# 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 the 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)**
Four students were admitted and three students completed the Ph.D. (Agricultural Statistics) degree.

(b) **M.Sc. (Agricultural Statistics)**
Five students were admitted and four students completed the M.Sc. (Agricultural Statistics) degree.

(c) **M.Sc. (Computer Application)**
Six students were admitted and three students completed the M.Sc. (Computer Application) degree.

Details of students completed various courses during 2005-06 is as follows:

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

**(i) Dinesh Kumar Pateria—A study on designs for investigating competition from neighbouring units**

In agricultural field experiments, the treatment applied to one experimental plot may affect the response on neighbouring plots besides the response on the plot to which it is applied. For example, in a **varietal trial** with tall and dwarf varieties of a species, plots with dwarf varieties may have low yield as compared to the normal yield because of the shading effect of the tall varieties in the adjoining plots. As a result, the estimates of treatment effect differences may be biased due to interference or competition from the neighbouring units. In the planning and analysis of such trials, it is therefore important to ensure that the effect of neighbouring plots is taken care of. Some analytical techniques, like analysis of covariance, can be useful for these situations, but in order to estimate the treatment effects as well as neighbouring competition effects, experimental designs are needed to be developed. It is important to ensure that no treatment is unduly disadvantaged by its neighbour. This is done by using the **neighbour-balanced designs** wherein the allocation of treatments is such that every treatment occurs equally often with every other treatment as neighbours(left and right). Some methods of constructing self-neighboured strongly balanced block designs for estimation of direct and neighbour effects have been obtained. Methods of obtaining circular neighbour balanced block designs have been described. Series of partially neighbour balanced block design has also been obtained. A method of constructing non-circular neighbour balanced block designs is also given. A class of block designs for competition effects with unequal block sizes has also been constructed. A list of the designs obtained giving parameters and efficiency has also been prepared. The joint information matrix for estimating direct and neighbour effects in block design set-up under mixed effects model has been derived and the conditions for the design to be universally optimal under different classes have been obtained. The class of designs that are universally optimal have also been obtained. Agroforestry and intercropping are a particular case of experiments where competition is suspected between different components. Concept of neighbour balanced designs for agroforestry experiments have been described and some series of designs have been obtained that are balanced for tree effects. The competition effects between different species in intercropping experiments have been studied. A SAS code using PROC IML is written for generation of information matrix of the block design for competition effects.

**Guide: Dr. Seema Jaggi**

**(ii) Amitava Dey—A study on estimation of multi-equation statistical models**

Multi-equation models also known as Seemingly Unrelated Regression Equations (SURE) models are a set of statistical equations in which random errors associated with these equations are correlated with each other. In time series modeling the errors are generally correlated, and as such the sample residuals contain some information about the future observations. This information, which is often ignored, has been used here in improving the precision of predicting the post-sample observations. The best linear unbiased predictor (BLUP) for given values of explanatory variables and known variance-covariance matrix of error term has been obtained by classical approach for an m-equation linear SURE model. The gain in efficiency of the proposed predictor over the usual generalized least-squares predictor has been obtained. Two particular cases, *viz.* (i) when the errors in each equation are independently and identically distributed and contemporaneous errors in different equations are correlated, and (ii) when error term in each equation follow AR(1) process, have been investigated. To observe the effect of sample size and magnitude of correlation between explanatory variables across the equations and of covariance between the error terms of different equations on the prediction efficiency, a Monte-Carlo experiment has been carried out using a two-equation model. Best linear unbiased predictor of the total of post-sample observations in a single draw

has also been proposed and it has been proved that best linear unbiased predictor of total of post sample observations is the sum of the best linear unbiased predictions of the individual commodities. Also, best linear unbiased predictors have been proposed for a 2-equation linear regression model with unequal numbers of observations. Estimation of SURE model has been investigated for two-equation linear regression models with three different patterns of missing observations having practical significance. The estimators and the variances of the estimators have been proposed. Consistent estimators of the regression parameters have been suggested when the variance-covariance matrix of the error vector is unknown and the small sample properties of these estimators have been studied through Monte-Carlo experiments.

