

ICARDA
Office of Deputy Director General-Research (DDG-R)
Biometrics and Statistics Section

A Report of BSS Activities During 2016

Activity titles:

1. Management & Coordination of BSS Activities (BSS-0)
2. Advisory Support to Research Projects (BSS-1)
3. Exploitation of Advanced Biometrical and Statistical Techniques (BSS-2)
4. International Crop Information System (ICIS) Support (BSS- 3)
5. Bioinformatics Support (BSS-4)
6. Biometrical and Statistical Computing (BSS-5)
7. Statistical software, data management and analysis (BSS-6)
8. Training (BSS- 7)
9. Support to DDG-R Office (BSS-8)

(Prepared January 2017)

1. Management and Coordination of BSS Activities (BSS-0)

- Prepared an update of BSS Strategy document

Citation: BSS(2016). **ICARDA's Strategy 2017-2026 for Biometrics and Statistics Support to its Research:** Enhancing Research Quality for Innovation and Knowledge Sharing in Biodiversity, Germplasm Enhancement and Sustainable Agri-Food Systems. BSS, DDGRO, ICARDA, Amman, 26 pp.

<http://hdl.handle.net/20.500.11766/5492>

- Developed the workplan (BSS 2016) to meet the goals set in BSS strategy document; implemented the BSS planned activities.
<http://hdl.handle.net/20.500.11766/4755>
- BSS reports were uploaded on the MEL system

2. Advisory Support to Research Projects (BSS-1)

Delivered biometrics and statistics support to the scientists and students on experimental design and statistical analysis, developed computing codes and carried out data analyses, helped in drawing inferences, suggested on presentations and conducted statistical reviews. The services were provided for the following research program activities:

BIGM/CRP DC Barley/ CRP Wheat/CRP GL

- Revised the manuscript “Genome Wide Association Mapping for Yield and Yield Components in Jordanian Barley (*Hordeum vulgare* L.) Landraces Grown under Rained Conditions” by Amer et al. revision for BMC Plant Biology (new indices computed, re-analysis of several subsets of data, thorough revision done in write-up with response to reviewer's comments). The manuscript copy is available. (Dr Ayed Al-Abdallat, ICARDA and University of Jordan)
- An alpha design for 158 wheat landraces in blocks of 8-plots/pots each with open bottom (Ayed Al-Abdallat, BIGM/University of Jordan)
- Analysed “Survey data on Wilt in chickpea fields in Sudan” (Student: Omyma); look into additional aspects (Seid Kemal)
- Participated in the meeting, 2-3 Nov 2016, IYP 2016 Regional Dialogues - #OPC-INT-YEARS presented my talk (2-3 Nov). Trip report available (Ala Hamwieh)
- Suggested an experimental design for studying the interaction between herbicide and chickpea genotype (Ala Hamwieh)

IWLME/CRP WLE

- Discussed and generated randomized plan for a four year trial to evaluate effect of cropping systems (Sorghum mono, sorghum intercropped with a relay cropping of forage legume with chickpea, and sorghum in rotation with the relay cropping of forage legume with chickpea) and animal manure application (+, -) on crop productivity and land degradation affected with stony lands in Ethiopia. Two factor factorial in RCBD with 5 replicates, plot size for sorghum.
- Reviewed two template documents (Word and Excel) on “to improve the quality of experiment reporting and data delivery by the partner of my project in Ethiopia”. [Claudio Zucca]
- Optimum irrigation and leaching release to maximize cotton and wheat yield in

rotation in Aral Sea area of Uzbekistan. Logistic curve fitted and optima derived (SE will be derived); all possible models were screened and the best equations were suggested. [Bogachan Benli]

