

Training Course Technical Report

Statistical Design, Data analysis and Biometrical Techniques in Agricultural Research

3/ 10/ 2016 - 13/ 10/ 2016

Amman, Jordan



Funded By

Japan International Cooperation Agency (JICA)
Arab Fund for Economic and Social Development (AFESD)

Conducted By

The International Center for Agriculture Research in the Dry Area (ICARDA)



Table of Contents

EXECUTIVE SUMMARY.....	1
GENERAL OVERVIEW	2
COURSE OBJECTIVES.....	2
TARGET AUDIENCE	2
ORGANIZING COMMITTEE.....	2
COURSE STRUCTURE.....	2
COURSE IMPLEMENTATION	3
GENERAL COURSE EVALUATION BY TRAINEES.....	4
CONCLUSION	4
Annex I: Course Program.....	6
Annex II: Trainers.....	9
Annex III: Trainees	Error! Bookmark not defined.
Annex IV: General Course Evaluation	10

EXECUTIVE SUMMARY

Name of the project

Capacity development for agriculture and water management for Iraq and regional Countries

Partners

- Arab Fund for Economic and Social Development; AFESD (<http://www.arabfund.org/>)
- Japan International Cooperation Agency; JICA (<https://www.jica.go.jp/english/>)

Purpose

The purpose of the course was to enhance capacity development of government officials and researchers who are engaged in agricultural development in Iraq and other countries. They gained knowledge and information on application of techniques and tools generate, manage and analyze data in the research environments of water resources management, crop improvement and crop management.

Specific objectives of the training course

To share knowledge on statistical concepts and methodologies for designing and analyzing data from field experiments, biometrical techniques applied in agricultural research, use of Genstat software, and to provide an opportunity to active researchers to carry out statistical analysis of their data, and prepare a draft research manuscript for publication and discuss experimental designs for the forthcoming seasons.

Specific outputs

Seventeen (9 male, 8 female) professionally trained NARS partners from Iraq and other countries were trained on experimental designs, enhanced data management, statistical analysis and some biometrical techniques in agricultural research. While ten Iraqis, one Algerian, and two Jordanian are funded by JICA, the others were sponsored by AFESD. They were provided with training material on the individual topics discussed and demonstrations shown in the area of statistics design, data analysis and biometrical techniques in agricultural research. Eight participants had brought data from their experiments and analyzed them with comments on the interpretation of results, while one participant generated randomized plan for his planned experiment for the next season. Participants' feedback was that they learnt a great deal and also expressed that such a course should be repeated in future with a much longer duration.

GENERAL OVERVIEW

For enhancing capacity of NARS of the WANA region for science quality in the research areas of Iraqi Ministry of Water Resources, ICARDA formulated the training course entitled “Statistical Design, Data Analysis and Biometrical Techniques in Agricultural Research” for designing and analysis water management experiments with financial support of AFESD and JICA. A total of 17 participants were invited to share knowledge on basics of generation and statistical analyses of data from designed experiments in the areas of water resources and crop improvements. The course was successfully implemented as planned.

OBJECTIVES

To share knowledge on statistical concepts and methodologies for designing and analysing field experiments, biometrical techniques applied in agricultural research, use of Genstat software and to provide an opportunity to active researchers to carry out statistical analysis of their data.

TARGET AUDIENCE

The course is set to target 17 mid-level researchers working in water resource management, crop improvement in the West Asia and North Africa region represented by participants from Iraq (10), Jordan (2), Lebanon (1), Algeria (1), Tunisia (2), and Sudan (1) (Please refer to Annex III).