**Guide: Dr. VK Sharma**

**(iii) Ramesh Kolluru—Statistical investigation on molecular marker based classification of crop varieties**

Knowledge about classification among breeding materials is an invaluable aid in crop improvement strategies. Thorough knowledge of the genetic diversity of a crop is necessary for parental selection that maximizes genetic improvement. More accurate and complete description of genotypes and patterns of genetic diversity could help in determining future breeding strategies and facilitate introgression of diverse germplasm into the current commercial genetic base of any crop. Quite often DNA markers along with cluster analysis are used to assess genetic diversity of different crops. Choice of genetic distance measures and clustering methods are the major issues in cluster analysis. It will be quite interesting to identify a suitable clustering procedure that could classify genotypes with greater accuracy, for a given crop. Many a times, it is very expensive to go for large number of molecular markers in classifying the crop genotypes. The sampling variance is used to determine how large a sample of markers is required to provide a given level of precision. Thus, it would be desirable to estimate genetic relationships using optimum number of polymorphic bands. Analysis of Molecular Variance (AMOVA) is used to summarize the population structure with the marker data from different genotypes, while remaining flexible enough to accommodate different types of assumptions about the evolution of the genetic system. Thus, it is desirable to estimate correlation of molecular diversity in AMOVA. Keeping in view of these points, the present investigation was focussed on the identification of suitable clustering procedure, which would render more accurate classification of crop genotypes, determination and identification of the effective number of polymorphic markers in genetic diversity estimation and identification of suitable procedure for the estimation of correlation of molecular diversity in the Analysis of Molecular Variance. Among different clustering methods and distance measures, a combination of Fuzzy clustering method and Modified Roger's distance was identified as the most suitable procedure for clustering rice cultivars using STMS marker data, whereas for the sugarcane crop and AFLP marker data a combination of Fuzzy clustering method and Nei & Li distance was identified as the best. The optimum number of STMS markers in rice was determined to be around 35, with minimum sampling variance (10% coefficient of variation), which gives the same genetic relationships as would have been obtained from large number of markers. Further these 35 markers were identified. In a similar way, for sugarcane crop a total of 300 AFLP markers were determined as optimum number of markers. For rice and sugarcane cultivars, the correlations of molecular diversity along with their standard errors were estimated as $0.37 \pm 0.039$ and $0.013 \pm 0.011$ respectively. Also, the minimum number of restriction sites required for testing the significance of correlation of molecular diversity was found to be 65 and 300 in rice and sugarcane respectively.

**Guide:. Dr. VT Prabhakaran**

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

**(i) Madan Gopal Kundu—Genetic analysis of growth curves in pigs**

Growth studies serve as aid in assessing the maximum production potential of livestock. Growth studies have been performed on pig-growth data along with computation of the genetic parameters of estimated growth curve parameters and body weight to determine whether growth curve parameters can be used or not for selection purpose. Richards' model has been fitted to each of the 698 pigs. The estimate of inflection parameter, *m*, indicates that the logistic model is the best fit. The parameter estimates of logistic model are 79.67 kg, 2.67 kg per week and 23 weeks for asymptotic body weight, maximum growth rate and age at point of inflection respectively. Heritability and genetic

correlations have been estimated for the body-weight data and estimated growth curve parameters (logistic) using full sib mixed model and half sib mixed model considering sex as fixed effect. It has been found that body weights are moderately heritable from 4th weeks of age. The heritability estimate of age at point of inflection is moderate whereas the other two parameters of logistic model viz., mature body weight and maximum growth rate are poorly heritable. The body weights were almost always negatively correlated with the age at the point of inflection and mature body weight. Again the age at point of inflection is strongly and positively correlated with the mature body weight. It seems that it is possible to have pigs with higher body weight at the age of 20th or 24th week which is very closure to slaughtering time and decreased mature body weight (mature body weight should be lower to decrease the maintenance cost of the animal in the parental stocks) through selecting animals on the basis of early ages at point of inflection. Besides this selection efficiency are also favorable for selecting animal at the early ages, namely at 7th and 8th weeks of ages, for the increased body weight at later ages, namely 20th and 24th weeks of age which may be a great weapon for maximizing profit for those farms which are devoted to commercial pig production. A data set has been generated for 756 animals using full-sib model and number of sires is taken as 63. The results obtained through analyzing the simulated data are in agreement with the results obtained through analyzing the real data.

**Guide: Dr. AK Paul**

**(ii) Pabitra Biswas—A study on resolvable block designs**

Resolvable block designs are important in practice since it is often useful to perform an experiment replicated at a time. Many of Balanced Incomplete Block designs, Partially Balanced Incomplete Block designs, and Cyclic designs provide resolvable designs for various parametric combinations. The á-design introduced by Patterson and Williams (1976) exist for $v = ks$ in blocks of size $k$ with $r$ replications and each replication having $s$ blocks is also resolvable. These designs are computer generated and software available for generating these designs are either not available or cost prohibitive to the experimenter. Also sometimes it is desirable to make use of the layout of the field in conducting the trial and replications may have to be placed contiguous to each other. For this purpose John and Williams (1995) introduced the concept of Latinized á-designs. These designs are also computer intensive and generations of layouts of such designs are also not readily available. Thus it is of importance to develop algorithm and software for generation of efficient á-designs and efficient Latinized á-designs. This will help in easy access of these designs to researchers in our country. Algorithm for the construction of efficient á-designs and Latinized á-design has been developed using Exchange and Interchange procedures to array generated randomly for the construction of designs rather to the design itself. Lower bounds to A and D efficiency of block designs have been also computed. A computer program in Visual C++ and also in SAS has been developed for this purpose. A catalogue of over 400 á-designs for $v \leq 200$, $3 \leq k \leq 10$, $2 \leq r \leq 5$ has been prepared and out of these 267 designs have lower bound to A-efficiency > 90%. A catalogue of Latinized á-designs for $v \leq 25$ and for which long block is a complete replicate has also been prepared.