SIRPS

- Analysed for multiple comparison, wrote response to reviewers comments, and edited the manuscript “The influence of seed density and treatment on the establishment of halophytes: implications for rangeland rehabilitation in the dry areas” (Mounir Louhaichi).
- Reviewed of the questionnaire for OFID Socio-economic survey “Different practices in rangeland depressions” and identified a statistical analysis plan-- contingency chi-square for independence, correspondence analysis for identifying the specific association; Knowledge support on z-values at Type 2 error (beta) and power (1-beta) in sample size formula; model for ordinal responses [Kathryn M. Clifton]
- SAS codes to carry-out the Ordinal Logistic Regression (Logistics and HPLogistic) [Muhi El Dine]
- Reviewed a manuscript for publication: “Bio-economic efficiency of creep supplementation of forage legumes or concentrate in pasture-based lamb production” by S. Ates et al.; Analysis of data on dual purpose feeds using a repeated strip-plot design (uncommon block structure for ANOVA) experiments in Turkey [Serkan Ates]
- Statistical analyses were carried out on data on soil parameters and shrub variables, when the shrubs were planted using Vallerani and contour land-use systems in Jordan (Mr. Motasen El-Kayed, /Dr M. Louhaichi, SIRPS)
- Reviewed a survey questionnaire on role of farmer organizations and suggestions on Survey Design to generate data related to the objectives.[Udo Rudiger and Mounir Louhaichi]

GU

- Reviewed of a concept note on "Resilience and vulnerability of agricultural production in Afghanistan under changing climate, land and socio-ecology"
- Reviewed a concept note “Digital Agriculture + ICT in DCL AFS” [Chandra Biradar]

Regional Programs

South Asia and China project

- Analysed an on-farm trial data on lentils, Jehanabad (2013/14 & 2014/15). [Puja Sah]
- Analyzed an on-farm trial data in lentils for seed dissemination in Bihar (introduced distress seed coefficient etc.). [Atul Dogra]
- Participated in the “Inception Workshop of IFAD-ICARDA Regional Project in South Asia: Enhancing Food and Nutritional Security, and Improved Livelihoods through Intensification of Rice-Fallow System with Pulse Crops in Bangladesh, India & Nepal”, 14-15 December, 2016 (NASC Complex, Dev Prakash Shastri Marg, Pusa, New Delhi-110012, India) [Ashutosh Sarker]

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Afghanistan projects/CLAP

- Participated in the Annual Planning Meetings, 31 Mar – 4 April 2016. A Trip Report is available.

- Experimental designs for two trials in 2016-17 (Conservation Agriculture in RCBD; Irrigation and Nitrogen application in Split-plots: Irrig/N ; both 3 reps)
- Reviewed/edited experimental designs for a total of 32 trials on a total of 7 crops.
- Reviewed/edited “AFGHANISTAN Community Livestock and Agriculture Project (CLAP) ICARDA-Team (2016). Annual Project Progress Report, January 2015 to December 2015 (Sub-Component 2.3: Improved Food, Fodder and Vegetable Crops (IFFVC) [MAIL-/CLAP/I-DSF-8112-AF-COM 2.3]). ICARDA. Kabul, Afghanistan.” [Daryakhan Akberzai and Lina Mohammadi]

Livestock

- Discussed design and carried out analysis of data to study effect of two new feed treatments on weight gain and milk production on a breed of goat (time point variables: body weight, milk yield, quality parameters; ANOVAs, Means, SEs, MCP; repeated measurements analysis on body weight and milk yield, etc.) [Srinivas Tavva]
- Statistical analyses of data:
 - MET analyses of wheat trials (4) [Darya Khan]
 - MET analyses of chickpea trials (3) [Lina Mohammadi]

See list of manuscripts in Publications section.

[Yashpal Singh Saharawat]

NARS

WARP/Jordan

- Analysis of data on evaluation of populations of 1) wheat accessions using incomplete block designs at three locations, and 2) barley accessions using p-rep designs at 5 locations (Ms Nawal Alhajaj, NCARE, Jordan)

WARP/Palestine

- Advised on three on-farm experimental designs, for vegetables: tomato, cucumber and eggplant, to evaluate three genotypes for each of the crops cultivated using two fertilizers (mono, compound) at three locations in farmers' fields. [Abdallah Alimari]

Sudan/NVRSRP

- Reviewed the manuscript “Statistics Science Issues in Computer and Information Technology: Computational Statistics under a Bayesian framework” by Siraj for publication/conference

Statistical Reviews

- Reviewed ten manuscripts submitted for publication in various scientific journals (See List-A below).