ORGANIZING COMMITTEE

Dr. Murari Singh, ICARDA Senior Biometrician

Mr. Charles Kleineremann, Head, ICARDA Capacity Development Unit (CDU)

Mr. Khaled El-Shamaa, ICARDA Research Database Manager and Senior Analyst

Mr. Masafumi Tamura, Technical Training Officer, ICARDA CDU

COURSE STRUCTURE

The course covered:

- Data management: Spreadsheet (Excel), Import and Export to other data formats, Data validation using pivot table, statistical functions and data transformation; use of Data Analysis Tools add-in.
- Estimation and testing hypotheses on means and variances; correlation and regression
- Design and analysis of variety trials: designs in randomized complete blocks (RCB) and incomplete blocks (alpha designs), combined analysis of data from several environments to evaluate GxE interaction
- Design and analysis of agronomic field trials: Multi-factor experiments in RCB, split-plot experiments in RCB, strip-plot experiments in RCB
- Introduction to Genstat for Windows and its use for management of data
- ICARDA’s Online Biocomputing facility
- Identification of statistical approaches for analysis of participant’s data, analysis and interpretation of the results

COURSE IMPLEMENTATION

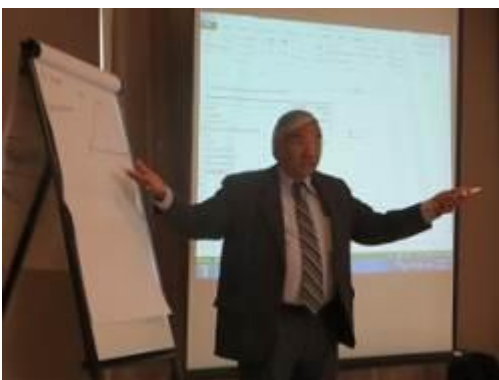
The training lectures and demonstrations on the practical were delivered to the participants. They practiced the advanced features of Excel for data management, completed exercises on generation of randomized plans, and analysis of datasets provided to them. Trainees presented the experiment descriptions and the data brought for analysis, followed by the comments and approach for the analysis mentioned by the instructors. The training course was run from 9am – 4pm each working day during 3 – 13 October 2016. The training was imparted by two technical instructors from ICARDA: Dr. Murari Singh, Senior Biometrician and Mr. Khaled El-Shamaa, Research Database Manager and Senior Analyst (Please refer to Annex II). The course implementation and program is summarized in the course agenda (please refer to Annex I).

The course was inaugurated with an opening speeches by Mr. Junji Wakui, Senior Representative, JICA Jordan Office, Dr. Murari Singh, Senior Biometrician, ICARDA and Mr. Charles Kleinermann, Head-CDU, ICARDA.



The course started with a presentation from Dr. Singh describing the course and course schedule and expected feedback on how to proceed for the case studies for statistical analysis. It was followed by Mr. Shamaa to introduce the data management using Excel and explain statistical functions, transformations, filter, text to columns, data validation, basic statistics and pivot table.

On the second day, Dr. Singh gave a lecture on estimation and test of hypothesis on means and variances, while Mr. Shamaa added different aspects of Excel data management followed by a practical session to understand the use of the Excel analysis ToolPak add-in.



On the third day, Dr. Singh delivered a lecture on correlation and regression analysis while Mr. Shamaa continued to work on a practical session on Excel scatter plots, and trend line options.

On the fourth day, Dr. Singh introduced GenStat and gave a practical session of generation of RCBDs using GenStat for analyzing data from an RCBD.

On the fifth day, Dr. Singh and Mr. Shamaa facilitated case studies by participants, and the following gives the short titles of the analysis carried out by the participants on their own data:

Tunisia: Analyses of wheat and chickpea germinations in petri-dishes in CRD

Algeria: Analysis of data on barley genotypes evaluated in alpha designs

Iraq: Analysis of data for fertilizer effect on wheat

Iraq: Soil Salinity status summary

Iraq: Comparing fertilizer types and their levels in RCBD

Iraq: Experimental design for fertilizer trials in split-strip plot experiment with tillage, irrigation and organic matter

Lebanon: Forage types and plant density effect on palatability, body weight and milk production

Jordan: Chickpea (25), faba bean and lentil (36) genotypes evaluation in alpha designs

Jordan: Feeding trial with barley - vetch mixture and stage of cutting on dry weight, fibre, and protein (design RCBD, 2 locations)



After presentation of the case studies, Mr. Shamaa introduced ICARDA's online bio-computing service followed by both lectures' consultation for analysis ICARDA online bio-computing service.

