

# ICAR



# News

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INDIAN AGRICULTURAL STATISTICS RESEARCH INSTITUTE ( ICAR ), LIBRARY AVENUE, PUSA, NEW DELHI-110 012



Director, staff and students of Indian Agricultural Statistics Research Institute heartily welcome Dr. S. Ayyappan who took over charge of Secretary, Department of Agricultural Research and Education (DARE) and Director General (DG), Indian Council of Agricultural Research (ICAR). Dr. S. Ayyappan is an eminent scientist and research administrator who has contributed immensely for the growth of ICAR. We are sure that under his dynamic leadership, ICAR will reach new heights, achieve fame and glory. Prior to the present assignment, Dr. Ayyappan has served as the Deputy Director General (Fisheries) during 2002-09; Director, Central Institute of Fisheries Education, Mumbai (Deemed University) during 2000-02; Director, Central Institute of Freshwater Aquaculture, Bhubaneswar during 1996-2000.

## IN THIS ISSUE

- Research Achievements
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### From Director's Desk . . .

This volume of Newsletter highlights some of the salient research and training achievements made and other significant activities performed during the period under report.

Universally optimal neighbour balanced block designs have been obtained. For obtaining balanced sampling plans and polygonal designs, a linear integer programming approach has been developed.

To deal with the situations, in which the variable under study is negatively correlated with the size measure of the units, inclusion probability inversely proportional to size sampling scheme has been introduced. Small area estimation methodology for zero inflated data has been developed and illustrated through real life examples.

Crop yield forecasting and disease forewarning models have been developed using the technique of artificial neural networks.

As an outreach activity of the Institute organized a travel workshop on Experimental Designs in collaboration with ANGRAU, Hyderabad for 60 participants. Three customized training programmes for Central Statistical Organization and one 21 days training programme on Recent Advances in Web Technologies for Information Management in Agriculture were organized.

Scientists of the Institute published 8 research papers and one project report during this period.

The Institute participated in number of meetings/conferences/symposia/workshops etc. More than 20 research papers were presented during these conferences. It is hoped that the contents of this document would be informative and useful for scientists in NARS. Any suggestions for improving the contents of the newsletter further, would be highly appreciated.

### निदेशक की कलम से . . .

प्रस्तुत समाचार पत्र में प्रतिवेदनाधीन अवधि के दौरान संस्थान की प्रमुख अनुसंधानिक एवं प्रशिक्षण उपलब्धियों के साथ-साथ विभिन्न महत्वपूर्ण गतिविधि यों पर प्रकाश डाला गया है।

सार्विक इष्टतम प्रतिवेशी सन्तुलित ब्लॉक अभिकल्पनाएँ प्राप्त की गयीं। सन्तुलित प्रतिचयन योजनाएँ एवं बहुभूजीय अभिकल्पनाएँ प्राप्त करने के लिए एक रेखीय इन्टिजर प्रोग्रामिंग अप्रोच विकसित की गयी।

ऐसी परिस्थितियों के लिए जिनमें अध्यनाधीन चर इकाइयों के आकार-मापों के प्रति नकारात्मक रूप से सह-सम्बन्धित हैं, आकार प्रतिचयन योजना के प्रति व्युत्पानुपाती समावेशी प्रायिकता को लागू किया गया। शून्य-स्फीत आँकड़ों के लिए लघु क्षेत्र आकलन पद्धति विकसित की गयी तथा इसकी वास्तविक जीवन के उदाहरण से व्याख्या की गयी है।

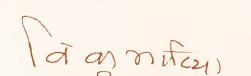
कृत्रिम न्यूरल नेटवर्क्स की तकनीकों का प्रयोग करते हुए उपज पूर्वानुमान एवं रोग पूर्व-चेतावनी मॉडल विकसित किये गये।

संस्थान की प्रसारण गतिविधि के रूप में, ए.एन.जी.आर.ए.यू., हैदराबाद के सहयोग से 60 प्रतिभागियों के लिए परीक्षणात्मक अभिकल्पनाओं पर एक ट्रैवल कार्यशाला आयोजित की गयी। केंद्रीय सांख्यिकीय संगठन के लिए तीन कस्टमाइज़ेड प्रशिक्षण कार्यक्रम तथा कृषि में सूचना प्रबन्धन हेतु वेब प्रैशोगिकियों में नवीनतम उन्नति पर एक 21 दिवसीय प्रशिक्षण कार्यक्रम आयोजित किया गया।

