

## LIST OF PUBLICATIONS

### Papers Published

1. AGRAWAL, RANJANA; JAIN, R.C. AND MEHTA, S.C. (2001). Yield forecast based on weather variables and agricultural inputs on agro-climatic zone basis. *Indian Journal of Agricultural Science*, Vol. 71(7).
2. BATRA, PK and PARSAD, RAJENDER (2001). Robustness of standard reinforced balanced incomplete block designs against interchange of a pair of treatments. *Journal of the Indian Statistical Association*, Vol. 39: 65-78.
3. BHAR, L. AND GUPTA V.K. (2001). A useful statistic for studying outliers in experimental designs. *Sankhya B*, 63: 338-350.
4. CHAND, LAL; WAHI, S.D, and LAL, PARKASH. (1998) Estimation of heritability and genetic correlation in the parameter space. *Ind. J .Anim. Gen. and Breeding*, 20(1), 37-40.
5. DEKA, BC; SETHI, V; PARSAD, RAJENDER and BATRA, PK (2001). Use of experiments with mixture methodology for quality evaluation of mixed fruit juice/pulp RTS beverages. *Journal of Food Science and Technology*, Vol.38(6): 615-618.
6. DEY, AMITAVA; SRIVASTAVA, R and PARSAD, RAJENDER (2001). Robustness of block designs for diallel crosses against missing observations. *Journal of Indian Society of Agricultural Statistics*, Vol. 54(3): 376-384.
7. GUPTA, AS and SAXENA, BC (2002): Vital demographic parameters in sheep and goats. *Indian Veterinary Journal, Chennai*, Vol 79: 140-143.
8. GUPTA, R and MOGHA, AK (2002). Stochastic analysis of series, parallel and standby system models with geometric lifetime distribution. *Journal of Ravi Shankar University, Raipur*. Vol 13, No. B (Science): 68CE 80.
9. GUPTA, VK and PARSAD, RAJENDER (2001). Block designs for comparing test treatments with control treatments - An overview. Special issue of Statistics and Applications to felicitate the 80<sup>th</sup> Birthday of Dr. M.N. Das, Vol. 3(1 & 2): 133-146.
10. JAIN, RAJNI AND ARORA, ALKA (2001). Networking for strengthening Agricultural Research: Concept and Benefits. *ARIS News*, page 1, April- June.
11. JAIN, RAJNI AND DAHIYA, SHASHI (2001). E-Agriculture: Potential of Internet for Indian Farmers™ *KURUKSHETRA-A Journal on Rural Development*, Vol. 49, (12). (September)
12. JAIN, RAJNI AND DAHIYA, SHASHI (2001). Rural Portal: Potential Tool for virtual farming. *CSI-Communications (August)*.
13. KAUL, SUSHILA and PANDEY, R.K. (2001). Structure of Land Tenancy in Indian Agriculture. *Yojana*, Vol 45, Sept. 12-17
14. KAUR, RAJINDER and BHATIA, AJIT KAUR (2001). Performance of oilseeds in comparison to other crops in different crop sequences. *Brassica*, Vol. 3 (5 & 6): 2-9.
15. KHURANA, GL, KUMAR, RAJENDRA and GARG, RN (2000). Identification of agronomic factors for higher grain productivity. *New Botanist*, Vol. 27: 25-32.
16. KHURANA, GL, KUMAR, RAJENDRA and GARG, RN (2000). Testing of adaptability of complex designs in C.S.R. experiments. *New Botanist*, Vol. 27: 75-79.
17. KUMAR, MUKESH, SINGH, PV and KUMAR, ANIL (2000). Effect of spacing, levels of nitrogen and GA<sub>3</sub> on growth and yield of tuberose. *Journal of Farming Systems Research and Development*. Vol.6 (1&2): 156-158
18. KUMAR, MUKESH, SINGH, PV and KUMAR, ANIL (2000). Flowering and bulb production of tuberose (*Polianthes*) as influenced by spacing levels of Nitrogen and Gibberallic acid. *Journal of Farming Systems Research and Development*. Vol.6 (1&2) :46-49
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21. KUMAR, RAJENDRA; SREENATH, PR and JAIN, SP (2001). Effect of coefficient of variation on the heterogeneity of error variance in agricultural field experiments. *Journal of Annals of Agricultural Research*, Vol. 22(1): 18-21.
22. KUTAULA, S.S. (2001). A Rational Econometric Approach for Punjab Agriculture Associated with UOP Profit Function Model. *Indian Economic Review*, Vol. 36(2): 393-410
23. NARAIN, PREM; SHARMA, S.D. Rai, S.C. and Bhatia, V.K. (2001) Regional dimensions of disparities in crop productivity in Uttar Pradesh. *Journal of Indian Society of Agricultural Statistics.*, 54(1): 62-79.