**Guide: Dr. PK Batra**

**(iii) Dwijesh Chandra Mishra—Some investigations on the method of ranked set sampling in the context of finite population**

The method of Ranked Set Sampling (RSS) proposed by McIntyre provides samples which are representative of the population. The RSS is useful in situations where the exact measurement of selected units is either difficult or expensive in terms of time, money or labour, but where the ranking of small sets of selected units according to characteristics of interest is possible with reasonable success on the basis of visual inspection or through other rough measurements. The method involves selecting '$n^2$' units from a population of size 'N' and randomly partitioning the $n^2$ units into 'n' sets of size 'n'. Each member of a set is ranked relative to one another and on the basis of ranking exactly one member of each group is chosen for quantification. Thus from the first set first ranked unit is chosen and quantified, from the second set the second ranked unit is chosen and like wise from the $n^{th}$ set the $n^{th}$ ranked unit is chosen. The theoretical framework for RSS procedure has also been developed for finite population sampling. The RSS procedure has been extended to the case of two stage sampling design when the population under study is finite. An estimator of population mean has

been proposed when the sampling design under question is two-stage random sampling. Three different cases have been considered i.e. SRS applied at the first stage of sampling and RSS applied at the second stage of sampling; RSS applied at the first stage of sampling and SRS applied at the second stage of sampling; and RSS applied at both the stages of sampling. The proposed estimators are shown to be unbiased. Relative efficiencies of RSS based estimators over Simple Random Sampling based estimator have been empirically evaluated using the data of an experimental station on wheat field. The results of the study revealed that the RSS based estimator was more precise than the SRS estimator. Gain in precision of RSS based estimator varied from 4.5 to 17 per cent. Further, a Double Ranked Set Sampling (DRSS) procedure has been proposed for estimation of finite population mean. The theoretical framework is limited to samples of size '2'. Expressions for the inclusion probability of a unit and joint inclusion probabilities of two different units have been derived. With the help of an artificial data efficiency comparison of DRSS based estimator of finite population mean over an estimator based on RSS and SRS has been made. The DRSS based estimator was found to be more precise than the RSS and SRS based estimators. Percent gain in precision of DRSS based estimator over RSS and SRS based estimator was found to be 112.76 and 144.73 respectively.

**Guide: Dr. UC Sud**

**(iv) Shiv Kumar Choudhary—Statistical investigation on simultaneous selection of genotypes for yield and stability under incomplete genotype × environment data on groundnut**

In any crop improvement programme it is quite common to assess the performance of the improved varieties when raised over a wide range of locations. The basic purpose here is to identify varieties that show high performance for yield and other agronomic traits over wide range of environmental conditions. This indicates the importance of stability performance, apart from mean performance, while recommending varieties for general/ specific adaptation. Integration of stability performance with high yield performance through some suitable measures is therefore necessary for selecting varieties under multi-environmental trials. Many a times, the statistical techniques appropriate to complete data do not directly apply to incomplete genotype x environment data. Normal tendency is to restrict the analysis only to those trials for which the data are complete. Any deliberate culling of incomplete data would render the comparison of genotypic performance for yield and stability over different environments unreliable. Also, the genotypes real merit is hardly been considered simultaneously for both high-yield and stability that too when the genotype x environment data is incomplete. So far, not much work has been done on studying the influence of missing observations on the performance of different simultaneous selection measures. Zone-V being the largest zone of groundnut crop under AICRP trials, few varieties that are performing well in one part of zone-V are unable to get selected due to their poor performance in another part of the zone.

Keeping in view these points, the study deals with cataloguing of different procedures available for selecting genotypes simultaneously for yield and stability, examining the influence of missing observations on the performance of different simultaneous selection measures and sub-zonalizing zone-V of AICRP trials and thereby identify genotypes simultaneously for high yield and stability. Under this investigation, different simultaneous selection indices available in literature have been catalogued. A new simultaneous selection index has also been proposed to select varieties for high yield and stabilty under incomplete data situation. Further, the performance of the proposed index has been tested on groudnut data and it was observed that the proposed index shows significant correlations with both high yield and stability as well as selects large proportion of high yielders and stable performers when the incompleteness in the data is upto 10% of the total sample size. The influence of missing observations on performance of simultaneous selection measures has been examined and it was observed that all the indices were performing well upto around 10% of incompleteness in the data. Beyond 10% incompleteness, the Rao *et al.* (2004) index and proposed index perform consistently over other indices in terms of selection of high yielders and stable performers. Zone-V of AICRP trials has been subzonalized based on yield performance of groundnut varieties in different locations by adopting different clustering techniques.

