दी शिक्षण योजना” के अन्तर्गत संस्थान में हिन्दी आशुलिपि के प्रशिक्षण का लक्ष्य भी संस्थान द्वारा पूरा कर लिया गया है तथा

केवल हाल ही में नियुक्त दो कनिष्ठ लिपिकों को हिन्दी टंकण के प्रशिक्षण हेतु भेजा गया है।

संस्थान में वार्षिक कार्यक्रम में निहित लक्ष्यों को पूरा करते हुए संस्थान के अधिकारियों/कर्मचारियों द्वारा अपनी ओर से लिखे जाने वाले सभी पत्र तो हिन्दी अथवा द्विभाषी रूप में लिखे ही गये साथ ही, “क”, “ख” तथा “ग” क्षेत्रों से अंग्रेजी में प्राप्त पत्रों के उत्तर भी शत-प्रतिशत हिन्दी में अथवा द्विभाषी रूप में दिये गये। “क” तथा “ख” क्षेत्रों की राज्य सरकारों एवं उनके कार्यालयों और गैर-सरकारी व्यक्तियों के साथ पत्राचार शत-प्रतिशत हिन्दी में अथवा अपेक्षानुसार द्विभाषी रूप में ही किया गया। संस्थान के विभिन्न वैज्ञानिक प्रभागों तथा प्रशासनिक अनुभागों द्वारा आयोजित की जाने वाली बैठकों की कार्यसूची तथा कार्यवृत्त शत-प्रतिशत हिन्दी में अथवा द्विभाषी रूप में जारी किये गये।

भारत सरकार, गृह मंत्रालय, राजभाषा विभाग द्वारा जारी वार्षिक कार्यक्रम के अनुसार अपना कार्य शत-प्रतिशत हिन्दी में करने के लिए आठ अनुभागों को विनिर्दिष्ट करने का लक्ष्य संस्थान द्वारा पहले ही प्राप्त कर लिया गया है। हमारे संस्थान में अपना कार्य शत-प्रतिशत हिन्दी में करने के लिए दस अनुभाग पहले से ही विनिर्दिष्ट हैं।

प्रशासनिक कार्य के अतिरिक्त संस्थान में वैज्ञानिक प्रकृति के कार्यों में भी हिन्दी के उपयोग को प्रोत्साहित किया जाता है। वैज्ञानिकों ने अपनी परियोजना रिपोर्टों के सारांश द्विभाषी रूप में दिये, विद्यार्थियों द्वारा अपने शोध-प्रबन्धों में द्विभाषी रूप में सारांश प्रस्तुत किये गये, सेमिनार हिन्दी में दिये गये। वैज्ञानिकों एवं तकनीकी कर्मियों द्वारा हिन्दी में शोध-पत्र प्रकाशित किये गये। इसके अतिरिक्त, संस्थान से बाहर आयोजित सम्मेलनों में भी संस्थान के वैज्ञानिकों द्वारा हिन्दी में शोध-पत्र/पोस्टर प्रस्तुत किये गये। संस्थान द्वारा किये जाने वाले सर्वेक्षणों की प्रश्नावलियाँ/प्रपत्र/निर्देश द्विभाषी रूप में तैयार किये गये।

संस्थान की वेबसाइट द्विभाषी है जिसको समय-समय पर अद्यतन किया गया। इस वर्ष संस्थान की वेबसाइट पर उपलब्ध “हिन्दी-सेवा लिंक” में द्विभाषी टिप्पणियों के साथ-साथ वैज्ञानिक तथा प्रशासनिक शब्दावली में सामग्री जोड़ी गयी।

गृह मंत्रालय, राजभाषा विभाग द्वारा जारी तथा परिचालित विभिन्न नकद पुरस्कार योजनाएँ संस्थान में लागू हैं। संस्थान के कर्मियों ने इन योजनाओं में भाग लिया।



संस्थान के पूर्वानुमान तकनीक प्रभाग की अध्यक्षता एवं पूर्व राजभाषा प्रभारी, डॉ. रंजना अग्रवाल द्वारा भारत सरकार, गृह मंत्रालय, राजभाषा विभाग की “हिन्दी में मौलिक पुस्तक लेखन हेतु वर्ष 2006-07 के लिए इन्दिरा गांधी राजभाषा पुरस्कार” योजना के अन्तर्गत “विज्ञान में ताक-झाँक” नामक वैज्ञानिक पुस्तक की पाण्डुलिपि प्रस्तुत की गयी ।

