2016 WORKPLAN

BIOMETRICS AND STATISTICS SECTION

OFFICE OF DEPUTY DIRECTOR GENERAL - RESEARCH

Prepared: December 2015

ICARDA
Science for Better Livelihoods in Dry Areas

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1. Summary

Biometrics and Statistics support will be made available in the design of experiments, data analysis and inference, and statistical review of scientific manuscripts. Support will also be given in statistical computing and other software of interest to the researchers. Through involvement in the CRPs and Generation Challenge Program, we shall have strong involvement in research and spatial database management including ICIS, long-term trials and Bioinformatics work which will focus on data management, identification of crop varieties for spatial adaptation and temporal stability, estimation of yield-trends in long-term trials, and analysis of molecular marker data, expression data and spatial modeling. It is expected that BSS will be involved in providing Research Methods supports to CRPs and bilateral projects by organizing training courses on experimental designs and statistical data analysis, and providing technical backstopping to NARS scientists at various Action and Satellite sites.

The plan assumes that 84 person-weeks will be needed in 2016. We will also seek expert consultation in the areas of quantitative genetics and Bayesian methods. This plan, in collaboration with GU, also focuses on organizing required tools and techniques for sharing ICARDA research data under an Open Access policy of ICARDA and CGIAR. In the current situation in Syria and relocation of scientists to various ICARDA-hubs, we will enhance our extra effort to stand-up to the challenges of the changed scenario and its evolution. The support will be provided through emails, Skype, as well as face-to-face meeting where applicable.

2. Plan Assumptions

The Plan is based on the following assumptions:

- Full commitment and participation by the research Programs/Sections in the various activities outlined.
- Budget availability for capital hardware items and software, and the communication lines.
- Approval of special projects funds
- Funds are available to cover travel for training, consultations and conferences etc.

3. Biometrics and Statistics

The quality of science in research work is enhanced by sound planning of the experiments/surveys, development of suitable statistical techniques and data analysis, inferences drawn and their presentation for dissemination. Biometrics covers the areas of statistical methods specifically devised for biological research environment, while Statistics addresses theoretical, methodological and applications of statistical tools in general. Continued developments in Biometrics and Statistics in areas such as design of experiments in field-plot research, statistical modeling of data, spatial statistics, re-sampling techniques, molecular marker and sequence data deserve further exploitation and adoption to support the Center projects. The Biometrics and Statistics Section (BSS) will support the required development to achieve a *total quality management in research* in terms of sound generation of research data, efficient storage and retrieval system for data, statistical analysis and inference, dissemination of research results, Biocomputing modules, and training to NARSs catalyze research technology transfer.

BSS's goal in the area of Biometrics and Statistics is to assist research programs in achieving reliable, efficient, repeatable and interpretable experimental/survey results. An ambitious core of activities has been derived from the CRPs where ICARDA is participating.

CRP1.1	Integrated agricultural production systems for the poor and vulnerable in dry areas
CRP2	Policies, institutions, and markets to strengthen assets and agricultural incomes for the poor
CRP3.1	WHEAT- Global Alliance for Improving Food Security and the Livelihoods of the Resource-poor in the Developing World
CRP3.5	Grain Legumes: enhanced food and feed security, nutritional balance, economic growth and soil health for smallholder farmers
CRP3.6	Dryland Cereals: Food Security and Growth for the World's Most Vulnerable Poor
CRP3.7	Sustainable staple food productivity increase for global food security: Livestock and Fish
CRP5	Durable Solutions for Water Scarcity and Land Degradation
CRP7	Climate Change, Agriculture and Food Security

These programs will be implemented by the existing research programs/units:

BIGM (Biodiversity and Integrated Gene Management) Program
SIRPS (Sustainable Intensification and Resilient Production Systems) Program
IWLME (Integrated Water and Land Management and Ecosystem) Program
GU (Geographical Information System) Unit

The biometrical and statistical activities have been grouped as:

1) Title: Biometrical and Statistical Support to Research Projects of the Center
Goal: To enhance efficiency of research by sound statistical planning and analysis of experiments / surveys and drawing statistical inference; maximal extraction of statistical information and optimisation the experimental resources; and statistical review of scientific documents.

2) Title: Experimental Research Informatics facility
Goal: To store, manipulate, retrieve, analyse and interpret experimental data on germplasm including those in ICIS (molecular marker & phenotype data) to exploit for selection of desired genetic material, SEEDMAN for seed management and Long-term Trials DB for cropping systems for their productivity and sustainability studies

3) Title: Bio-computing
Goal: To automate the computing efforts and minimize the cost

3. 0 Management, Coordination, and Human Resource Development [included, September 2016]