**Guide: Dr. AR Rao**

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

**(i) Aparna Kumari—Information system for major fruit crops (apple, banana & mango) of India**

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 of agriculture and the domain of horticulture is no exception. India has a good horticultural resource base and related research and development infrastructure, which resulted in increased production and productivity of several fruits. At present, India is the second largest producer of fruits next only to China and the fruit production has tripled over the last fifty years. Total production of fruits has been estimated at 45.49 million tonnes (10% of total world production) from 3.79 million hectare in the year 2002. Fruit Crop Information System (FruitCIS) is a web based user-friendly, information system for major fruit crops of India, developed using Java Server Pages (JSP). It is developed as a comprehensive information system for apple, banana and mango fruit crops. 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 FruitCIS may help progressive farmers, policy planners, researchers, students and extension workers for rapid dissemination of knowledge and benefit humankind. Information system has the potential to help farmers to run their business more economically and get the information at every stage of fruit growth and storage. FruitCIS has a three-layered architecture. Client Side Interface Layer is implemented in HTML and JavaScript. Server Side Application Layer is implemented using Java Server Pages and Java Database Connectivity. Database Layer is implemented in Microsoft Access 2000. FruitCIS can be implemented as a network-based system with a server at IASRI so that information is available on-line. FruitCIS runs at any node of the Internet through a browser. Security features are provided in such a way that only person concerned can access the database. There is provision to insert and update the information. FruitCIS provides information on fruit distribution, family, genus, species, origin, chromosome number, nutritional value etc. statistics (area, production & productivity) of major growing states for the past/recent ten years, ambient environment requirement (temperature, rainfall, humidity etc.) for growing these crops, varieties (cultivars, hybrids and their state, yield etc.), planting material & planting system (systems detail & spacing detail), fertilizers and manure being used (types of fertilizers, methods, amount & time of application etc.), micro nutrient requirement (name, importance & deficiency symptoms), irrigation management (systems & its detail, time & frequency of watering etc), training/ pruning details (time, methods, importance etc.), diseases, physiological disorder and pests management (common name, causal organism, description symptoms, control, IDM/IPM etc.), weeds (common & botanical name and their control), harvesting (maturity index & technique, equipment needed etc.), storage details, location of domestic markets/international markets, processing detail (processed products, methods, uses) and company details. FruitCIS provides search facility for fruit statistics, variety, soil type, fertilizer, irrigation, maturity index, planting system type, disease, pest, disorder, nutrient type, weed, storage, processed product and company wise information. The software also provides facility for search using keyword and search using different search engines. Users can also view customized reports on fruit statistics. User can interact with subject specialists through e-mail, which has been developed using Java mail feature. On-line help is provided for both administrator and user. There is also a facility for image uploading in database. The feature of providing information to users through frequently asked questions has also been included in this software.

**Guide: Dr. SD Sharma**

**(ii) Chhawi Saurabh—Information system on intercropping experiments**

Information Systems are assuming an ever-increasing importance in the agriculture development and playing an important role for changes in socio-economic development of the country. Information System on Intercropping Experiments (ICEIS) is an attempt to develop a web based user-friendly, integrated solution for all the Intercropping Experiments related with On-Farm and Off-Farm activities conducted all over the country. It has a three-layered architecture. Client Side Interface Layer is implemented using HTML and JavaScript, Server Side Application Layer using Java Server Pages (JSP) and Java Database Connectivity. Database Layer is implemented using

Microsoft Access 2000. ICEIS can be implemented as a network-based system with a server at a central location (IASRI) so that information is available on-line. ICEIS runs at any node of the Internet through a browser. Security features are provided in such a way that only authorized person can access the database. There is provision to insert, update and delete the information.

ICEIS provides information regarding Intercropping experiments including experimental site history, location details, design details, objective of the experiment, treatment details, soil types and its texture, season in which the experiment was conducted, basal condition details which in turn will include sowing dates, seed rates, spacing, basal manuring, preparatory cultivation, planting methods, irrigation details, date of harvest for both main crop and inter crop and some general informations like disease and pest attack, crops condition etc. It also has the provision to search information related to conducting centre, experiment, treatments applied, main crop and inter crop informations, fertilizer doses, design information, experimental data in case of unanalyzed experiments and results in case of analyzed experiments. The users can view customized results on various aspects of the intercropping experiments as well as they can also interact with concerned people through e-mail. On-line help is also available to help both administrators and users.

**Guide: Dr. VK Mahajan**

**(iii) Soumen Pal—Decision support system for nutrient management in crops**

Information services to the farmers can be improved through the creative use of IT. Farmers use information on weather conditions, markets, agricultural developments and practices. IT with its various tools such as Internet, GIS, ESs and DSSs can play a vital role in providing the decision support to the farmers. Decision Support System on Nutrient Management in Crops (DSSNMC) is a web-based Decision Support System (DSS) to assist farmers in taking decisions related to nutrient management in crops. DSS has great importance in agriculture, as experts are not always available to answer farmers' query. DSSNMC has three modules to provide decision support to farmers. First module is based on soil test values. In this module, user provides soil test values along with desired crop to be grown, variety of that crop, season for that particular variety, soil type and targeted yield within a particular range. Based on the input provided by the user the system recommends application of chemical fertilizers for supplying the requirement of major nutrients such as nitrogen, phosphorus and potassium to the crop. The second module provides decision support on the basis of location such as district. If a farmer could not get the soil tested, the system will take input such as the location of the farm in the district, targeted yield and rest of the parameter values such as available nitrogen, phosphorus, potassium and the soil pH are obtained from the system database where standard values for a particular district are stored. The decision support to the farmers is provided in the same way as in the first module.

Another module is based on nutrient deficiency symptom of the crop. The basis here is the observation of the farmers, which they compare with the images already stored in the system. After identification of the type nutrient deficiency of the crop, the farmer can apply the treatment measures provided by the system.

The software has only one level of authentication i.e. Administrator. Administrator has the privilege to add, modify or delete information from the database. Users can interact and get decision support from the software without any authentication. They can also ask questions regarding the crop related problem by sending e-mails to the concerned experts. Users can also view some frequently asked questions (FAQs) regarding various queries.