संस्थान में सितम्बर 2007 के दौरान हिन्दी चेतनामास का आयोजन किया गया । इस दौरान आयोजित प्रतियोगिताएँ/कार्यक्रम इस प्रकार हैं : काव्य-पाठ, शिक्षक दिवस, डॉ. दरोगा सिंह स्मृति व्याख्यान, प्रभागीय चल-शील्ड, वाद-विवाद, प्रश्न-मंच, हिन्दी आशुलिपि, हिन्दी टंकण, हिन्दी निबन्ध लेखन, हिन्दी टिप्पण एवं प्रारूप लेखन, वर्तनी एवं शोध-पत्र-पोस्टर-प्रदर्शन प्रतियोगिता । संस्थान में 05 सितम्बर 2007 को शिक्षक दिवस का आयोजन किया गया । इस अवसर पर मुख्य अतिथि, प्रो. मदन गोपाल सरदाना को सम्मानित किया गया । 14 सितम्बर 2007 को हिन्दी दिवस के अवसर पर डॉ. दरोगा सिंह स्मृति व्याख्यानमाला का 16वाँ व्याख्यान भारतीय कृषि अनुसंधान परिषद् के उप-महानिदेशक (अभियांत्रिकी), डॉ. नवाब अली द्वारा “कुपोषण दूर करने में सोयाबीन का योगदान” विषय पर दिया गया । हिन्दी चेतनामास के समापन समारोह के अवसर पर 01 अक्टूबर 2007 को संस्थान में हो रहे

हिन्दी कार्यो तथा चेतनामास के दौरान आयोजित समस्त कार्यक्रमों/प्रतियोगिताओं की एक झलकी प्रस्तुत की गयी तथा समारोह के मुख्य अतिथि, कृषि अनुसंधान एवं शिक्षा विभाग के अपर सचिव तथा भारतीय कृषि अनुसंधान परिषद् के सचिव, श्री अनिल कुमार उपाध्याय द्वारा सफल प्रतियोगियों को पुरस्कृत किया गया ।

संस्थान की हिन्दी पत्रिका, “सांख्यिकी-विमर्श” के तीसरे अंक का प्रकाशन किया गया । इस अंक में संस्थान के कीर्तिस्तम्भ, इस वर्ष संस्थान द्वारा किये गये अनुसंधानों, राजभाषा से सम्बन्धित कार्यो व अन्य गतिविधियों के संक्षिप्त विवरण के साथ-साथ कम्प्यूटर पर रोचक लेख, सूचना प्रौद्योगिकी एवं जीव विज्ञान में अनुप्रयोग, वर्षा का पूर्वानुमान तथा क्योटो प्रोटोकॉल जैसे सामयिक महत्व के विषयों से सम्बन्धित लेख संग्रहित हैं । संस्थान द्वारा विकसित गेहूँ की फसल के लिए प्रबंधन दक्ष तंत्र तथा संस्थान के पुस्तकालय सूचना तंत्र का विवरण भी दिया गया है। डॉ. दरोगा सिंह स्मृति व्याख्यानमाला के अन्तर्गत भारतीय कृषि अनुसंधान परिषद् के उपमहानिदेशक (अभियांत्रिकी), डॉ. नवाब अली द्वारा दिया गया व्याख्यान आमंत्रित ज्ञानवर्धक लेख के रूप में पत्रिका में सम्मिलित किया गया है । कृषि सांख्यिकी के क्षेत्र में प्रयोग होने वाले सौ तकनीकी शब्दों का शब्द-शतक हिन्दी व अंग्रेजी में दिया गया है ताकि लेखकों को हिन्दी में लेख लिखने में आसानी हो सके ।



### List of Approved On-going Research Projects

#### Remote Sensing and Geographic Information System

1. Developing remote sensing based methodology for collecting agricultural statistics in Meghalaya.  
**Prachi Misra Sahoo**, Anil Rai, Randhir Singh
2. Developing remote sensing based methodology for collecting agricultural statistics in North-East hilly region.  
**Prachi Misra Sahoo**, Anil Rai , HVL Bathla, Tauqueer Ahmad, Samir Farooqi