On the seventh day, Dr. Singh introduced two factor factorial experiments and it was followed by its practical session on design and analysis of two factor factorial trials in RCB.

On the eighth day, Dr. Singh and Mr. Shamaa shared additional information on ICARDA online bio-computing service and its country case studies.

The last day of the training started with clarification of country case studies, general comments, and queries, and was followed by a certificate award ceremony, and feedback from trainees and suggestions on how to improve the courses. The certificates were distributed with speeches by Ms. Suha Bakir, JICA Jordan office, a representative of the participants, Dr. Murari Singh, and Mr. Masafumi Tamura, ICARDA.



GENERAL COURSE EVALUATION BY TRAINEES

At the end of the training, each participant provided feedback on their perception of the effectiveness of the training process, format and content. This gives ICARDA valuable information from which to validate or fine-tune each training component as well as the overall training program. Through training evaluation questionnaires, this report presents an overview of the final evaluation (Annex IV). Regarding the overall methodology of the training course, most participants qualified it as Excellent or very good, and the average score of each item range from 4.2 to 4.7 pts/5.0 pts which also express participants' satisfaction. Participants expressed their interest in giving more time for field work and practical session (Please refer to Annex IV).

CONCLUSION

The training course was successfully implemented as planned. The participants learned the techniques and tools on design of experiments, data management, and statistical analysis and with application in crop improvement and resources management. They also practiced use of advanced Excel, Genstat

statistical software and ICARDA online Biocomputing facility. The feedback from participants was that such a course should be out-scaled with a longer duration.

Annex I: Course Program

Monday, 3 October 2016: Day 1		
09:00 - 09:45	Registration, welcome address and course opening session	ICARDA - CDU Dr. Murari Singh
09:45 - 10:30	Description of the course / modification of course schedule; Feedback on how to proceed for <i>the case studies for statistical analysis</i> Introduction to the data management using Excel: Data entry and manipulation, activate Analysis ToolPak add-in	Dr. Murari Singh Mr. K. El-Shamaa
10:30 - 11:00	Welcome coffee	ICARDA - CDU
11:00 - 13:00	Statistical functions, transformations (e.g. log and angular transformation), filter, text to columns, data validation	Mr. K. El-Shamaa
13:00 - 14:00	Lunch break	ICARDA - CDU
14:00 - 16:00	Basic statistics and PivotTable	Mr. K. El-Shamaa
Tuesday, 4 October 2016: Day 2		
09:00 - 10:30	Estimation and test of hypothesis on means and variances (t- test, F- test)	Dr. Murari Singh
10:30 - 11:00	Coffee break	ICARDA - CDU
11:00 - 13:00	Excel data management (continue)	Mr. K. El-Shamaa
13:00 - 14:00	Lunch break	ICARDA - CDU
14:00 - 16:00	Practical: Use of Excel Analysis ToolPak add-in	Mr. K. El-Shamaa
Wednesday, 5 October 2016: Day 3		
09:00 - 10:30	Correlation and Regression analysis	Dr. Murari Singh
10:30 - 11:00	Coffee break	ICARDA - CDU
11:00 - 13:00	Practical: Use of Excel Analysis ToolPak add-in, Excel scatter plots and trend line options.	Mr. K. El-Shamaa
13:00 - 14:00	Lunch break	ICARDA - CDU
14:00 - 16:00	Practical: Use of Excel Analysis ToolPak add-in, Excel scatter plots and trend line options.(continue)	Mr. K. El-Shamaa
Thursday, 6 October 2016: Day 4		
09:00 - 10:30	Introduction to GenStat: Basics of experimental design (i.e. terminology, requirements of a good experiment, Fisher's principles of experimentation); Designing experiments in randomized Complete Blocks, ANOVA assumptions and analysis	Dr. Murari Singh
10:30 - 11:00	Coffee break	ICARDA - CDU
11:00 - 13:00	Practical: Generation of RCBDs using GenStat; Analysis of data from an RCBD using GenStat.	Mr. K. El-Shamaa
13:00 - 14:00	Lunch break	ICARDA - CDU
14:00 - 16:00	continue	Mr. K. El-Shamaa
Friday, 7 October 2016		
Saturday, 8 October 2016		
Sunday, 9 October 2016: Day 5		