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27. PARSAD, RAJENDER; GUPTA, VK and VOSS, D (2001). Universally optimal nested row and column designs with unequal block sizes. *Journal of Indian Society of Agricultural Statistics*, Vol.54 (2): 244-257.
28. PAUL, A.K and BHATIA, V.K. (2001). Modification of beta-binomial method of estimation of heritability of stayability. *Journal of Indian Society of Agricultural Statistics*, 54(3):385-395.
29. PRABHAKARAN, V.T. (2001). Implications of curvilinear response in dairy cows with increasing level of exotic inheritance in relation to a plausible breeding strategy for cattle development. *Ind. J. Genet.* 61(3): 270-273.
30. PRAJNESHU and RAVICHANDRAN, S. (2001). Use of expected-value parameters for estimating length- weight relationship in fishes. *Ind. J. Fish.* 48: 199-202
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32. RAIGER, H.L. and PRABHAKARAN, V.T. (2001). A study on the performance of a few non-parametric stability measures using pearl-millet data. *Ind. J. Genet.* 61(1): 7-11.
33. RAO, A.R. and PRABHAKARAN, V.T. (2001). A bootstrap method of estimating heritability from varietal trial data. *Ind. J. Genet.* 61(2): 87-91.
34. RAUT, KC and KHATRI, RS (2001). Some aspects of livestock development in India- a critical reappraisal. *Journal of the Indian Society of Agricultural Statistics*, Vol 54 (1): 52-61.
35. RAVICHANDRAN, S. and PRAJNESHU (2001). State space modelling versus ARIMA time-series modelling. *Journal of Indian Society of Agricultural Statistics*, 54: 43-51.
36. RAVICHANDRAN, S. and PRAJNESHU (2001). Structural time-series modelling for describing fish production. *Ind. J. Anim. Sci.*, 71, 499-501.
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42. SHARMA, SD (2001). Agricultural Information Management CE Systems and Services. Proceedings of 2001 International Conference on the Development of Agricultural Information Management, Technology and Markets in the 21<sup>st</sup> Century at Beijing, China
43. SHARMA, SUKHDEV; KAUL, SUSHILA and PANDEY, RAMAKANT (2001). Yuva Laren Magar bhukhmari Aur Kuposhan Se, *KHETI*, 53: 29-30 & 34.
44. SINGH, JAGBIR and BATHLA, HVL (2001). Estimation of foodgrain losses and seasonal fluctuation. *Agriculture Situation in India*, Vol. LVII, No. 10, (Jan): 551-554.
45. SINGH, RANDHIR and DAHIYA, DC (2001). Land use statistics and extent of floods during 1997-98 for district Rohtak, Haryana using remote sensing satellite data. *NNRMS bulletin*, *NNRMS (B)* 26: 81-85.
46. SINGH, RANDHIR; SEMWAL, DP; RAI, ANIL and CHHIKARA, RAJ.S. (2002). Small area estimation of crop yield using remote sensing satellite data, *International Journal of Remote Sensing*. Vol 23 (1): 49-56.
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48. SUD, U.C; SRIVASTAVA, A.K. and SETHI, I.C.(2001). Multiple Frames in Repeat Surveys. *Journal of the Indian Society of Agricultural Statistics*
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50. SUD, UC, SRIVASTAVA, AK AND SETHI, IC (2001). Multiple frames in repeat surveys. *Journal of the Indian Society of Agricultural Statistics*, Vol. 54 (2): 196-208.
51. SUD, UC; SRIVASTAVA, AK and SHARMA, DP (2001). On a biased estimation in repeat surveys. *Journal of the Indian Society of Agricultural Statistics*, Vol 54 (1): 29-42.
52. SUD, UC; SRIVASTAVA, AK and SHARMA, DP (2001). On the estimation of population in repeat surveys. *Journal of the Indian Society of Agricultural Statistics*, Vol 54 (3): 355-369.

53. VARGHESE, CINI and GEORGE, KC (2001) **A composite sow index and its effects due to sire, parity and season.** *Indian Journal Animal Sciences* Vol.71(9): 865-867.
54. VATS, MR; SEHGAL, DK and MEHTA DK (2001). **Integrated effect of organic and inorganic fertilizers on yield sustainability in Long-Term Fertilizer Experiments.** *Indian Journal of Agricultural Research.* Vol. 35(1): 19-24.