List-A

- “Notes on Testing Carry-Over Effects in Continuous Data under an Incomplete Block Crossover Design” by Kung-Jong Lui, for Comm. Statistics-Simulation and Computation.
- “Evaluation of GreenCrop Tracker for the estimation of leaf area index in wheat using digital photography” by Sandhu et al. for Agricultural Research.
- “Statistical models for evaluating of genotype \times environment interaction in rainfed safflower” by Khoshnood Alizadeh et al. for Agricultural Research
- “Spatio-temporal genetic diversity in Indian barley (*Hordeum vulgare* L.) varieties based on SSR markers” for Indian Journal of Experimental Biology
- “On Some Statistical models with a random number of observations” by Manuel

L. Esquivel, Pedro P. Mota and J. T. Mexia, for Journal of Statistical Theory and Practice

- “G x E interaction studies in multi-location trial data of hybrid rice by AMMI and GGE-biplot analysis” by Ponnuswamy et al. for Plant Breeding (PLBR)
- “Benefit of statistical designs in two-phase experiments on vase life in carnations (*Dianthus caryophyllus* L.) “ for Postharvest Biology and Technology
- “Optimal Block Designs with Non-Additive Mixed Effects Interference” for Communications in Statistics – Theory and Methods
- “Designs for Diallel Cross Experiments Incorporating Neighbour Effects” by Aswal, et al. for Biometrical Journal
- “Statistical Analysis of Agricultural Experiments” [book] by V.K. Gupta, Rajender Parsad, Lal Mohar Bhar and Badidya Nath Mandal for Journal of Statistical Theory and Practice

(Contributed by Murari Singh)

- Khaled attended the annual planning meeting for Afghanistan projects and deliver the “Biometrical Best Practices in light of 2015 working experience with Afghani colleagues” presentation, 31 Mar - 4 Apr 2016, New Delhi, India.
- 6 ICARDA scientists/researchers were assisted on:
 - spatial implementation for both “Regression models for lentil seed and straw yields in Near East” and “Chickpea Responsiveness to Climatic variability in Mediterranean region” studies requested by Dr. Singh, Murari.
 - Analysis of the insecticidal fumigant of 4 essential oils against chickpea leaf miner experiment using ANOVA and LD 50 analysis and applying AUDPC and Abbott’s correction techniques requested by Dr. Sabraoui, Abdelhadi.
 - regression analysis for Hassan, Sawsan "estimating forage shrub cover and biomass in arid environments" paper requested by Dr. Louhaichi, Mounir.
 - statistical summaries of the OFID survey data for feeding calendar analysis requested by Dr. Clifton, Kathryn.
 - Analysis of 5 sets of augmented designs for wheat rusts data, Izmir (using AUGIWay & MET Means Bio-Computing module) requested by Dr. Nazari, Kumarse.
 - analysis Ph.D. experiment data requested by Hassan, Sawsan.
- 6 Ph.D. and M.Sc. students were assisted on the analyses for their theses:
 - Check and verify *Trifolium* data integrity, completeness, and format of 260 samples in 62 species characterized by 91 features. I also developed decision tree to classify *Trifolium* species requested by Ms. Kanawaty, Aya (Dr. Shehadeh, Ali Ph.D. student).
 - Perform correlation, regression, and t-test for data on shrubs traits linked to coverage ratio in Badia requested by Mr. El-Kayed, Motasem (Dr. Louhaichi, Mounir M.Sc. student).
 - Response several statistical queries about stability indicators requested by Mr. Gharseddin, Kifah (Dr. Maalouf, Fouad Ph.D. student).
 - Response several statistical queries including Path analysis requested by Ms. Al-Basha, Noha (Dr. Nazari, Kumarse M.Sc. student).

- Perform correlation, t-test, PCA, and clustering analysis requested by Mr. Fahel , Omar (Dr. Al-Khatib, Fateh Ph.D. student).
- Perform ANOVA analysis requested by Ms. Termaniny, Aya (Dr. Al-Khatib, Fateh Ph.D. student).
- Improved the functionality of the F1 Cross Excel macro utility to increase its usability as a tool in breeder's hand. The new features requested by Dr. Tadesse, Wuletaw.
- Generated 5 field experiments randomizations (4 Alpha, 1 RCB).
- Evaluated CIMMYT International Nursery website and utilities, and discussed issue of integrate ICARDA International Nursery to our current Bio-Computing Online service and Geoinformatics systems for better Multi-Environment Trials analysis which is requested by Dr. Niane, Abdoul Aziz.
- Delivered support to 3 requests come from NARS projects and partners:
 - analyzed 2 factorial CRD experiments using ANOVA procedure requested by Dr. Khamassi, Khalil from Tunis.
 - responded several statistical enquiries related to the MET CB output report requested by Akbarzai, Darya Khan from Afghanistan.
 - reviewed the Afghani risk perception survey questionnaire and provided few tips to improve it, this task requested by Dr. Biradar, Chandrashekhar for Dr. Tavva, Srinivas.