09:00 - 10:30	Designing experiments in incomplete blocks (i.e. need and mechanisms for reducing experimental error, balanced designs, square lattice designs, rectangular designs, and alpha-designs) -Analysis of data from experiments in alpha design (REML menu, Fixed and Random models, variance components, Wald test, predicted values: BLUE and BLUP) REML for RCBD and efficiency of IBD over RCBD	Dr. Murari Singh
10:30 - 11:00	Coffee break	ICARDA - CDU
11:00 - 13:00	Practical: Generation of alpha design using GenStat Analysis of data from experiments in alpha design	Mr. K. El-Shamaa
13:00 - 14:00	Lunch break	ICARDA - CDU
14:00 - 16:00	Practical continued.	Mr. K. El-Shamaa
Monday, 10 October 2016: Day 6		
09:00 - 10:30	Case studies: Tunisia: Wheat, chickpea germinations in petri-dishes in CRD (Khalil...) Algeria: Barley lines in alpha designs (Kenza Mokhtar) Iraq: Fertilizer effect on wheat, 15 treatments in RCBD, a control replicated twice within each block (Salih...). 4 types of fertilizers either alone or in mixture and with three levels and total of 3 controls. Iraq: Soil Salinity status summary (Khaldoun) Lebanon: Forage types and plant density effect, selected 3 compositions (% alfa alfa) effects on palatability, body weight and milk production (Celine...) Jordan: Chickpea (25), faba bean and lentil (36) genotypes evaluation in alpha designs (Maysoon...) Jordan: Feeding trial- forage growth (3 cuts) for dry weight, fibre, protein ... in barley & vetch mixture (6 mixtures), RCBD, 2 locations (Maisaa) Iraq: Comparing fertilizer types and their levels in RCBD (Sana)	Dr. Murari Singh & Mr. K. El-Shamaa
10:30 - 11:00	Coffee break	ICARDA - CDU
11:00 - 13:00	Introduction to ICARDA Online Bio-Computing service.	Mr. K. El-Shamaa
13:00 - 14:00	Lunch break	ICARDA - CDU
14:00 - 16:00	Case studies-consultation for analysis ICARDA Online Bio-Computing continued-	Dr. Murari Singh & Mr. K. El-Shamaa
Tuesday, 11 October 2016: Day 7		
09:00 - 10:30	Introduction to two-factor factorial experiments - Factorial experiments: Two-factor factorial in RCB - Design and analysis of split-plot in RCB - Design and analysis of strip-plot experiments in RCB	Dr. Murari Singh
10:30 - 11:00	Coffee break	ICARDA - CDU
11:00 - 13:00	Continue.	Mr. K. El-Shamaa