### **Research papers accepted for publication**

1. BHAR, L. AND DEY, A. **Triallel cross block designs that are roubust against missing observations.** *Utilitas Mathemetica.*
2. BHAR, L. and GUPTA V.K. **Robust row-column designs for complete diallel cross experiments,** *Metrika*
3. BHAR, LM and GUPTA, VK. **A useful statistic for studying outliers in experimental designs.** *Sankhya B.*
4. BHAR, LM and GUPTA, VK. **Robust Row-Column designs for complete diallel cross experiments.** *Metrika.*
5. BHATIA, AK and KAUR, RAJINDER. **Statistical studies on integrated nutrient management in rice-wheat sequence.** *Journal of Farming Systems Research and Development.*
6. CHAND, LAL; WAHI, S.D. and BHATIA, V.K. **Inheritance of fitness traits in goats.** *J. Res., Birsa Agricultural University.*
7. GARG, RN; KUMAR, RAJENDRA; KUMAR, ANIL and GUPTA, VH. **Study of correlation between physical properties of sandy loam soil and yield of wheat influenced by Bio-Gas slurry and flash.** *Journal of Farming Systems Research and Development.*
8. GHOSH, H. and DAS, A. **Optimal diallel cross design for estimation of heritability.** *in J. Stat. Plann. Inference.*
9. GHOSH, H. **Optimal design for point and interval estimation of ratio of variance components in one way ANOVA model.** *Journal of the Indian Society of Agricultural Statistics.*
10. GOLA, R.C. AND RAI, ANIL.. **Two stage successive sampling with partial replacement of units.** *Journal of the Indian Society of Agricultural Statistics.*
11. GUPTA, VK and PARSAD, RAJENDER. **Current status of experimental design and challenges ahead.** *Proceedings of XIII National Conference of Agricultural Research Statisticians.*
12. GUPTA, VK; PARSAD, RAJENDER and DAS, ASHISH. **Variance balanced block designs with unequal block sizes.** *Utilitas Mathematica*
13. JAGGI, SEEMA; GUPTA, VK and SHARMA, VK. **Design and analysis of agroforestry experiments: An overview.** *Indian Journal of Agroforestry.*
14. KAUL, SUSHILA and PANDEY, R.K. **Food Availability and its Implication for Food Security in India** *Bihar Journal of Agricultural Marketing.*
15. KAUR, RAJINDER and BHATIA, AK. **Assessment of intercropping systems through bivariate analysis.** *Journal of Farming Systems Research and Development.*
16. KHURANA, GL; BATRA, PK and KUMAR ANIL. **Efficient estimation of the relationship between plot-size and the soil variability of groundnut yield.** *Journal of Farming System Research and Development.*
17. KHURANA, GL; KUMAR ANIL and CHOUDHARY, VK. **A Statistical methodology for exploration and exploitation of packages of treatments for higher grain productivity.** *Journal of Farming Systems Research and Development.*