इस अवधि के दौरान संस्थान के वैज्ञानिकों द्वारा 08 शोध-पत्र तथा एक एक परियोजना रिपोर्ट प्रकाशित की गयी।

संस्थान द्वारा अनेक बैठकों/सम्मेलनों/संगोष्ठियों/कार्यशालाओं इत्यादि में सहभागिता की गई इन सम्मेलनों में 20 से भी अधिक शोध-पत्र प्रस्तुत किये गये। आशा है कि इस अंक की विषय-वस्तु नार्स (NARS) में कार्यरत वैज्ञानिकों के लिए सूचनाप्रद एवं उपयोगी सिद्ध होगी। इस समाचार पत्र की विषय-वस्तु में भावी सुधार लाने के लिए आपके सुझावों का स्वागत है।

  
VK Bhatia  
(VK Bhatia)

  
(विजय कुमार भाटिया)  
(Vijay Kumar Bhatia)

## RESEARCH ACHIEVEMENTS

### ● Neighbour Balanced Designs

Neighbour balanced designs, wherein the allocation of treatments is such that every treatment occurs equally often with every other treatment as neighbours, are used when the treatment applied to one experimental plot may affect the response on neighbouring plots besides the response to which it is applied. These designs ensure that no treatment is unduly disadvantaged by its neighbours and help in estimating the neighbour effects besides the direct effects of treatments. Combined intra-inter block reduced normal equations for estimating direct and neighbour effects have been derived. Sufficient conditions have been obtained for the block design to be universally optimal for estimating direct and neighbour effects under mixed effects model. Universal optimality of circular neighbour balanced block designs under mixed effects model, assuming block effects to be random has been established. Some universally optimal families of circular neighbour balanced block designs have also been obtained.

### ● Polygonal Designs

A linear integer programming approach has been developed for obtaining polygonal designs for given number of treatments  $v$ , block size  $k$ , concurrence of treatments separated by a distance of  $m+1$  or more as  $\lambda$  and all other concurrences as zero,  $m \leq [v/2]$  here  $[.]$  denotes the greatest integer function. The main feature of the proposed approach is that it directly identifies the required incidence vectors for generating a polygonal design. Using the proposed approach, a complete solution is provided for constructing polygonal designs for number of treatments  $v \leq 100$ , block size  $k=3$ ,  $\lambda=1,2$  and  $m=1,2,\dots,[v/2]$ . These designs have a one to one correspondence with Balanced Sampling plans excluding adjacent units.

### ● Inclusion Probability Inversely Proportional to Size Sampling Scheme

Inclusion probability proportional to size sampling schemes (IPPS) are the sampling schemes in which the first order inclusion probabilities are proportional to size measures. IPPS sampling scheme perform better than the available alternative sampling schemes provided that the sizes of the units are positively correlated with the variable under study and there is proportionality relationship between variable under study and size measure of the units. However, situations may arise in which there is negative correlation of sizes of units with the variable under study. To deal with such situations, the concept of inclusion probability inversely proportional to size sampling scheme (IPIPS scheme) is introduced. IPIPS scheme ensures that the first order inclusion probabilities of units are inversely proportional to size measures of the units. The method of IPIPS scheme has been obtained by making use of Sampfords' Inclusion Probability Proportional to Size sampling scheme (IPPS sampling

scheme). As an alternative, Probability Proportional to Aggregate Inverse of Sizes sampling plan (PPAIS sampling plan) is introduced and its properties are studied. A unit by unit sampling is also suggested to achieve the above proposed sampling plan. An analogue form of ratio estimator is also introduced, which is shown to be unbiased under the PPAIS scheme. The expressions for the second order inclusion probabilities of the PPAIS are also obtained. Performance of the proposed estimator under PPAIS plan and IPIPS sampling scheme is compared with alternative plans and their superiority over other unequal probability sampling schemes is established thorough a simulation study on bivariate normal populations for different correlations between  $Y$  and  $X$ .