DSSNMC is developed using ASP.NET, which is a new web-based technology. Database part is developed using Microsoft Access (MS Access). It is the database widely used for its simplicity and ease in operation.

**Guide: Dr. IC Sethi**

## 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 Institute 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 04 July 2005 to 31 Dec. 2005. The Course comprise of two independent modules of three months duration each. Six officials including one Departmental participated in both the modules. Module-I was organized during 04 July 2005 to 24 September 2005.Two officials participated in Module-I only.

Module-II was organised during 03 Oct 2005 to 31 December 2005. One officer participated in Module-II only. 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 31 December 2005 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 'Data Driven Web Solutions using Open Source Technology' was organised during 17 September to 07 October 2005 under the aegis of Centre of Advanced Studies in Agricultural Statistics and Computer Applications. The training programme was attended by 13 participants from various ICAR Institutes and State Agricultural Universities. Sh. Vipin Kumar Dubey was the Course Director.


Inauguration of a Training Programme on
'Data Driven Web Solutions using Open Source Technology'

This training programme offered sufficient practical knowledge to develop and host a database server on Linux operating system with Apache web server using MySQL as RDBMS and PHP server side script for database connectivity. In brief the practical was divided into four modules. Installation of Linux, Apache, MySQL and PHP.

Major areas covered were Introduction to Open Source Technology, An Overview of Open Source Software Licenses, Data Warehousing in Agriculture, IT Innovations and Challenges for NARS, Introduction to Linux OS, Basic File System Security, Administrative Issues in Linux, Introduction to Web Server, Introduction to Apache, Global Environment Directives, Main Server Configuration Directives, Virtual Hosts Directives, Concepts of RDBMS, Introduction to MySQL, MySQL Administration, MySQL GUI, HTML, Introduction to PHP and XML, etc.

Guest Lectures on Administrative Issues in Linux, System and Network Management and Cyber Security were also organised.

- A 21-days training programme under the aegis of Centre of Advanced Studies in Agricultural Statistics and Computer Applications on 'Recent Advances in the Analysis of Survey Data', was organised for the scientists of ICAR Institutes/SAUs during 18 November to 08 December 2005. The training programme was attended by 20 participants from various ICAR Institutes and State Agricultural Universities. Dr. KK Tyagi was the


Inauguration of a Training Programme on
'Recent Advances in the Analysis of Survey Data'

Course Director for the training programme.

During the training, the participants were exposed to recent advances in the field of Sample Surveys like Historical Perspective of Sample Surveys, Simulation Techniques, Small Area Estimation, Model Based Approach in Survey Sampling, Regression Analysis, Categorical Data Analysis, Variance Estimation, Remote Sensing, Current Status of Crop Surveys, Qualitative Aspect in Sample Surveys, Imputation Techniques, GIS, Current Status of Livestock Surveys etc. The participants were also given exposure to working on computers and use of different statistical packages.

Joint Director delivering the lecture to the participants of a Training Programme

- A 21-days training programme on 'Statistical Techniques for Agricultural Research with Emphasis on Use of Software' was organised during 21 December 2005 to 10 January, 2006

Inauguration of a Training Programme on 'Statistical Techniques for Agricultural Research with Emphasis on Use of Software'

A participant receiving the certificate during Valedictory Function of CAS Training Programme on 'Statistical Techniques for Agricultural Research with Emphasis on Use of Software'

under the aegis of Centre of Advanced Studies in Agricultural Statistics and Computer Applications. The training programme was attended by 21 participants from various ICAR Institutes and State Agricultural Universities. Dr. Seema Jaggi was the Course Director for the training programme.

The training programme was aimed at providing the participants opportunity to study and learn some sophisticated techniques of data analysis using softwares which may help them in analysis and interpretation of their results more meaningfully, with better sense of reliability and confidence. In particular, this course was designed to acquaint researchers with the techniques of data collection, statistical analysis, interpretation and presentation of results. The course was oriented towards application and a combination of lectures, exercises, and hands-on exercises on SPSS/ SAS/ MS-EXCEL. A web page was designed regarding the details of the training and was attached in our Institute's website. This course was intended primarily for scientists undertaking agricultural research. In all 21 participants from various disciplines of Agriculture representing different ICAR Institutes (12) and State Agricultural Universities (9) attended this training. The topics were covered under following four modules (i) Statistical Softwares and Information Systems in Agricultural Research, (ii) Statistical Methods in Agricultural Research, (iii) Planning of Agricultural

Experiments/ Surveys and (iv) Modern Approaches to the Analysis of Agricultural Data. Concepts were explained largely without using much of mathematics using computer software and the course emphasized on understanding that which analysis is appropriate to use and correct interpretation of the results. 23 faculty members from the institute and 4 guest speakers (Prof. Prem Narain, Dr. P.R. Sreenath, Dr. R.N. Sahoo and Dr. G.K. Jha) delivered lectures during this training. Course material in the form of Reference Manual and Electronic Manual was provided to all the participants.