18. PARSAD, RAJENDER; SHARMA, SD and GUPTA, VK. [Agricultural Statistics- problems for future research](#). *Proceedings of XIII National Conference of Agricultural Research Statisticians*.
19. PAUL, A.K. and BHATIA, V.K. [Role of auxiliary traits for estimation of heritability of stayability](#). *Journal of the Indian Society of Agricultural Statistics*.
20. PAUL, A.K. and BHATIA, V.K. [Comparison of beta-binomial methods with other methods for estimation of heritability of stayability for unbalanced data](#). *Ind. J. Anim. Sci.*
21. PRABHAKARAN, V.T. [Implications of curvilinear response in dairy cows with increasing level of exotic inheritance in relation to a plausible breeding strategy for cattle development](#). *Ind.J. of Anim. and Plant Breeding*.
22. PRAJNESHU; RAVICHANDRAN, S. and WADHWA, SAVITA. [Structural time series models for describing cyclical fluctuations](#). *Journal of the Indian Society of Agricultural Statistics*.
23. RAI, ANIL, SRIVASTAVA, A.K. AND SINGH, MAN. [A socio-economic study on agroforestry in Chhachhrauli block of Yamunanagar district of Haryana](#). *Indian J. Agroforestry*,
24. RAMASUBRAMANIAM, V; SINGH, RANDHIR and RAI, ANIL. [Re- sampling based variance estimation under two-phase sampling](#). *Journal of the Indian Society of Agricultural Statistics*.
25. RAUT, KC; BHATIA, VK and KHATRI, RS (2002): [Disparities in livestock development of India](#). *Journal of the Indian Society of Agricultural Statistics*. Vol 55 (1).
26. RAVICHANDRAN, S. and PRAJNESHU. [Bayesian nonlinear state space modelling for Schaefer model in fisheries](#). *Ind. J. Appl. Stat.*
27. RAVICHANDRAN, S. and PRAJNESHU. [Time-varying state space regression model in fisheries](#). *Ind. J. Fish.*, 49.
28. SETHI, SC; MATHUR, DC and SHARMA, SK. [Price spread and marketing pattern of vegetables in Pune in Haryana](#). *Economic Journal, Karnal*.
29. SHARMA, SD; SHARMA, VK and JAGGI, SEEMA. [Teaching of Agricultural Statistics: status and challenges ahead](#). *Proceedings of XIII National Conference of Agricultural Research Statisticians*.
30. SHARMA, VK; VARGHESE, CINI and JAGGI, SEEMA. [On optimality of change-over designs balanced for first and second order residual effects](#). *Metron*.
31. SINHA, P., PRAJNESHU and VARMA, A. [Growth models for mango powdery mildew development](#). *Ann. Pl. Protec. Sci.*, 10.
32. SRIVASTAVA, AK and JHA, GK. [Some Methodological Issues in Agricultural Surveys](#). *Jr. of Income & Wealth*.
33. SUD, UC; SRIVASTAVA, AK and SHARMA, DP. [On the estimation of population variance in repeat surveys](#). *Journal of the Indian Society of Agricultural Statistics*. Vol 55 (1).
34. VARGHESE, C; RAO, A.R. and SHARMA, V.K. [Robustness of William's Square designs](#). *Metrika*.
35. VARGHESE, CIN; SHARMA, VK and RAO, AR. [Optimality of circular cross - over designs balanced for first and second residuals](#). *Utilitas Mathematica*.
36. VATS, MR; SEHGAL, DK and MEHTA DK. [Phosphorus application for sustainable yields in long term fertilizer experiments](#). *Fertilizer News*.
37. WAHI, S.D. and CHAND, LAL. [Analytical procedure for estimation of variance of genetic parameters](#). *Ind. J. Anim. Genet. & Breeding*.

## Research Project Reports

### (a) Published

1. Sampling procedure for selection of representative samples of fertiliser from ships (2001) *by UC Sud, HVL Bathla and Anil Rai*
2. A study for estimation of crop yield at block level using crop cut and farmers' estimate (2001) *by UC Sud, AK Srivastava, HVL Bathla, DC Mathur and GK Jha*
3. Fertilizer response ratios for different crops in India (Funded by Ministry of Agriculture) *by S.D. Sharma, P.K. Batra, V.K. Sharma and N.K. Sharma.*
4. Planning designing and analysis of data relating to experiments conducted under AICRP on LTFE *by M.R. Vats, D.K. Sehgal and D.K. Mehta.*
5. Energy Requirement in Agricultural Sector: A Linear Programming Approach. Joint Publication of IASRI, New Delhi and CIAE, Bhopal *by V.K.Gupta, Rajender Parsad, Dipanker De, Hukam Chandra and R.S.Singh.*
6. Impact Assessment of Technology Intervention and Crop Diversification in Tribal, Backward and Hilly Areas, Phase-I (2001) Survey Report of Arid Region *by R.K. Pandey, Sushila Kaul and D.R. Singh.*
7. "Guidelines for Monitoring and Concurrent Evaluation of Sub- projects under NATP" published as a part of the NATP sub-project under the O & M component. ,Institutionalisation of Research Priority Setting, Monitoring & Evaluation and Networking of So- cial Scientists'
8. Pilot study for developing Bayesian probability forecast model based on farmers' appraisal data on wheat crop (2001) *IASRI Publication by Chandrahas and T. Rai.*
9. Study of Demand for Agricultural Products and Its Implication for Food Security in India (2002) *by R.K. Pandey and Sushila Kaul.*