### ● Small Area Estimation for Zero Inflated Data

The thrust of planning process, in recent years, has shifted from macro to micro level. There is demand by the administrators and policy planners for reliable estimates of various parameters at the micro level. In view of the demands of modern time, the thrust of research efforts have shifted to development of precise estimators for small areas. An offshoot of this development is that various Small Area Estimation (SAE) techniques are being proposed by the researchers for implementation. SAE techniques are now increasingly used in many developed countries. In our country large number of surveys/censuses are being carried out. There are, therefore, opportunities for use of SAE techniques so that reliable estimates of various parameters of interest are available to administrators and policy planners. Commonly used methods of SAE based on a linear mixed model, for example, the empirical best linear unbiased predictor, pseudo-emirical best linear unbiased predictor and model-assisted empirical best predictor of Jiang and Lahiri (2006, *J. American Statist. Assoc.*, **101**, 301–311) can be inefficient for zero-inflated data situations. Presence of excess zeros in the data is a well-known problem in small area estimation. A variety of approaches have been suggested for dealing with this problem. However, when the focus is on SAE using survey data, much less is known- even though presence of excess zeros within a small area are clearly much more influential than they are in the larger overall sample. Accordingly, in the study "Small Area Estimation for Zero Inflated Data" a method has been developed for SAE using the mixture model that accounts for presence of excess zeros in the data. For this purpose, the mixture model is defined as a combination of linear mixed model and generalized linear mixed model. The proposed approach of SAE works in three steps. First a linear mixed model is fitted for positive values of the variable and then in the second step, a generalized linear mixed model is fitted for probability of positive values. Finally the two models are combined

at estimation stage. The performance of the proposed method is evaluated through simulation studies using both data generated under the model and the real survey data of 59<sup>th</sup> round of the National Sample Survey Organization on Debt-Investment Survey 2002-03 for rural areas of the State of Uttar Pradesh. The variable of interest is amount of loan outstanding per household with an aim to predict the district level average value of amount of loan outstanding per household.

- **Forecasting Crop Yield and Forewarning Diseases using Artificial Neural Networks**  
Artificial Neural Networks (ANN) have received a great deal of attention, because complicated problems can be treated by this even if the data are imprecise and noisy. Use of this approach has been studied for forecasting crop yield as well as forewarning diseases. Neural network models have been developed using crop yield (detrended) of rice, wheat and sugarcane for Central plain zone (Kanpur, Lucknow, Fatehpur and Hardoi districts), Eastern plain zone (Allahabad, Varanasi, Faizabad and Ballia districts) and Bundelkhand zone (Jhansi, Banda and Jalaun districts) of Uttar Pradesh state in India as response or output variable and weather indices as input variables. For disease forewarning, models have been developed for various aspects viz. maximum pest disease severity, crop age at first appearance of disease, crop age at maximum disease severity for Alternaria blight and Powdery mildew for different locations and for different varieties in mustard crop as response variable and weather indices as predictors. In the study, Multi Layer Perceptron (MLP) and Radian Basis Function (RBF) based neural network with different hidden layers (one and two) and different number of neurons in a hidden layer with hyperbolic function as an activation function have been studied and compared with weather indices based regression model and it has been found that MLP performs better in terms of Mean Absolute Percentage Error (MAPE) in most of the cases which indicates that neural network models possess considerable potential as an alternative to regression models for forecasting agriculture system.

## **AWARDS AND RECOGNITION**

- Dr. Himadri Ghosh was awarded Mrs. Bhargavi and CR Rao Award for Best Poster Presentation during the International Conference of frontiers of interface between statistics and sciences held at CR Rao Advanced Institute of Mathematics, Statistics and Computer Science during 30 December 2009 – 02 January 2010.
- डॉ. रंजना अग्रवाल को भारत सरकार, सूचना एवं प्रसारण मंत्रालय के प्रकाशन विभाग द्वारा आयोजित भारतेंदु हरिश्चन्द्र पुरस्कार योजना के अंतर्गत वैज्ञानिक लेखों की पुस्तक (पांडुलिपि) 'विज्ञान में ताक झाँक' को 29.3.2010 को बाल एवं किशोर साहित्य वर्ग में प्रथम पुरस्कार (संयुक्त) मिला।

- Dr AK Gupta received III prize for the research paper entitled Estimation of Area, Production and Productivity of Flowers for oral presentation during the National Symposium on Lifestyle Floriculture: Challenges and Opportunities held at Dr.Y S Parmar University of Horticulture and Forestry, Nauni, Solan (HP) on 20 March, 2010.