- A 21-days training programme on 'Development of Portals using LAMP Technology' was organized during 01-21 February 2006 under the aegis of Centre of Advanced Studies in Agricultural Statistics and Computer Applications. The topics covered


Inauguration of a Training Programme on
'Development of Portals using LAMP Technology'

were Introduction to Portals, Linux Operating System, Apache Web Server, MySQL Database Server and PHP Server Side Script. The training programme was attended by 15 participants from various ICAR Institutes and State Agricultural Universities. Sh. K.K. Chaturvedi was the Course Director.

This training programme offered sufficient practical knowledge to develop and host Portal on Linux operating system with Apache web server using MySQL as RDBMS and PHP server side script for database connectivity.

In brief the practical was divided into four modules: Installation of Linux, Apache, MySQL and PHP.

Major areas covered are Enlighten LAMP Technology in NARS, An Overview of Portals, Data Warehousing in Agriculture, Library Information System, Cyber Security and IT Laws, Working with Linux and Shell, Files & Directories Structure in Linux, Basic File System Security, Administrative Issues in Linux, Introduction to Apache and Global Environment Directives, 'Main' Server Configuration and Virtual Hosts Directives, Concepts of RDBMS, Working with MySQL, MySQL Administration, MySQL GUI, HTML (Formatting and Images), HTML (Links, Frames and Forms), Introduction to PHP, Building Blocks of PHP & Flow Control, Loops & Functions, Array & Times and Dates, Files Handling, Working with Forms, PHP and MySQL Integration and Development of Portal using Zope, etc.

Guest Lectures on Administrative Issues in Linux, Mail Server Configuration, Issues in Development of Portals and Monitoring of N/W activities were also organised.

## OTHER TRAINING PROGRAMMES

### Training Programme for Visitors

- A training programme on SPSS for two persons from NBRI, Lucknow during 13-18 June 2005 was organised under resource generation programme and an earning of Rs.10000/- was made. Dr. V.K. Mahajan organized the training.


Inauguration of a Training Programme on
'Small Area Estimation Techniques'

- One day training programme was organised on 30 January 2006 for the visitors on 'Large Sample Survey' sponsored by Ministry of Statistics & Programme Implementation. The training was attended by twenty participants.


A participant receiving the certificate from Chief Guest during Valedictory Function of Training Programme on 'Small Area Estimation Techniques'

- A refresher training programme on 'Small Area Estimation Techniques' for ISS Officers sponsored by CSO, Ministry of Statistics and Programme Implementation was organised during 25-30 July, 2005. Dr. Randhir Singh was the Course Director. The training programme was inaugurated by Dr. S. Ray, D.G. and CEO, NSSO, Ministry of Statistics and Programme Implementation. Dr. Ray emphasized the need of such programmes to enable the ISS officers working in important positions to make use of the latest techniques for decision-making. The course was planned for 15 participants but only 9 participants could join the course. The course has been organised in the form of lectures, practicals and group discussions. The reference manual of the course was prepared and provided to the participants in the beginning of the course. The topics covered included the classical techniques and their application and recent technologies like remote sensing, GIS and their application in small area estimation. Lectures were mainly delivered by the scientists of the Institute working on the problems related to small area estimation. Two experts namely, Dr. Padam Singh, Former Additional Director General, ICMR and Dr. A.K. Srivastava, Former Joint Director, IASRI were also invited to deliver the lectures. The valedictory function of the course was held on 30th July in the afternoon. Shri P.S. Rana, Secretary, Govt. of India, Ministry of Statistics and Programme Implementation was the Chief Guest on the occasion and distributed the certificates to the participants. Shri Rana was very happy with the smooth conduct of the course and expressed his views that the number of participants in such courses should be large and this number should be around 25 in each such course and suggested that CSO may like to take necessary steps in this direction. A number of participants also expressed their views on the course in the function. Most of the participants appreciated the conduct of the course and expressed gratitude to all the lecturers. All the participants felt that their performance will improve after attending the course and they will be able to provide more precise answers to the need of information at small area levels.
- An International study tour/training programme on 'Development of Agricultural Statistics System' for the participants from Timor Leste was organised at the Institute during 06-11 March 2006. The programme was sponsored by Food & Agriculture Organisation. The introductory session of the programme was held on 06 March, 2006. Scientists and Technical Officers of the Division attended this session. Dr. HVL Bathla was the Course Director. One participant was Director of Policy, Planning and Programme, Ministry of Agriculture, Forestry and Fisheries and another was Senior Statistician (Statistics Agriculture), Ministry of Planning and Finance, Timor Leste. Participants were visited NSSO, RK Puram, New Delhi and a lecture on Statistical System in India was arranged there. Lectures on area, yield and production statistics, Land use statistics and cost of cultivation was arranged at DES, Krishi Bhawan, New Delhi. A lecture on Official statistics and crop forecasting was delivered at NCFC, Krishi Bhawan, New Delhi. Participants visited to National Sample Survey Organisation (FOD), Faridabad for demonstration of girdawari operation, sample check, preparation of data schedules, tabulation programmes and preparation of estimates of yield rates. Participants also visited the Office of Land Records, Gwalior (Madhya Pradesh) for demonstration of land record

system of one of the State i.e. Madhya Pradesh and field visit for demonstration of actual crop cutting experiments and socio economic surveys.