#### Assessment and Evaluation Studies

3. Assessment of survey capabilities of private sector.  
**UC Sud**, SD Sharma, HVL Bathla, RC Goyal, MS Narang, DC Mathur, AK Gupta, Satya Pal, VK Jain, Bhagwan Dass, Alka Arora
4. Impact assessment of fisheries research in India.  
**GP Reddy** (NAARM), AK Vasisht, DR Singh
5. Adoption and impact of resource conserving technologies on farm economy in Indo-Gangetic Plains, India  
**RP Singh (IARI)**, AK Vasisht

#### Production and Area Estimation

6. Pilot study to develop an alternative methodology for estimation of area and production of horticultural crops.  
**Tauqueer Ahmad**, HVL Bathla, Anil Rai, DC Mathur, RM Sood
7. Study to investigate the causes of variation between official and trade estimates of cotton production  
**Tauqueer Ahmad**, HVL Bathla, Anil Rai, Prachi Misra Sahoo, AK Gupta, VK Jain, DV Mhadgut (CIRCOT, Mumbai)

8. Pilot study to develop sampling methodology for estimation of production of mushroom.  
**AK Gupta**, UC Sud, DC Mathur
9. Pilot study on small area crop estimation approach for crop yield estimates at the gram panchayat level.  
**UC Sud**, HVL Bathla, RS Khatri, VK Mahajan, DC Mathur, Hukum Chand

#### Cropping Systems Research

10. Planning, designing and analysis of experiments planned ON STATION under the Project Directorate of Cropping Systems Research.  
**Rajinder Kaur**, Ajit Kaur Bhatia, Anil Kumar
11. Planning, designing and analysis of ON FARM research experiments planned under Project Directorate of Cropping Systems Research.  
**NK Sharma**, PK Batra
12. Planning, designing and analysis of data relating to experiments conducted under AICRP on long-term fertilizer experiments.  
**DK Sehgal**, Krishan Lal, SMG Saran
13. Some investigations on design and analysis of agro-forestry experiments.  
**Seema Jaggi**, VK Sharma, AS Gill (IGFRI, Jhansi), Cini Varghese
14. A statistical investigation on production, economic and energy potential of crop sequences in different agro-ecosystems.  
**Rajinder Kaur**, VK Sharma
15. Planning, designing and analysis of experiments relating to AICRP on STCR.  
**Aloke Lahiri**, VK Sharma, A Subha Rao, Y Muralidharudu, Rajender Parsad, MR Vats, Abhishek Rathore and VK Gupta

16. Long term manorial and fertilizer experiment on potato based cropping systems.

**CPRI Campus, Modipuram:** NC Upadhayay, OP Singh, AK Shukla, MA Khan, BP Singh, DB Singh, V Sunaina, Kamlesh Malik, Nalini Rajan Kumar, Dinesh Kumar

**From CPRI, Shimla:** MC Sood, PM Govindakrishnan, KP Chandran

**From PDCSR, Modipuram:** SS Paul

**From IASRI, New Delhi:** Rajender Parsad

17. Impact of Micronutrients on crop productivity and returns

**SP Bhardwaj,** Rajendra Kumar, Ashok Kumar, Anil Kumar

#### Information System for Agricultural and Animal Experiments

18. Agricultural field experiments information system.

**PK Batra,** OP Khanduri, DK Sehgal

19. Development of animal disease information system for organized sheep farm with CSWRI, Avikanagar as Lead Centre.

Scientist from CSWRI and IASRI

#### Experimental Design for Agricultural, Animal, Agroforestry and Fisheries Research

20. Statistical and algorithmic approach for improved estimation of treatments effects in repeated measurements designs. (Funded by DST)

**Cini Varghese,** AR Rao, VK Gupta, Sanjeev Kumar

21. Design and analysis of experiments for spatially correlated observations. (Funded by DST)

**Seema Jaggi,** VK Gupta, Rajender Parsad

22. Designs for mixture experiments in agriculture.

**Krishan Lal,** VK Sharma, VK Gupta, PK Batra, Lal Mohan Bhar

23. Study on robustness of block designs for biological assays against loss of data.

**Ravindra Srivastava,** VK Gupta, Rajender Parsad

24. Estimation of extent of farming practices, resources and activities with energy use.

**Jagbir Singh,** KK Tyagi, KK Kher, AK Gupta, VK Jain

25. Web solutions for partially balanced incomplete block designs.

**Anu Sharma,** Cini Varghese, Seema Jaggi

26. Experimental designs for agricultural research involving sequences of treatments.

**Cini Varghese,** Seema Jaggi

#### Studies on Gene Action, Estimation of Genetic Parameters and Genetic Merit, Genetic Progress and Other Related Statistical Methods