### (b) Finalised

1. Pilot sample survey for estimating the area and yield rates of ginger and potato in hilly areas *by MS Narang and RC Gola.*
2. Estimation of flow and change in dynamic population *by Jagbir Singh*
3. A statistical investigation on the long-term effect of fertilizer on productivity of cereal *by V.K. Sharma and Rajinder Kaur.*
4. Development of early warning and yield assessment models for rainfed crops based on agrometeorological indices *by Asha Saksena, R.C. Jain (Retired on 30.11.99), R.L. Yadav*
5. Forecasting fish production from ponds *by Lalmohan Bhar, S.S. Walia and A.K. Roy*

## DISSERTATIONS APPROVED

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

#### 1. J.S. Dhekale - Analytical Techniques in Intercropping Experiments

Intercropping research attracted worldwide attention and number of experiments are being conducted to study different objectives like maximization of yield, identification intercropping systems or varieties suitable for cultivation, etc. There is no standard method of analysis therefore, an attempt has been made to study various analytical techniques used in analysis of intercropping experiments.

Analytical techniques have been studied by classifying intercropping experiments into two types. Type I with sole crop treatments and type II without sole crop treatments. For type I experiments an analogy between experiments with mixtures and replacement series

intercropping experiments is established and analytical method has been proposed, also the type I experiments of replacement series consisting of other factors like spacing fertilizer etc. are analyzed by mixture x process variable techniques. For additive series experiments, contrast analysis has been used.

Bivariate method of analysis of intercropping experiments is proposed and three tests are proposed for testing single sole crop treatment versus intercropped treatment, both sole crop treatment versus intercropped treatment and for testing difference between two intercropped treatments.

Intercropping is stable cropping system, but when more than one system is available then method for identifying stable intercropping system in presence of environmental covariate is proposed and explained with suitable example.

(Guide: Dr V.K.Gupta)

## 2. Prachi Misra - Application of Spatial Statistics in Agricultural Surveys

Estimation of crop area and crop production forms the most important dimension around which the overall agricultural statistics system of our country revolves. Forecasting of crop production is one of the important aspects of agricultural statistics system. The Production of the major agricultural crops in the country is estimated on the basis of the estimates of area under the crop and the average yield per unit area. For estimating area under a crop at district level, different approaches have been followed. In agricultural surveys the parameters of interest are often geographical in nature i.e. they carry the effect of location to which they belong. This implies that the data is spatial in nature but it is sampled using the traditional sampling designs like simple random sampling, stratified sampling and systematic sampling which do not give reliable and consistent estimates in case of spatial data. Thus, for spatial data there is need for developing spatial sampling designs, which take care of the dependency in the data. In this study an attempt has been made to improve the conventional survey methodology for agricultural surveys by using the newer technologies of Remote sensing and GIS.

Spatial sampling is a particularly difficult problem to deal with, since spatial units are not independent observations. Spatial sampling requires the researcher to recognize the degree of dependence in the spatial data. The proposed spatial sampling techniques are based on the fact that the neighbouring units tend to be homogeneous when the parameter of interest is geographical in nature. Once a particular unit is included in the sample, the neighboring units are not likely to provide much additional information of the target population. The proposed sampling techniques take care of the location effect, which is the most important property of the spatial data. All units, which are contiguous i.e. the units that touch the boundary of a particular unit are regarded as its neighbours. The spatial correlation for an auxiliary character is used to give higher probability of selection to distant units as compared to neighbouring units. The basic principle of sample selection in case of spatial sampling is that the probability of selection of any unit increases as the distance from the units (area) already selected in the sample increases. Suitable unbiased estimators, which take into account the order of the draw, have been suggested. On the basis of the method of sample selection and estimation four spatial sampling methods have been suggested. These are (i) Contiguous Unit Based Spatial Sampling (CUBSS) Technique (ii) Stratified Contiguous Unit Based Spatial Sampling Technique (iii) Modified Contiguous Unit Based Spatial Sampling Technique (iv) Stratified Modified Contiguous Unit Based Spatial Sampling Technique. The study has been conducted for Rohtak district of Haryana state at village level. The villages are considered as the regular lattice case i.e. assuming that the population consists of regular units. A simulation study is conducted to study the performance of the proposed estimators as compared to the existing ones generally used for sampling spatial data. For the simulation study, the irrigated area of the district has been taken as the study character and the cultivated area as the auxiliary character. The results of the study reveal that the proposed sampling techniques provide more efficient, stable and reliable estimates as compared to the various existing spatial sampling techniques.