## **VISIT ABROAD**

- Dr. V.K. Bhatia, participated in the Conference on Implementing the Strategy for Improving Agricultural statistics in Africa during 01-05 February 2010 at Tunis, Tunisia.

## **HUMAN RESOURCE DEVELOPMENT**

- A training programme on Small Area Estimation for the Indian Statistical Services and other senior officers of States/Union Territories, was organized during 18-22 January 2010. This course was sponsored by Central Statistical Organization, Ministry of Statistics & Programme Implementation, Govt of India. Dr. UC Sud was the Course Director and Dr. Hukum Chandra was the Co- Course Director of the programme.
- A six days Training Programme on Research Methodology for Official Statistics sponsored by Central Statistical Organization for ISS officers and statistical personnel was organized during 01-06 February 2010. Dr UC Sud was the Course Director and Dr. T. Ahmad was the Co-Course Director of the programme.
- A twenty one days training programme on Recent Advances in Web Technologies for Information Management in Agriculture under Centre of Advanced Faculty Training organized during 16 February - 08 March 2010. Ms. Anu Sharma was the Course Director and Sh. SB Lal was Co-Course Director of the training programme.
- A Refresher Training Programme on Agricultural Statistical System in India for 14 participants (non-ISS Officers of State Depts of DES) sponsored by Central Statistical Organisation, Ministry of Statistics & Programme Implementation (MOSPI), Government of India (GOI) was organised during 15-19 March, 2010. Dr KK Tyagi was the Course Director and Dr AK Gupta was the Co-Course Director of the programme. The training programme was inaugurated by Sh SK Das, Director General, CSO. Valedictory address was delivered by Dr BBPS Goel, Ex-Director, IASRI and Dr. VK Gupta, National Professor, ICAR presided over the valedictory function.
- Two days computer training was conducted by Institute during 16-17 February 2010 on the topics MS Word, MS Excel and Role of IT in the functioning of Finance Division under special training programme on financial matters' for the officials of ICAR Hqrs.

## **Conferences/Symposia/Workshop organized**

- Conducted a Travel Workshop on Experimental Designs jointly with ANGRAU, Hyderabad for the scientists and teachers of

ANGRAU, Hyderabad at RARS, Anakapalle on 06 January 2010. Dr. Rajender Parsad from IASRI Co-ordinated this workshop. Faculty members for this workshop were Dr VK Gupta, Dr Rajender Parsad and Dr Hukum Chandra. 60 participants from North Coastal Zone, West Godavari Zone and High Altitude Zone attended this workshop.

- During International Conference on Statistics, Probability, Operations Research, Computer Science and Allied Areas held at Andhra University, Visakhapatnam from 04-08 January 2010, following sessions of Special Invited Talks were organized.
  - Design of Experiments (Conveners: Dr. Rajender Parsad and Dr. Sudhir Gupta).
  - Small Area Estimation (Convener: Dr. Hukum Chandra and Co-Convener: Dr. U.C. Sud)
  - Recent Advances in Sample Surveys (Convener: Dr. U.C. Sud and Co-Convener: Dr. Hukum Chandra )
  - Statistical Modelling (Convener: Dr. Prajneshu and Co-Convener: Dr. Himadri Ghosh)
  - Recent Advances in Statistical Genetics (Convener: Dr. V.K. Bhatia and Co-Convener: Dr. A.K. Paul)
- Organized a Symposium on Statistics for Studying the Impact of Climate Change during XII Annual Conference of Society for Statistics, Computer and Applications at Department of Statistics, Siksha Bhavana, Visva Bharati during 24-26 February 2010 (Conveners: Dr Rajender Parsad and Dr K. Chatterjee).
- Workshop cum brainstorming session on Future Technology Needs for Rainfed Agriculture in India in collaboration with CRIDA, Hyderabad on 19 March, 2010.

## COMPUTING FACILITIES

### Wide Area Network

Internet services have been provided to the users and the website of IASRI is being updated regularly. This site has been visited 443807 times since 01 April 2008 and 809052 times since 05 September 2003.

### SEMINARS DELIVERED

Seminars in different areas of Agricultural Statistics and Computer Application were delivered. These seminars include presentation of salient findings of the completed research projects by the scientists, thesis/ORW/course seminars of students of M.Sc. and Ph.D. (Agricultural Statistics) and M.Sc. (Computer Application) and Guest Seminars.