(Contributed by Khaled El-Shamaa)

3. Exploitation of Advanced Biometric Techniques (BSS – 2)

With a view to develop knowledge products as publications, statistical analyses strategies/outlines were developed in discussion with concerned scientists, examined datasets, computing wrote (mainly) Genstat programs, carried out statistical analyses and wrote biometrics and statistics component were written in the manuscripts for publications.

Innovations:

- Bayesian approaches for on-farm trials (unreported so far for on-farm trials)
- Spatial adjustments, AIC best of a number of models fitted on repeated checks, for quantitative traits in an field evaluation of 3102 accessions of chickpea and evaluation of crossover-type GxE interaction; Phylogenetic trees using DARWin and iTOL.
- Developed computing codes and analysis for selecting desirable genotypes under both the years and genotype-frequency of crossover interactions, traits correlations, regression of yield on other traits, each year; Bayesian formulation of on-farm trials data analysis.

These and other concepts, techniques and tools led to the preparations of following documents:

Published

1. Abdulqader Jighly, Manickavelu Alagu, Farid Makdis, Murari Singh, Sukhwinder Singh, Livinus C. Emebiri, Francis C. Ogonnaya (2016). Genomic regions conferring resistance to multiple fungal pathogens in synthetic hexaploid wheat. *Molecular Breeding*, 36:127. First Online: 29 August 2016. DOI: 10.1007/s11032-016-0541-4
2. Fouad Maalouf, Seid Ahmed, Khalil Shaaban, Bayaa, Bassam, Fawzi Nawar, Murari Singh and Ahmed Amri (2016). New faba bean germplasm with multiple resistance to *Ascochyta* blight, Chocolate spot and rust diseases. *Euphytica* DOI 10.1007/s10681-016-1726-y
3. Omer, Siraj Osman, Abdel Wahab H Abdalla and Murari Singh (2016) "Bayesian estimation of genotypic and phenotypic correlations from crop variety trials" in *Crop Breeding and Applied Biotechnology*, 16: 14-21.
4. Chaubey, Y.P., Sarker, A. and Singh, M (2016). Power transformations: An application for symmetrizing the distribution of sample coefficient of variation from inverse gaussian populations. Chapter 11, p127-137 in *Applied Mathematics and Omics to Assess Crop Genetic Resources for Climate Change Adaptive Traits* (Editors: Abdallah Bari, Ardesbir B. Damania, Michael Mackay and Selvadurai Dayanandan). CRC Press, Taylor & Francis.
5. Singh, M., A.B. Damania and Y.P. Chaubey (2016). Plant Genetic Diversity: Statistical methods for analyzing distribution and diversity of species. Chapter 15, p189-203 in *Applied Mathematics and Omics to Assess Crop Genetic Resources for Climate Change Adaptive Traits* (Editors: Abdallah Bari, Ardesbir B. Damania, Michael Mackay and Selvadurai Dayanandan). CRC Press, Taylor & Francis.

Posters:

6. "Genetic variability and heritability of agronomic traits in 3102 selected chickpea (*Cicer arietinum*) lines" by Surendra Barpete et al. for ICP2016-Marrakesh.
7. Poster: "Genotype x Environment Interaction and Identifying High Yielding Stable Lines in Wheat Under Afghanistan Environments" by Darya Khan Akbarzai, Yashpal Saharawat*, Lina Mohammadi, Abdul Rahman Manan, Assadullah Habibi, Nooralhaq Hakimi, Naweef Safi, Mawya Masomi, Adulhaq Farhang, S. Tavva, Swain Nigmananda and Murari Singh
8. Poster: "Genotype x Environment interaction and identifying high yielding stable chickpea genotypes under Afghanistan environments" by Lina Mohammadi, Yashpal Saharawat*, Darya Khan Akbarzai, Abdul Rahman Manan, Assadullah Habibi, Nooralhaq Hakimi, Naweef Safi, Mawya Masomi, Adulhaq Farhang, S. Tavva, Swain Nigmananda and Murari Singh