The spatial data are not only dependent in nature but is highly irregular as in case of irregular lattice the shape and size of the units vary to a great extent. This additional problem of irregularity along with dependency of the data has also been studied. To consider this problem the use of distance-based neighbour has been suggested. Based on these neighbours the modified formula for spatial correlation is obtained. Four spatial sampling techniques are proposed for irregular area units. These are (i) Distance Unit Based Spatial Sampling (DUBSS) Technique (ii) Stratified Distance Unit Based Spatial Sampling Technique (iii) Modified Distance

Unit Based Spatial Sampling Technique (iv) Stratified Modified Distance Unit Based Spatial Sampling Technique. The efficiency of these estimators are compared with the one obtained for regular lattice case. The results show that the spatial sampling techniques proposed for irregular area provide more efficient estimators.

The advent of remote sensing technology and its potential in the field of agriculture has given new opportunities for improving crop acreage procedures. However, in neither of these approaches spatial information of the crop distribution is taken into consideration though studies have shown that there exist spatial dependence in remotely sensed data. A suitable methodology is developed for estimating crop area by integrating remote sensing and GIS based spatial sampling approach. An empirical study to estimate the area under wheat crop for district Rohtak, Haryana for the year 1995-96 using IRS-1B, LISS-II data has been conducted by using average NDVI of the village as an auxiliary character. Further, the estimates obtained from this approach are compared with those obtained from usual remote sensing method. The results of the study show that inclusion of remote sensing parameter in GIS assisted spatial sampling techniques enhance the performance of the estimators.

Thus, in this study some new and more efficient spatial sampling techniques have been proposed. The results of the study point out that in spatial surveys, a considerable gain in efficiency of the estimators could be achieved by using a GIS and remote sensing assisted spatial sampling strategy, which helps in better allocation of resources leading to higher levels of accuracy of the estimates.

(Guide: Dr. Randhir Singh)

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

### **1. Jawaid Ashraf - Designs for two Non-interacting Sets of Treatments Applied in Succession.**

The use of same experimental material for several successive experiments is quite prevalent in the fields like horticulture, animal sciences and forestry, where subject under investigation is long lived. At every succession or stage a different set of treatments is applied and the response is recorded only at the end after the final application of treatments. Designs with  $v_1$  and  $v_2$  treatments in first and second sets applied at first and second stages respectively have been considered with the arrangement of the experimental material in a structure of  $b$  blocks. It is assumed that the two sets of treatments are non-interacting. Some methods of construction of block designs for different characterizations have been obtained that are structurally complete.

Design patterns with these characterizations admit simple and straightforward analysis. The methods have been obtained by developing the initial block consisting of pair of treatments from both the sets. The characterization properties like variance balance of these designs have been studied. The methods are also developed based on the superimposition principle. A catalogue of the designs obtained by these methods for two non-interacting sets of treatments has been prepared. Method of constructing structurally incomplete block designs for two sets of treatments applied in succession has been developed making use of combination of some known designs like randomized block designs, Balanced incomplete block designs etc. A catalogue of the designs obtained giving layout plans of the designs is also prepared.

(Guide: Dr. Seema Jaggi)

### **2. S.K.Satpati - Nested Block Designs and their Applications**

A nested block design is defined as a design with two systems of blocks where the second system (called sub-blocks) is nested within the first system (called blocks). These designs have been developed to take care of the heterogeneity in the experimental units or the experimental conditions caused by two factors (one factor is nested within the other factor). A nested block design with sub-block size 2 can also be used for obtaining efficient designs for diallel crosses. Keeping in view the importance of these designs in agricultural experimentation, the combinatorial aspects of block designs have been investigated. An exhaustive review of methods of construction of nested balanced incomplete block (NBIB) designs has been made. Some new methods of construction of NBIB designs and nested balanced block (NBB) designs have been obtained. The catalogue of NBIB designs with  $v \leq 16, r \leq 30$  has been updated by including the NBB designs. Some non-proper nested variance balanced block designs have



also been obtained. New methods of construction of nested partially balanced incomplete block (NPBIB) designs have been developed using NBIB designs, Latin square association scheme and rectangular association scheme. NPBIB designs with  $v \leq 25, r \leq 30$  obtainable from existing and new methods of construction have been catalogued. Some nested block designs that are variance balanced with respect to block classification and partially balanced with respect to sub-block classification have also been obtained. The concept of nested balanced treatment incomplete block (NBTIB) designs has been introduced to deal with the experimental situations where the experimenter is interested in comparing several test treatments with a control treatment. Several methods of construction of NBTIB designs have been obtained. NBTIB designs with  $v \leq 25, r \leq 30$  obtainable from these methods of construction have been catalogued.