#### The details of Seminars Delivered

Category	Type of seminar	Number
Student	Course	08
	ORW	16
	Thesis	01
Scientist		11
Guest		03
<b>Total</b>		<b>39</b>

Guest seminars were delivered by Dr. Ramanna V. Davuluri, Director, Comutational Biology, The Vista Cancer Centre,The Vista Institute, (USA), Dr. Sat Gupta, Professor of Statistics, North Carolina,(USA) and Dr. Bikas Sinha, Former Member, National Statistical Commission.

## PUBLICATIONS

### Research Papers Published

- Behera, SK, Paul, AK and Wahi, SD (2010). Estimation of heritability of mastitis disease using ANOVA method. *IUP J. Genetics & Evolution*, **3(1)**. 24-29.
- Bhardwaj, SP and Vasisht, AK (2009). Strategic measures to meet market challenges in the changing scenario of liberalization. *Ind. J. Agril. Marketing*, **23(3)**, 42-54.
- Jaggi, Seema, Gill, A.S., Varghese, Cini, Sharma, V.K. and Singh, N.P. (2009). Impact assessment of agroforestry system on yield of associated barley (*Hordeum vulgare*) and gram (*Cicer arietinum*) crops. *Current Advances in Agricultural Sciences-An Int. J.*, **1(2)**101-105.
- Parsad, Rajender, Gupta, VK, Kumar, Jitendra and Shakil, NA (2008). Significance of statistical tools for agrochemical research. *Pest. Res. J.*, **20(2A)**, 8-17.
- Singh, N Okendro, Wahi SD and Paul, AK (2010). Performance evaluation of bootstrap strategies on the estimate of standard error of heritability by half-sib method. *Ind. J. Anim. Sci.* , **80(1)**, 81-84.
- Singh, N. Okendro and Paul, AK (2010). Fitting of allometric model with expected-value parameters for different species of snow trout from Jhelum river, Kashmir. *Ind. J. Anim. Sci.*, **80(1)**, 85-88.
- Sud, UC, Bathla, HVL, Muralidharan, K, Mathur, DC, Thamban, C and Sairam, CV (2009). Estimating cost of production of coconut in region. *J. Plantation Crops*, **37(3)**, 201-205.
- Vasisht, AK and Bhardwaj, SP (2009). Price dynamics of agricultural commodity futures and its impact on demand supply situation of agricultural commodities. *Ind. J. Agril. Marketing*, **23(3)**, 72-82.

### Project Reports:

- Chandra, H, Bathla, HVL and Sud, UC (2010). Small area estimation for zero-inflated data. Indian Agricultural Statistics Research Institute, New Delhi, India. Project report No. IASRI/P.R.-02/2010.

## PAPERS PRESENTED IN CONFERENCES

- 97<sup>th</sup> session of Indian Science Congress held at Trivandrum, Kerala during 03-07 January 2010.
  - Agrawal, Ranjana, Chandras and Kaustav, Aditya. Use of discriminant function analysis for forecasting wheat yield.
  - Varghese, Eldho, Jaggi, Seema and Varghese, Cini. Row-column designs balanced for nearest neighbours.

- Meher, Prabina Kumar, Rao, AR, Wahi, SD and Jaggi, Namita. An empirical investigation on detection of multivariate outliers in breeding data.
- Mehta, SC, Pal, Satya and Kumar, Vinod. Weather based models for forecasting potato yield in Uttar Pradesh.
- International Statistical Association Joint Statistical Meeting held at Andhra University, Visakhapatnam during 04-08 January 2010.

#### **Invited talks**

- Bhatia, VK and Paul, AK. Genetics of Stayability of Dairy Cattle .Session on Recent Advances in Statistical Genetics.
- Gupta, VK, Kole, Basudev Parsad, Rajender and Bhar, LM. Mixed Level Supersaturated Designs. Session on Design of Experiments.
- Parsad, Rajender, Gupta, VK, Bhar, LM and Subrata K Behera. Block Designs with Factorial Treatment Structure for Cropping Systems Research. Session on Design of Experiments.
- Prajneshu and Ghosh, Himadri. Statistical Modelling. Session on Statistical modeling.
- International Applied Statistics Conference 2010 held in Colombo, Sri Lanka from 08-09 January 2010.
  - Abeynayake, NR and Jaggi, Seema. A review of block designs with neighbour effects.
- National Meet of Tractor and Agricultural Machinery Manufacturers (TAMM) at PAU Ludhiana during 16-17 January 2010.
  - Tyagi, KK, Singh, Jagbir, Kher, KK, Jain, VK and Singh, Surendra. Status and projection estimates of agricultural implements and machinery.
- XII Annual Conference of Society for Statistics, Computer and Applications at Department of Statistics, Siksha Bhavana, Visva Bharati during 24-26 February 2010.