Technical Reports/Submitted for publication/Draft of publications

9. Murari Singh, Srinivas Tavva, Yashpal Singh Saharawat and Javed H. Rizvi (2016). A Bayesian Assessment of Productivity and Risks to Achieve Target Yields From Improved Chickpea and Mung Bean Varieties Using On-Farm Trials in Afghanistan. *Biometrics and Statistics Technical Report 1*(2016). BSS/DDG-R, ICARDA, Amman. Also submitted.
10. Srinivas Tavva, Murari Singh, Javed Rizvi, Yashpal Singh Saharawat and Zalmai Alokozai, Wazir Gul Rasoli, Naveef Safi and Abdul Rahman Manan (2016). Food and nutritional security through improved production practices in legumes in Afghanistan. Submitted.

11. Omyma Elmahi, Mohamed Seid Ahmed, M. Singh and Nafisa Elmahi Ahmed (2016). “Roles of crop production practices on the incidence of wilt/root rot diseases affecting chickpea in the Sudan”. Submitted.
12. RPS Verma*, A. Visionsi, S. Gyawali and M. Singh (2016). “Identifying barley genotypes for optimum input conditions in the WANA Regions”. Submitted.

DRAFTs

13. Karthika Rajendran et al. (2016). “Characterization of grain β -ODAP concentration and important yield components in the genetic resources of grass pea (*Lathyrus sativus*) at ICARDA”.
14. Sarker et al. (2016) “Genetic variability for nutritional quality in Lentil (*Lens culinaris* Medikus Subsp. *culinaris*)”.
15. Shrestha et al. (2016). Genotypic variability and GxE interaction for the micro-nutrients Zn & Fe in lentil cultivars in Nepal.
16. Sarker et al. (2016). Reducing anti-nutritional factor and enhancing yield with advancing time of planting and zinc application in grasspea in Ethiopia
17. Darya Khan Akbarzai, Yashpal Saharawat*, Lina Mohammadi, Abdul Rahman Manan, Assadullah Habibi, Nooralhaq Hakimi, Naween Safi, Mawya Masomi, Adulhaq Farhang, S. Tavva, Swain Nigmananda and Murari Singh (2016). Genotype x Environment Interaction and Identifying High Yielding Adaptable and Stable Lines in Wheat Under Afghanistan Environments” by
18. Lina Mohammadi, Yashpal Saharawat*, Darya Khan Akbarzai, Abdul Rahman Manan, Assadullah Habibi, Nooralhaq Hakimi, Naween Safi, Mawya Masomi, Adulhaq Farhang, S. Tavva, Swain Nigmananda and Murari Singh (2016). “Genotype x Environment interaction and identifying high yielding adaptable and stable chickpea genotypes under Afghanistan environments”.
19. Surendra Barpete*, Aakash Goyal, Aladdin Hamwieh, Vivek Singh Tomar, V S Gautam, Murari Singh, Ashutosh Sarker and Shiv Kumar Agrawal (2016). “Genetic variability and heritability of agronomic traits in 3102 selected chickpea (*Cicer arietinum*) lines”.
20. Hamwieh et al (2016). “Chickpea Responsiveness to Climate Change in Mediterranean region”.

Conferences and Meetings:

- Participated in the International Conference on Pulses 2016, Marrakesh, 18-20 April 2016. Trip report available.
- Attended the Genomic Selection Symposium at ICARDA, 29-30 September 2016, Rabat. Trip report available.
- Organized a session on Bayesian Statistics, 22 Nov 2016, at the 70th Annual “International Conference on Statistics & Big Data Bioinformatics in Agricultural Research” at its headquarter ICRISAT, Patancheru, Telangana under annual meeting of Indian Society of Agricultural Statistics (ISAS), 21-23 Nov 2016, communicated and followed up to invite the speakers. Trip report available

(Contributed by Murari Singh)

- Documented, configured and setup GU High Performance Computing (HPC) facility which includes head server node running Microsoft HPC Pack 2012 and 14 cluster nodes.
- Completed “Data Scientist’s Toolbox”, “Getting and Cleaning Data”, and “Exploratory

Data Analysis” courses as part of the Johns Hopkins University “Data Science” specialization certificate at Coursera.org.