**Research Fellowship**

During 2005–06, 12 Ph.D. and 28 M.Sc. students received research fellowship. 12 Ph.D. students received IARI Scholarship at the rate of Rs. 7000/- p.m. in addition to Rs.10,000/- per annum as the contingent grant. 14 M.Sc. students received ICAR Junior Research Fellowship at the rate of Rs. 5760/- p.m. besides Rs. 6000/- per annum as the contingent grant and 14 M.Sc. students received IARI Scholarship at the rate of Rs. 5040/- p.m. besides Rs. 6000/- 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, Joint Director | 1984 |
| 2. | Dr VK Sharma, Professor (Agricultural Statistics) | 1984 |
| 3. | Dr Randhir Singh, Principal Scientist | 1974 |
| 4. | Dr Prajneshu, Principal Scientist | 1984 |
| 5. | Dr VT Prabhakaran, Principal Scientist | 1987 |
| 6. | Dr VK Bhatia, Principal Scientist | 1987 |
| 7. | Sh SD Wahi, Principal Scientist | 1987 |
| 8. | Dr Ranjana Agrawal, Principal Scientist | 1988 |
| 9. | Dr HVL Bathla, Principal Scientist | 1991 |
| 10. | Dr R Srivastava, Principal Scientist | 1993 |
| 11. | Dr UC Sud, Principal Scientist | 1995 |
| 12. | Dr KK Tyagi, Principal 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 Saxena, Principal Scientist | 1998 |
| 17. | Dr Amit Kumar Vasisht, Principal Scientist (at IARI) | 1998 |
| 18. | Dr Rajender Parsad, National Fellow | 1995 |
| 19. | Dr Anil Rai, Senior Scientist | 1995 |
| 20. | Dr Seema Jaggi, Senior Scientist | 1995 |
| 21. | Dr MS Narang, Senior Scientist | 1998 |
| 22. | Dr Aloke Lahiri, Senior Scientist | 1998 |
| 23. | Dr Lal Mohan Bhar, Scientist (Sr. Scale) | 1998 |
| 24. | Dr Amrit Kumar Paul, Scientist (Sr. Scale) | 1998 |
| 25. | Dr Tauqueer Ahmad, Scientist (Sr. Scale) | 1998 |
| 26. | Dr AR Rao, Scientist (Sr. Scale) | 1998 |
| 27. | Dr Ramasubramanian V., Scientist (Sr. Scale) | 1999 |
| 28. | Dr Girish Kumar Jha, Scientist (Sr. Scale) | 1999 |
| 29. | Dr Cini Varghese, Scientist (Sr. Scale) | 2000 |
| 30. | Dr RL Sapra, Principal Scientist (at IARI) | 2002 |
| 31. | Dr Prachi Misra Sahoo, Scientist | 2002 |
| 32. | Dr Krishan Lal, Senior Scientist | 2003 |
| 33. | Sh Hukum Chandra, Scientist | 2003 |
| 34. | Sh Amrender Kumar, Scientist | 2003 |
| 35. | Md Wasi Alam, Scientist | 2003 |
| 36. | Dr Prawin Arya, Scientist (Sr. Scale) | 2003 |
| 37. | Dr Himadri Ghosh, 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. | Sh Harnam Singh Sikarwar, Scientist (SG) | 1997 |
| 7. | Dr DK Agarwal, Principal Scientist | 1999 |
| 8. | Md Samir Farooqui, Scientist | 2001 |
| 9. | Ms Alka Arora, Scientist | 2001 |
| 10. | Ms Shashi Dahiya, Scientist | 2001 |
| 11. | Ms Sangeeta Ahuja, Scientist (Study Leave) | 2002 |
| 12. | Sh Sudeep, Scientist (Study Leave) | 2002 |
| 13. | Sh Vipin Kumar Dubey, Scientist | 2002 |
| 14. | Sh KK Chaturvedi, Scientist | 2002 |
| 15. | Sh SN Islam, Scientist | 2004 |
| 16. | Sh SB Lal, Scientist | 2004 |
| 17. | Ms Anshu Dixit, Scientist (Study Leave) | 2004 |
| 18. | Ms Anu Sharma, Scientist | 2004 |