13:00 - 14:00	Lunch break	ICARDA - CDU
14:00 – 16:00	Practical: Design and analysis of two-factor factorial trials in RCB	Dr. Murari Singh & Mr. K. El-Shamaa
Wednesday, 12 October 2016: Day 8		
09:00 - 10:30	Introduction to ICARDA Online Bio-Computing service	Dr. Murari Singh & Mr. K. El-Shamaa
10:30 - 11:00	Coffee break	ICARDA - CDU
11:00 - 13:00	ICARDA Online Bio-Computing continue	Mr. K. El-Shamaa
13:00 - 14:00	Lunch break	ICARDA - CDU
14:00 - 16:00	ICARDA Online Bio-Computing continue; Country case studies	Mr. K. El-Shamaa & Dr. Murari Singh
Thursday, 13 October 2016: Day 9		
09:00 - 10:30	General comments/queries/clarification Country case studies	Dr. Murari Singh & Mr. K. El-Shamaa
10:30 - 11:00	Coffee break	ICARDA - CDU
11:00 - 13:00	Overview of the course	Dr. Murari Singh
13:00 - 14:00	Lunch break	ICARDA - CDU
14:00 - 16:00	Evaluation and closing	ICARDA - CDU

Annex II: Trainers

Name & Surname	Institution	E-mail
Dr. Murari Singh	ICARDA Senior Biometrician	M.Singh@cgiar.org
Mr. Khaled El-Shamaa	ICARDA Research Database Manager and Senior Analyst	k.el-shamaa@cgiar.org



Dr. Murari Singh is a Senior Biometrician and also an Executive Assistant to the Deputy Director General for Research. He renders statistical consultancies and carry out research in applied statistics in the areas of agro-biological and environmental sciences, and manage Biometrics and Statistics support at the Center. He holds Ph.D. in Agricultural Statistics from Indian Agricultural Research Institute, New Delhi, India, and M.Sc. in Statistics from Banaras Hindu University, Varanasi, India. He has earned over thirty eight years of experience of rendering research and statistical consultancy to agro-biological and socio-economic researchers in the areas of design of experiments, sample surveys, statistical inference, statistical computing and application of biometric techniques in agriculture; teaching undergraduate and postgraduate students for 4 years in a Canadian University.



Mr. Khaled El-Shamaa is a Research Database Manager and Senior Analyst. He provides biometrics support for developing Genetic Resources, Crop and Genomic Information and Analysis Systems, and participates in database & web-based system development including several dynamic websites for international partners. He holds two Diplomas in the Automation & Industrial Electronics from Aleppo University and Computer Engineering from Aleppo University, and a B.Sc. In Electrical & Electronics Engineering-Computer Engineering from Aleppo University. He worked as a lecturer in Biotechnology department at Technical Engineering faculty at Aleppo University. He has co-authored for several book chapter and co-Authored in scientific papers.

Annex IV: General Course Evaluation

Item	Average score %
I. Contents of the course	
Relevance of the course to your job	4.38
Accomplishment of subject matter	4.38
Clarity of course objectives	4.61
Level of lectures	4.66
Time allocated for discussions	4.50
Interaction with participants enrolled in the course	4.61
Overall, how would you rate this course	4.94
II. Schedule and time allocation	
Percentage of Time allocated to lecturers	4.05
Usefulness of lectures	4.44
III. Teaching aids	
Effectiveness of teaching aids in general	4.66
Clarity of slides/overheads/PowerPoint	4.50
Handouts and material	4.72
IV. Administrative arrangement	
Pre-course communication	4.50
Travel arrangements	4.22
Quality of the accommodation	4.27
Payment of allowance on time	4.50
Transportation	4.38
Lecture rooms	4.55

Scale of performance: 1 (lowest) – 5 (highest)

V: Your comments and suggestions on the course

1. Most important ideas/concepts found in the training course:

- Experimental design and data analysis
- A better plan for future field experiments
- How to manipulate Excel and statistical analysis on Excel
- Importing data from Excel and how to analyze on Genstat
- How we choose a suitable design for experiments
- Designing methods give good experiences less mistakes in data analysis
- How to analyze my data and how to choice the right design to analysis
- Modern methods in other countries

2. Suggestions for future improvement of the course:

- The time of the training is not enough to learning all designs and statistical tests.
- Need a longer session and field visits and learn methods of data collection
- I am looking for advanced course in the future.

3. Do you recommend this course to be repeated in the future:

Yes: 100 % No