- Explored R techniques and packages to perform geoinformatics and spatial analysis, as well as combine it to ArcGIS using R-Bridge tool.
- Explored utilizing Neural Networks technique to predict next year rainfall depends on previous year’s rainfall profile.

(Contributed by Khaled El-Shamaa)

4. Research and Spatial Database Management (BSS –3)

- Designed formats for following metadata and full datasets for open access (OA) and shared with scientists.
- Metadata and full datasets for CIEN-S (Chickpea International Elite Nursery), 1997-2010, Tel Hadya and Terbol were detailed and shared on the MEL system (BIGM/CRP GL; Aladin Hamwiah)
- Metadata for Barley HI-2014 were detailed and shared on the MEL system (BIGM/CRP DS; RPS Verma)
- Prepared a template metadata for Afghanistan projects for OA (Afghanistan Project/YS Saharawat/Darya Khan)
- Prepared a template metadata for faba bean projects for OA
 - 3 datasets (Breeding/agronomy, physiology)
 - 3 datasets (diseases: AB, CS, RO)
 (BIGM/ F Maalouf)
- Organized CIEN-W 2011-2015 datasets (A. Hamwiah)

(Contributed by Murari Singh)

- Spatial analysis on the Climate Changes in the Rainfall Season Shift in MENA region using concepts of break point and area under curve in R language.
- Downloaded the ECMWF for 2014-2015, pre-process, and downscale Tmin, Tmax, and Precipitation using GU HPC clustering facility and documented all the steps.
- Developed an Excel macro to import KML place marks into Excel spreadsheet.
- Developed a script in R language to convert points in Excel into ArcGIS shapefile.
- Generated drought pluvial graph using Tel-Hadya and Terbol rainfall data.
- Maintained GeoAgro portal and kept it up and running, this includes:
- Updated the content on request (e.g. publications, staff, CA links and logos).
- Updated Fergana maps at ArcGIS server backend
- Redesigned the interface to view/compare Fergana land use and yield gaps.
- Updated the portal email template and fixed email server downtime.
- Synchronized list of available Landsat 8 scenes frequently.
- Wrote batch script to backup portal database by CG.
- Monitored Apache server to avoid run out of memory issue.
- Generated a usage statistics report when requested.
- Retrieved requested rasters.
- Fixed broken links.
- Worked on Amazon AWS cloud service (i.e. techniques, agreement, scope of work, partner, monitor, etc.).
- Developed scope of work document for the GeoAgro mobile application.
- Supported WebGIS SLM-OC team when requested (e.g. setup local testing server,

- Amazon AWS hosting, review installation guide, publish samples to ArcGIS server).
- Searched for UAV camera (RedEdge by MicaSense), purchased and received it, test it, create Atlas account to process its output, and follow up missing DLS issue.
- Purchased NANO QX required maintenance parts (batteries, motors, and propellers) fix it and practice test flight. Follow up Drone propellers PR.
- Attended the Esri MENA User Conference 8-10 Nov 2016, Dead Sea, Jordan to represent ICARDA GU in the exhibit and delivered the “Geoinformatics for Nourishing Drylands” presentation during its activities.
- Practiced managing ODK server settings at the port 8080 on GeoAgro server as well as utilizing Esri Survey123 (i.e. introduction and training).
- Provided requested climatic data on requests (e.g. Tel-Hadya and Breada meteorological data 2012-2013 requested by Ceccarelli, Salvatore; Nigeria ECMWF daily precip, tmin, tmax, and par; MSWEP 3-hourly rainfall data 1979-2015 dataset)
- Supported intern (download 52 Landsat 8 scenes, R code crawl sub directories to calculate LSWI, RedEdge testing, and Drone mission planner).
- Explored how to model annual rainfall prediction using NN and RF techniques.
- Kept Tel-Hadya meteorological station data up-to-date aligned with sent feeds.