(Guide: Dr. Rajender Parsad)

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

#### **1. G.V.V.Shyamla Jyoti - Automation of Circulation Control System in the Library**

The library serves as a centre for arousing and simulating intellectual curiosity and thus satiating the desire to learn by offering reading materials and bibliographic searches to satisfy the quest for knowledge. Circulation Control concerns the record keeping of books and other literature issued to users and what has been returned by them. It also helps in checking pilferage and losses and in promptly locating which of the documents stand with whom and when it is due. To manage such information manually is not only tiring and time consuming, but difficult to manage correctly. Thus the circulation section of a Library is very important as it controls and regulates the entries and exits to the library. Keeping the soul aspect of Circulation Control of a Library in mind, CIRCOSYS (Circulation Control System) is developed as the Intranet solution for the smooth running of Circulation activities of a Library. CIRCOSYS brings the Circulation Control System on the web and overcomes the limitations of the manual system. That is, it helps manage circulation of materials more rapidly, more accurately and less expensively. CIRCOSYS keeps a record of all the books available in the Library and to whom they are issued currently. When an item is overdue it sends reminders through e-mail automatically. Besides this, it also collects some useful statistics about the system. CIRCOSYS is developed using Java Server Pages (server side programming) and JDBC (Java Database Connectivity), which makes it platform independent. The client side programming is done using HTML and Java Script. It is divided into three separate modules for End User, Circulation Assistant and Administrator. Depending on the user type they will have pre-assigned privileges.

(Guide: Dr.S.D.Sharma)

#### **2. Nguyen The Cuong - Information System on Agronomic Practices for Wet Seeded Rice in Cantho- Vietnam**

The dynamic of agricultural systems include complex biological, social and economic processes. Future possibilities are affected by many different factors that influence their biological and economic efficiency. Successful management of these systems can be facilitated by a proper tool to support rational decisions. Such a tool should follow the logic of the decision making process, and include the capacity to support management activities.

The purpose of present study was to develop a web-based "Information system on agronomic practices for wet- seeded rice in Cantho province – Vietnam" (ISAPWER), which would help the users to be more informed about decisions related to rice production in the region. The ISAPWER contains the information of agronomic practice on wet- seeded rice in the form of text and pictures on agronomic aspects from the land preparation up to post-production activities.

The ISAPWER is developed using the concepts of web-based client-server 3<sup>rd</sup> tier model. The user interface layer is constructed using HTML and JavaScript. The application layer is implemented in Java Server Pages and JDBC. The database layer is built in Microsoft Access 2000. The ISAPWER can run at any computer that connects to the Internet through the Java-enabled browser.

The ISAPWER, with a user-friendly interface, allows any user who has access to the Internet to quickly get the desired information. It can be implemented as a web application, which allows simultaneous access to many users. There is a provision to insert, delete and update the information at the remote computer. The ISAPWER was developed in response to



the recognition that many farmers do not have access to information on how to grow the rice. Information technology offers new ways to present information to these farmers through present package

(Guide:Dr.I.C.Sethi)

### **3. Preeti Tanwar - Web-based information system on infrastructural facilities available in NARS.**

An information system related to various Infrastructural facilities available in NARS has been developed. Various General and Specific Reports are generated with the complete description of facilities. Reports in the software emphasize list of Labs, Divisions, Veterinary Hospitals, Library, Lecture Rooms, Hostels, Central Instrument Labs, Vehicles etc in various Institutes and Some Reports are generated according to the user options like various divisions in selected Institute, Facility description after selecting division even if Institute is not known, list of all Institutes after selection of type of facility, Description all existing Infrastructural facilities after selection of Institute. Database can accommodate any kind of facility, irrespective of its type. Help is also provided in the software so that the end user will have no problems in navigating the system. Being web based, it is made platform as well as server independent. It could act as comprehensive Information directory for the end users & also for the Administrators in managing huge databases of Infrastructural facilities available in NARS.

(Guide:Dr.R.C.Goyal)

### **4. Ratan Jyoti - Development of Information System for the National Pusa Insect Collection**

The National Pusa Insect Collection (NPIC) is one of the biggest insect collections in Asia. This insect store house comprises of a space of more than 6000 sq. ft. area, 200 dust proof insect cabinets and 150 insect almirahs and has a collection of more than 2 lakhs specimens comprising of around 17000 identified species, some of which are more than a hundred years old. New specimens are being added regularly. Collections are important not only for research, bio-diversity studies and variation but also serve as reference material for the species. A systematic collection always provides many ways of diagnosis which opens the way to new classification. Searching from this large database is time consuming and tedious job often resulting damage to the stored specimens. The frequent repeated handling of these fragile and nearly extinct specimens requires computerization of NPIC.