Activity Code:	BSS-0
Activity Title:	Management and Coordination of BSS Activities
Objective:	To manage and coordinate the activities of BSS and prepare proposals for continued development of the Section within ICARDA's Medium Term Plan and Strategy.
Activity Description:	Identification of the activities and coordination with various programs and units to support ICARDA research and NARS capacity development. Development of workplan to meet the goals set in BSS strategy document; Implementation of the BSS planned activities: allocation of resources available and budget management, assignment of responsibilities, monitoring of performance, assessment of the achievements, proposals, continued development of BSS resources, and reporting to the management.
Leader:	M. Singh
Participants:	A. Noble, K. El-Shamaa, Dalia Kana'n
Time Frame:	Jan-Dec 2016
Total Person-Weeks:	6
Other required Resources:	Budget
Performance Measure:	Achievements of goals set in the operational plan

3.1 Advisory Support to Research Projects

Activity Code:	BSS-1
Activity Title:	Biometrical and statistical supports to research projects of the Center
Objective:	To render biometrical and statistical consultancies, and assistance in planning and analysis and drawing statistical inference from the experiments/surveys conducted under various projects at the Center and the collaborative projects in the NARS; to review the scientific documents.
Activity Description:	We will provide biometrical and statistical support to the scientists and researchers from the research programs and collaborative NARS projects. These will include experimental designs and statistical analysis of data from various experiments to: a) identify and select high yielding and stable genotypes, select tolerant genotypes for diseases and pests (for all the mandated crops: barley, wheat, lentil, chickpea, faba bean and grass pea), b) select sustainable and highly productive cropping system, c) develop crop, land and water models, d) evaluate and compare technologies at the farmers' fields (e.g. in Afghanistan), among others, e) data management of GRU datasets for analysis including data validation and integrity checks. Specifics: **SIRPS**: Revision of manuscript "The influence of seed density and treatment on the establishment of halophytes: implications for rangeland rehabilitation in the dry areas" (ML) **South Asia and China RP**: a)Design of experiments, analysis of field data (for Pulse Breeding for abiotic stresses), b)Analysis of multi-environment data (Harvest Plus); c) Analysis of data on farmer-participatory trials GOK-ICARDA (Sarker); d)Participation in Annual Planning Meeting for Afghanistan Projects (YS)
Target Stakeholders	BIGM, SIRPS, IWLME programs, GU, RPs and NARS
Leader:	M. Singh
Participants:	Concerned scientists, K. El-Sham'aa
Time Frame:	January - December 2016
Total Person-Weeks:	19 on CRPs/bilaterals
Other required Resources:	Statistical books and research publications
Performance Measure:	Extent of support (Anticipated: all requests for experimental designs, 10 datasets/experiments for statistical analysis: computing program codes, and outputs)

3.2 Exploitation of Advanced Biometric Techniques

Activity Code:	BSS - 2
Activity Title:	Exploitation of advanced biometrical and statistical techniques
Objective:	Develop statistical methods to fill the gaps in biometrical and statistical techniques in designing experiments and surveys, and modelling of data
Activity Description:	The activities will include: - Application of Bayesian methods in crop variety trials, estimation of genotypic correlation under METS, **Chickpea International Elite Nursery (CIEN) winter material adaptation and stability studies**; Trait associations in CIEN materials; Estimation of breeding values using information of kinship matrix and Bayesian approach in bread wheat; Estimation of breeding values of small ruminants - Collaborative research activities with GU - Is our crop breeding climate change responsive? Examine/ Correlate the yield of selected breeding lines/checks with weather parameters. Similar thoughts on cropping systems. (CIEN-W material) - Join the scientific consultation on improving Focused Identification of Germplasm Strategy (FIGS) using cutting edge Bayesian mathematics and GIS data to help breeders mine effectively genebanks and get a best-bet list of promising accessions.
Target Stakeholders	BIGM, SIRPS, IWLME programs, GU, RPs and NARS
Seminar:	Bayesian estimation of barley trials in blocks
Travel	
Leader:	M. Singh
Participants:	Associated scientists, Mr. K. El-Sham'aa, consultants
Time Frame:	January - December 2016
Total Person-Weeks:	17
Other required Resources:	
Performance Measure:	Joint publications (at least 2 cases with their methodologies, computing program codes)

3.3 Research and Spatial Database Management

Activity Code:	BSS –3
Activity Title:	Research and Spatial Database Management
Objective:	To Manage Research and Spatial Data as per ICARDA Open Access Policy
Activity Description:	- Research and spatial data streamlining, management and development of data - Sharing portal along with providing support on statistical computing and programming. - Carryout software specifications and design data structures for large datasets from research projects, e.g. CRPs, Bilateral. - Carry out data quality control/checks to ensure compliance standards - Support computational and web programming and related activities. - Develop and support in spatial data cataloguing, management and scientific web-tools - Around 10 datasets will be mounted on the GU server for OA - Continue to interact with the ICIS community of developers and practice to keep the system operational, maintain the system and develop interfaces on uploading the data and for producing report such as queried datasets for specialized analyses - Share knowledge with the in-house and NARS researchers for the use of the system - Provide user support
Target Stakeholders	BIGM Program
HR development	K. El-Shamaa on Spatial Data
Leader:	K. El- Shamaa
Participants:	C. Biradar, M. Singh, concerned scientists
Time Frame:	January - December 2016
Total Person-Weeks:	20
Other required Resources:	
Performance Measure:	Facilities and usage (at least 10 datasets with metadata)