(Contributed by Khaled El-Shamaa)

5. BSS-4: Bioinformatics support

None! No Bioinformatics requests received during 2016.

6. BioComputing (BSS- 5)

Online BioComputing. Customization and development included the following:

- Updated the Genstat Program for Line \times Tester data analysis (for any general levels for line and tester factors); version 15 June 2016
- Updated METMEANS— for quadratic average of SEs and replace any missing (SE by this average to avoid missing weights); Also included SEs of means combined over environments; Cultivar Superiority index (Lin and Binns 1988) and its partitioning into genotypic and G \times E interaction components, and their standardization.
- RCBD modules were customized for inclusion of heritability on mean-basis and BLUPs and output formats.

Specialized analyses: Wrote computing codes for analyses for specific analyses including evaluation of 3000 chickpea lines, barley landrace data, wilt in chickpea in Sudan, crop and livestock datasets from Afghanistan.

(Contributed by Murari Singh)

- I processed 38 BioComputing Online analyzing requests (1 AUG1Way, 1 IBD, 24 SPUR, and 12 MET Means) from 2 countries (26 Jordan and 12 Pakistan/Canada) including checking related data validity and integrity.
- I rebuild the BioComputing Online web pages using Bootstrap 3 technology, published it, as well as tested and updated the new MET Means and RCBD modules. <http://geoagro.icarda.org/bss/biocomputing>
- I developed an online R application using Shiny framework to perform LD50 analysis. <http://geoagro.icarda.org/bss/shinyapps/ld50.php>

(Contributed by Khaled El-Shamaa)

7. BSS-6: Technical support on statistical software

- Supported statistical software installation and license issues in all requests (23 cases) distributed as follow:
 - 11 GenStat cases, 9 ArcGIS cases, 1 SigmaPlot, 1 CycDesign, and 1 ASReml
 - 7 BIGM requests, 4 IWLM, 4 BSS, 3 GU, 2 SIRPS, 1 DS-ICARDA, and 2 Outreach
- Delivered quality support for users' needs in terms of guidance for Excel and statistical packages utilization in all requests (15 cases) as follow:
 - GenStat (trainees license offer - CDU).
 - R language (read SPSS sav file format - IWLM and GU, read NetCDF file format - SIRPS & GU, crop and stack NC files - IWLM, Rstudio IDE - ITU, raster package - GU, process Landsat data - GU, calculate NDVI - GU).
 - Excel (count multi-choices survey responses - SIRPS).
 - ArcGIS (VBA extension - IWLM, publish RESTful maps on server - DS-ICARDA, get hot spots grading raster - GU).
 - Others (MySQL Workbench admin tool - BIGM-IN).
- Followed up renewal license issues including upgrading and purchase requests for GenStat, CycDesign, SigmaPlot, ASReml, SAS, ENVI, and ArcGIS.

(Contributed by Khaled El-Shamaa)

8. Training (BSS-7)

Conducted the following courses/workshops for the NARS and ICARDA scientists/technicians with following titles and dates:

- Hands-on training session on using MET CB, MET IB, and MET Means BioComputing Online modules for 2 trainees from Afghanistan, 5 Apr 2016, New Delhi, India. Instructor: **Khaled El-Shamaa**)
- “Statistical Data Analysis and Interpretation of SARD-SC Wheat Experiments” for 18 trainees (from Eritrea, Ethiopia, Kenya, Lesotho, Mali, Niger, Nigeria, Sudan, Tanzania, Zambia, and Zimbabwe), 26-30 Jul 2016, Niamey, Niger. (Instructor: **Khaled El-Shamaa**)
- CDU/JICA/IFSED: Statistical Design, Data Analysis and Biometrical Techniques in Agricultural Research, 3-13 October, 2016, Amman, Jordan. Total 17 participants (Iraq: 10, Jordan:2, Algeria:2, Tunisia:1, Lebanon:1, Sudan:1); Females (8), Males (9). (Instructors: Murari Singh and Khaled El-Shamaa).
- An in-house training course for International Nurseries staff on share knowledge and best practices in design, data manage and analysis of multi-location trials for 7 trainees, 12-16 Dec 2016, Terbol, Lebanon. (Instructor: **Khaled El-Shamaa**)
- Processed 48 BioComputing Online requests related to 3 training courses. [Khaled El-Shamaa]