The present investigation was carried out with the idea of developing web based Information System for National Pusa Insect Collection (ISNPIC). ISNPIC provides information on various aspects of insects. The information is provided in the form of text as well as pictures. ISNPIC is a best possible approach for Insect identification Service. A person with little computer knowledge can operate and get desired information. It also provides information on Insects, NPIC and Indian Agricultural Research Institute.

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 Access 2000. ISNPIC can be implemented as a network-based system with a server at NPIC so that information is available on- line. ISNPIC runs at any node of the Internet through a browser. Security features are provided in such a way that only administrator can access the database. There is provision to insert, update and delete the information. It has facility to browse and search the collection in the NPIC. It is possible to get enlarged view of the image of insect specimen in the NPIC for making comparison with the specimen available with the user. It has on-line help to facilitate smooth navigation. Facility has been provided for interaction with the System Administrator of NPIC through email. Links are also provided for information on insects that is currently available on Internet.

(Guide:Dr.P.K.Malhotra)

### **5. Ruby Susana Kujur - Development of Software for Agricultural Discussion Forum**

The recent advances in computer and communication technology have made computer hardware and software more affordable and user-friendly and have resulted in faster movement

of information and its utilization. Information systems are assuming an ever-increasing importance in the agricultural development and computer-based information systems/databases and computer communication networks are today and in the foreseeable future, a pre-requisite for taking coherent and balanced decisions. Agricultural Discussion Forum (ADF) is one such step in this direction. Discussion Forum is an informal forum where people discuss issues of their interest with no fixed agenda except trying to provide solutions for some specific problems. Keeping in view the requirements of the users, the Agricultural Discussion Forum has been developed and is a feasible Internet solution. It has provision for reliable data and information and also for future research.

(Guide:Dr.R.C.Goyal)

## **6. Vikas Kumar - Development of Search Engine for Agriculture Community**

The present era has seen an exponential growth and diversification of all forms of information, which is sometimes called as information explosion. This has been made possible due to the impact of computer technology on the present society. Today the World Wide Web grows by roughly a million electronic pages, adding to the hundreds of millions already on-line. This volume of information is loosely held together by more than a billion annotated connections, called links. For the first time in the history, millions of users have virtually instant access from their home and offices to creative output of a significant and growing fraction of the world's population. Any user connecting to a web site will just get an electronic copy of the part of the document one is interested in. Simultaneously any number of other users can also get this document. This definitely is a major landmark in the evolution of the manner of sharing knowledge.

Due to the web's rapid growth, the resulting network of the information lacks organization and structure. In fact, the Web has involved into a global mess of previously unimagined proportions. Individuals with any background, education, culture, interest and motivation can write web pages in any language, dialect or style. Each page may range from a few characters to a few hundred thousand pages. The extraction of relevant information in response to a specific need from this digital mass has become a challenge. The main tool that has emerged for getting at the information in this environment is the Search Engine.

A number of Search Engine software have been developed but most of searching software are coded as a legacy code of 'c' or in 'c++', which make them platform dependent and difficult to incorporate with web server, because it requires special configuration of server.

The agriculture is a specialized field and information related to this is present on specific sites, generally institutional site, state sponsored sites or agricultural industry sites. For the information requirement of Agriculture related fields, searching on these sites will be more relevant than searching on whole Internet. In Agriculture sector particularly in India not much effort has been made to develop and deploy a search engine, which may serve the vast agriculture community. Most people with Web sites are customers of commercial Internet providers and they use commercial search engines. So there is a need to develop a web-based agricultural search engine.

In the present investigation efforts have been made for developing software for a Search Engine using robust functionality of JAVA, simple and efficient algorithm of best search engine and a search engine that is suitable for small site or for intranet. AgriKhoj is developed for Internet purpose. It has a three-layered architecture. Client Side Interface Layer is implemented in HTML, JavaScript and Cascading Style Sheet (CSS). Server Side Application Layer is implemented in Java Servlets & JDBC. Database Layer is implemented in Microsoft Access 2000. AgriKhoj can be implemented as a network-based system with a server. A person with little computer knowledge can operate and set it to work.

(Guide:Dr.R.C.Goyal)