3.4 Bioinformatics Support

Activity Code:	BSS-4
Activity Title:	Bioinformatics support
Objective:	To provide bioinformatics support for developing Genetic Resources, Crop and Genomic Information and Analysis Systems at ICARDA
Activity Description:	- Explore, procure, download and install the updated versions of needed software to analyse molecular marker data, sequence data, expression data and phenotype, and get trained on the use of such software; - Develop any other needed bioinformatics and statistical genetic tools and databases, for customized applications - Conduct training in required software for in-house and NARS researchers in the areas including genetic mapping, QTL estimation and LD mapping - Exploit these tools to help enhance biotech scientists in achieving their goals - Capacity building in bioinformatics
Target Stakeholders	BIGM program
HR development	K. El-Sham'aa to attend courses in Bioinformatics areas, and explore for graduate studies
Leader:	K. El-Sham'aa
Participants:	M. Singh, concerned scientists.
Time Frame:	January - December 2016
Total Person-Weeks:	5
Other required Resources:	Declare concerned scientists needs and challenges
Performance Measure:	Facilities and usage

3.5 BioComputing

Activity Code:	BSS-5
Activity Title:	Development of Bio-computing facilities
Objective:	Develop biometrical, statistical and bioinformatics computing modules, document them and make them accessible on-line within the Center and to the NARSs.
Activity Description:	- Develop/modify the computing programs (2-4) to enhance research at ICARDA and NARSs. - Maintenance of the current Online Bio-computing system - Develop R package for ICARDA usage perform common analysis and designs which will be free to share with NARs and trainees with no hiding license cost. Output report will be customized to our own needs, input format and process steps will be as simple as possible with a very low learning curve, and implement it as web application using shiny server. - Explore the potential of Field Book v2.2, for field data recording (http://www.wheatgenetics.org/field-book) - Explore more effective way of license procurement and the possibility of cloud licensing availability on Internet.
Target Stakeholders	BIGM, SIRPS, IWLME programs, GU and NARS
Leader:	M. Singh
Participants:	K. El-Sham'aa, concerned scientists.
Time Frame:	January - December 2016
Total Person-Weeks:	7
Other required Resources:	
Performance Measure:	Usage, Computing modules (2)

3.6 Support on Statistical software, data management and analysis

Activity Code:	BSS- 6
Activity Title:	Technical support on statistical software
Objective:	To provide installation, maintenance and user support on all statistical packages that are supported by BSS and assistance in data analysis
Activity Description:	Assist the scientific users in installation, use and debugging of the problems in data analysis by statistical packages: GENSTAT, SPSS, AGROBASE, CycDesigN, STATA, R language, SigmaPlot, and advanced Excel macros and statistical functions. Upgrade the statistical software and their licenses; installation of any other agreed packages.
Target Stakeholders	BIGM, SIRPS, IWLME programs, GU, RP and NARS
Leader:	K. El-Sham'aa
Participants:	M. Singh
Time Frame:	January - December 2016
Total Person-Weeks:	6
Other required Resources:	
Performance Measure:	Number of user requests attended

3.7 Training

Activity Code:	BSS- 7
Activity Title:	Training in biometrical and statistical methods and associated computing
Objective:	To develop NARS capacity in application of biometric techniques with a view to enhance the science quality
Activity Description:	Likely courses list to grow: NARS: - Statistical Design, Data Analysis and Biometrical Techniques in Agricultural Research, October, 2016, Amman, Jordan - Training courses at Aleppo by Khaled - Design and Analysis of Water Resources Experiments" on 9 May in the training course "Improving Agricultural Water Productivity (with emphasis on irrigated production systems), 24 April – 12 May 2016 ICARDA, Amman, Jordan ICARDA in-house - Statistical Design and Analysis Using Genstat (at Amman/Cairo/Rabat/Aleppo)
Target Stakeholders	CDU, NARS, RP, BIGM, SIRPS, IWLME programs
Leader:	M. Singh
Participants:	K. El-Sham'aa, C. Kleinermann, scientists and regional program coordinators
Time Frame:	January - December 2016
Total Person-Weeks:	10
Other required Resources:	
Performance Measure:	Number of training courses (2) and participants (15)

4. Personnel Plan in Person-week

Time allocation

Activity No.	Activity title	M. Singh	K. El-Shamaa	Total
BSS-0	Management and Coordination of BSS Activities	**5**	**0**	**5**
BSS-1	Biometrical and statistical support to research projects of the Center	**10**	**9**	**19**
BSS-2	Exploitation of advanced biometrical and statistical techniques	**10**	**4**	**17**
BSS-3	Research and Spatial Database Management	**5**	**13**	**20**
BSS-4	Bioinformatics support	**2**	**3**	**5**
BSS-5	Bio-computing online facilities	**4**	**3**	**7**
BSS-6	Technical support on statistical software	**1**	**5**	**6**
BSS-7	Training in biometrical and statistical methods and associated computing	**5**	**5**	**10**
	Total	**42**	**42**	**84**