- Developed training materials for R language implementation in Geo-Informatics and Geo-Spatial analysis in GIS systems context. [Khaled El- Shamaa]
- Developed a training module on “Statistical Design and Analysis of Date Palm Insect Pest Management Experiments” as a part of IPM of Date Palm manual (Chapter under review/available. Murari Singh and Khaled El-Shamaa)

ICARDA In-house course

- **Data analysis using Genstat**, May 15 – 23, 2016 (14-16 hr, 4 sessions in total), ICARDA, Amman, Jordan. Aim: To Enhance Science Quality. (1-4 scientists). Topics: ICARDA in-house biometrics and Statistics interactions on “Statistical Design and Analysis Using Genstat” (at Amman) (4 participants: Claudio, Serkan, Sawsa, Muhi El-dine). Experimental design for cropping system to improve land quality in Ethiopia; Discussion/examples—test for normality, heterogeneity of variances, outliers; Sample size determination, SE, power consideration, Genstat Procedure Menu; Ordinal data analysis; Strip-split-plot (Blocks: Rep/Crops/(Variety*Zodaks))[Instructor: Murari Singh]

(Total number of participants in the above 2 courses: 14)

NARS Degree students and non-degree participants

- 1 Karim El-Fakhouri, Morocco (Student of M. El-Bouhssini): Crop: Mint/. Reviewed the selected output and suggested on interpretation and presentation on “Efficacy of different insecticides on adults *C.melanostrictus*”; Analysis carried out on data for “Population dynamics and severity of the weevil *Ceutorhynchus melanostrictus* (Marsham, 1802) on Mint crop in Chaouia region”
- 2 Abdelhadi Sabraoui, Morocco (Student of M. El-Bouhssini): Chickpea Leaf miners Strategy and steps for analysis of data from an experiment on “Evaluation of the insecticidal activity against larvae and adults of chickpea leaf miner (*Liriomyza cicerina*.R)” at Rabat. (KES and MS)
- 3 Motasem El Kayed /Student of Mounir Louhaichi. Advice on statistical analysis of soil and shrub data in Vallerani and Contour landuses and change over time (two years): Distribution of soil parameters and shrub variables individual system and years in terms of descriptive statistics, normality, homogeneity of variances; t-test; correlations, and simple/multiple regression. SIRPS 23- May 2016 10.
- 4 Sawsan Hassan, ICARDA – her Ph D study data analysis. Analysis of data from her Ph. D. study: Datasets on roots, mother pad, 1st generation and 2nd generation observations, from a CRD for studying effects of soil volume and time of cutting the pad of a genotypes of cactus species, with 3 reps and. ANOVA, polynomial partitioning into single dfs, transformations, residual plot analyses (with K. El-Shamaa); A short write-up on Statistical Methods component of the M&M part.
- 5 Ms Reena Mehra (India), Ph. D. student of Dr A. Sarker. Analysis and interpretation of data on Lentil accessions (187) evaluated in unreplicated design with (evenly) repeated checks. REML—BLUPs, Correlations, path analysis, cluster analysis, anova with clusters, 6 – 15 Dec 2016.

(Contributed by Murari Singh)

9. Support to DDG-R Office (BSS- 8)

- Drafted a position paper on “ICARDA’s Science Quality” for BOT meeting 6-10 May

2016, Izmir, Turkey meeting. April 2016

- Reviewed: ICARDA STRATEGIC PLAN 2017-2026, Draft ver0. By Dr J. Passioura June 8 - , 2016
- Reviewed and submitted my comments on the draft proposal “Sustainability and Operationalization of Established Regional Research Centers in Five Arab Countries” July 13, 2016. A Proposal Submitted by ICARDA for Financial support by: Arab Fund for Economic and Social Development (AFESD) and Kuwait Fund for Arab Economic Development (KFAED)
- Prepared a comparison of Center’s performance Measurements using measures (indices) on journal article publications by staff and responded to queries. Two statistics, PPS and PPI were tabulated and a PPT was prepared for the Management. Aug-Sep 2016

(Contributed by Murari Singh)