| Code | Title | Course Instructors |
|---|---|---|
| | **Courses taught during the Academic Year 2004–05** | |
| | **Trimester – III** | |
| | **Agricultural Statistics** | |
| AS-103 | Elementary Sampling and Non-Parametric Methods (2+1) | Asha Saxena, Jagibir Singh and Prachi Misra |
| AS-163 | Statistical Inference (4+1) | Rajender Parsad and LM Bhar |
| AS-164 | Design of Experiments – I (3+1) | Seema Jaggi and VK Gupta |
| AS-166 | Statistical Genetics – I (3+1) | VT Prabhakaran and AR Rao |
| AS-299 | Seminar (1+0) | Ramasubramanian V |
| AS-302 | Advanced Design of Experiments – II (2+1) | R Srivastava and PK Batra |
| AS-304 | Advanced Sample Survey – II (2+1) | UC Sud and Prachi Misra |
| AS-307 | Forecasting Techniques (1+1) | Chandrahas and Ramasubramanian V |
| CS-299 | Seminar (1+0) | Ramasubramanian V |
| | **Computer Application** | |
| CS-132 | Data Structures and Structured Programming (2+1) | Shashi Dahiya and KK Chaturvedi |
| CS-133 | Numerical Algorithms Analysis and Software (2+1) | HS Sikarwar and Pal Singh |
| CS-134 | Modeling and Simulation (2+1) | PK Malhotra and Anshu Dixit |
| CS-135 | Computer Communication Networks (2+0) | Alka Arora and SN Islam |
| CS-299 | Seminar (1+0) | Ramasubramanian V |
| | **Courses taught during the Academic Year 2005–06** | |
| | **Agricultural Statistics** | |
| | **Trimester – I** | |
| AS-101 | Elementary Statistical Method (2+1) | VT Prabhakaran and SD Wahi |
| AS-150 | Mathematical Methods in Statistics – I (4+0) | Cini Varghese and Himadri Ghosh |
| AS-160 | Probability Theory (2+0) | LM Bhar |
| AS-161 | Statistical Methods – I (2+1) | VT Prabhakaran and GK Jha |
| AS-161(Old) | Statistical Methods – I (3+1) | VT Prabhakaran, GK Jha and LM Bhar |
| AS-167 | Applied Multivariate Analysis (2+1) | Ranjana Agrawal and AR Rao |
| AS-168 | Econometrics(2+1) | VK Sharma and Sivaramane N |
| AS-169 | Planning of Surveys/Experiments (2+1) | MS Narang, RS Khatri and MR Vats |
| AS-200 | Design of Experiments – II (1+1) | Rajendra Parsad and Cini Varghese |
| AS-201 | Sampling Techniques – II (1+1) | KK Tyagi and GK Jha |
| AS-202 | Statistical Genetics – II (1+1) | VK Bhatia and AK Paul |
| AS-203 | Regression Analysis (1+1) | LM Bhar and Ramasubramanian V |
| AS-204 | Linear Models (2+0) | VK Sharma and R Srivastava |
| AS-206 | Optimization Techniques (1+1) | UC Sud and Amrendra Kumar |
| AS-370 | Recent Advances in the Field of Specialisation | Prajneshu and VK Gupta |
| AS-299 | Seminar (1+0) | Seema Jaggi |
| | **Trimester – II** | |
| AS-102 | Elementary Design of Experiments (2+1) | Aloke Lahiri and Krishan Lal |
| AS-151 | Mathematical Methods in Statistics – II (4+0) | PK Batra and NK Sharma |
| AS-162 | Statistical Methods – II (2+1) | Seema Jaggi |
| AS-165 | Sampling Techniques – I (3+1) | Tauqueer Ahmad, Anil Rai |
| AS-170 | Statistical Modeling (2+1) | Prajneshu |
| AS-171 | Bioinformatics – I (3+1) | VK Bhatia, Rajender Parsad, AR Rao and KV Bhatt (NBPGR) |
| AS-205 | Advanced Statistical Inference (1+1) | Krishan Lal and UC Sud |
| AS-207 | Stochastic Processes (3+0) | Himadri Ghosh |
| AS-301 | Advanced Design of Experiments – I (2+1) | R Srivastava and VK Gupta |
| AS-303 | Advanced Sample Survey – I (2+1) | HVL Bathla and Jagbir Singh |
| AS-305 | Advanced Statistical Genetics – I (2+1) | VK Bhatia |
| AS-299 | Seminar (1+0) | Seema Jaggi |

**Computer Application**

**Trimester – I**

| | | |
|---|---|---|
| CS-100 | Introduction to Computer Application (1+1) | Balbir Singh |
| CS-111 | Introduction to Computer Organization and Architecture (3+0) | Shashi Dahiya |
| CS-112 | Fundamentals of Computer Programming in C (2+1) | KK Chaturvedi |
| CS/CA-114 | Discrete Mathematics (2+0) | PK Batra and HS Sikarwar |
| CS-211 | Compiler Construction (2+1) | SB Lal and VK Dubey |
| CS-212 | Operating System (2+1) | HO Agarwal and IC Sethi |
| CS-215 | Software Engineering (2+0) | Alka Arora and Anu Sharma |
| CS-216 | Object Oriented Analysis and Design (2+1) | VK Dubey and SB Lal |
| CS-299 | Seminar (1+0) | SN Islam |

**Trimester–II**

| | | |
|---|---|---|
| CA-101 | Computer Fundamentals & Programming (3+1) | Alka Arora |
| CA-121 | Object Oriented Programming & Design (2+1) | VK Dubey and SB Lal |
| CA-122 | Operating System (2+1) | HO Agarwal |
| CS-123 | Fundamental of Computer Programming & its Applications (2+1) | KK Chaturvedi and Pal Singh |
| CA-124 | System Analysis & Design (2+1) | IC Sethi and MS Farooqi |
| CA-225 | Data Analysis in Agriculture (1+2) | VK Mahajan and MS Farooqi |
| CS-227 | Data Base Management System (2+2) | RC Goyal and Vipin Dubey |
| CS-228 | GIS and Remote Sensing Techniques (2+1) | Anil Rai and Prachi Mishra |
| CA-299 | Seminar (1+0) | SN Islam |

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