#### **Invited Talks**

- Gupta, VK, Bhar, LM, Parsad, Rajender and Kole, Basudev Efficient unbalanced mixed-level supersaturated designs.
- Gupta, VK, Kole, Basudev and Parsad, Rajender. Mixed level supersaturated designs.
- Parsad, Rajender, Gupta, VK and Malhotra, Raj S. Experimental designs for mitigation and adaptation strategies of climate change. Symposium on statistics for studying the impact of climate change.

#### **Contributed Papers**

- Bhowmik, Arpan, V, Ramasubramanian, Chandras and Kumar, Adarsh. Logistic regression for classification in agricultural ergonomics.
- Gupta, VK, Singh, Poonam, Kole, Basudev and Parsad, Rajender. Addition of runs to a supersaturated design.



A View Training Programme on Recent Advances in Web Technologies for Information Management in Agriculture

#### **Saleable Technologies**

- Statistical Package for Factorial Experiments (SPFE 1.0)
- Statistical Package for Agricultural Research (SPAR 2.0)
- Statistical Package for Augmented Designs (SPAD)
- Statistical Package for Block Designs (SPBD 1.0)
- Statistical Package for Animal Breeding (SPAB 2.0)



A View of Travel Workshop on Experimental Designs at RARS, Anakapalle

- V. Ramasubramanian, Bhatia, VK, Garg, KG, Kumar, Suresh, Kumar, Amrendra and Kumari, Jyoti. Technological scenario in plant genetic and breeding using scientometrics.
- International conference on optimization and its application held at Banaras Hindu University, Varanasi on 17 February 2010.
  - Dr. Prajneshu.Fuzzy Regression models(Invited Talk).
- 11<sup>th</sup> International conference of the International Academy of Physical Sciences held at University of Allahabad on 20 February 2010:
  - Dr. Prajneshu.Nonlinear time-series models.
- National Symposium on Lifestyle Floriculture: Challenges and Opportunities held at Dr. Y S Parmar University of Horticulture and Forestry, Nauni, Solan (HP) on 20 March 2010.
  - AK Gupta. Estimation of area, production and productivity of flowers.
- National Workshop on Applicable Statistics held at Department of Statistics, M.D. University, Rohtak during March 28-30, 2010.

#### **Invited Talks**

- Dr. VK Bhatia, Application of Statistics for Growth of Quantitative Genetics and Estimation of Genetic Parameters.
- Dr. Prajneshu, Nonlinear statistical models and their applications.
- Rajender Parsad, Applications of Experiments with Mixtures.

#### **ADVISORY SERVICES**

##### **Consultancy project:**

Prioritization of Rainfed Area in the Country in collaboration of CRIDA Hyderabad was approved by National Rainfed Authority, Ministry of Agriculture, New Delhi. This consultancy is for development of Socio-economic indicators which are to be integrated with Bio-physical indicator to be developed by CRIDA, Hyderabad at district level for prioritization of district for development.

#### **PERSONNEL**

##### **Congratulations on your Promotion**

Name	Promoted to	Date
Dr. UC Sud	Head, Division of Sample Survey	09.02.2010
Dr. AK Vasisht	ADG(PIM)	02.03.2010

##### **Appointments**

Name	Date
Smt. Udita Shyokand, Scientist	15.03.2010

##### **Transfer to Institute**

Name	Date
Sh SK Sharma, Asstt. F&AO	08.01.2010

##### **Transfer from Institute**

Name	Date
Sh Vishal Acharaya, Asstt. F&AO	11.01.2010

##### **Wish you Happy Retired Life**

Name	Date
Sh. SS Walia, Scientist(SG)	01.01.2010
Dr. Jagbir Singh, P. Scientist	31.01.2010
Smt. Kiran Rani Oberoi, AAO	28.02.2010
Sh. KK Kher, Scientist(SG)	31.03.2010
Capt. Mehar Singh, CAO	31.03.2010

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