27. Effect of selection and incomplete model specifications on heritability estimates.

**VK Bhatia,** SD Wahi, AK Paul, AR Rao

28. A statistical study of rainfall distribution and rainfall insurance.

**Asha Saksana,** Prajneshu, Himandri Ghosh

29. Statistical investigation on the performance of non-parametric stability measures when the genotype by environment data is non-normal. (Funded through AP Cess Fund, ICAR)

**AK Paul,** Inder Singh, VT Prabhakaran

30. Some investigations on stable and robust clustering procedures. (Funded through AP Cess Fund, ICAR)

**Wasi Alam,** SD Wahi, VT Prabhakaran, Pal Singh

31. Computational analysis of SNPs at functional elements of rice areas.

**AR Rao,** Anu Sharma, SB Lal, Trilochan Mohapatra (NRCPB, IARI, New Delhi)

32. Empirical investigations on estimation of genetic correlation.

**SD Wahi,** AR Rao

#### Forecasting Techniques in Agricultural System

33. Crop forecasting using state space models.

**Ramasubramanian V,** Chandrahas

34. Neural network based forecast modeling in crops.

**Amrender Kumar,** Ramasubramanian V, Ranjana Agrawal

35. Stochastic process modeling and forecasting through discrete nonlinear time series approach.  
**Himadri Ghosh**, Prajneshu
36. Use of discriminant function and principal component techniques for weather based crop yield forecast.  
**T Rai**, Chandrahas, Ranjana Agrawal, SS Walia
37. Weather based models for forecasting potato yield in UP  
**SC Mehta**, Satya Pal
- Study of Technological Change, Risk and Uncertainty in Agriculture**
38. A study on editing and imputation using Neural Networks.  
**Ramasubramanian V**, Ranjana Agrawal, SB Lal, Vipin Kumar Dubey
39. An econometric analysis of groundwater markets in Indo-Gangetic Plains of India.  
**DR Singh**, AK Vasisht, Prawin Arya, Ashok Kumar, Mahender Singh
40. Supply constraints in tur (arhar) crop  
**Ashok Kumar**, DR Singh
41. Visioning, policy analysis and gender (V-PAGE) (Sub-Prog. III): Policy analysis & market intelligence (NAIP Project)  
**SD Sharma**, AK Vasisht, DR Singh, Ashok Kumar, SP Bhardwaj, Prawin Arya, Sushila Kaul, Pratap Singh (NCAP), NP Singh (IARI), Anil Rai, KK Chaturvedi
42. Visioning Policy Analysis and Gender (V-PAGE) Sub-Prog. II: Technology forecasting  
**SD Sharma**, Ranjana Agrawal, Ramasubramanian V, Amrender Kumar, Satya Pal, Anil Rai, KK Chaturvedi, Girish Kumar Jha (IARI)
43. An econometric study of women empowerment through dairying in selected districts of Haryana.  
**Sushila Kaul**, SP Bhardwaj, Sanjeev Panwar
- Development of Databases and Information System for National Agricultural Research System**
44. Software for survey data analysis.  
**VK Mahajan**, GK Jha, SB Lal, Anu Sharma
45. Development of PERMISnet-II.  
**Balbir Singh**, Alka Arora, Mohd. Samir Farooqi, Shashi Dahiya
46. National Information System on Agricultural Education Network in India (NISAGENET).  
**RC Goyal**, PK Malhotra, VH Gupta, SB Lal, Alka Arora, K Chaturvedi, Ashok Kumar
47. Statistical Package for Animal Breeding 2.1 (SPAB 2.1)  
**IC Sethi**, SD Wahi
48. Knowledge data warehouse for agricultural research  
**Anil Rai**, PK Malhotra, Seema Jaggi, KK Chaturvedi, Prachi Mishra Sahoo, Mohd. Samir Farooqi
49. Strengthening, refining and implementation of expert system on wheat crop management.  
**SN Islam**, HO Agarwal, Mohd. Samir Farooqi, KK Chaturvedi, HS Sikarwar
50. Support system for manpower planning – PERMISnet  
**Alka Arora**, Balbir Singh, Samir Farooqi, Shashi Dahiya, Anil Rai
51. National Information System on Agricultural Education Network in India (NISAGENET 2)  
**RC Goyal**, PK Malhotra, Ashok Kumar, VH Gupta, KK Chaturvedi, Mohd. Samir Farooqi



