

AgMIP

The Agricultural
Model Intercomparison
and Improvement Project

MULTIPLE CROP MODEL TRAINING PROGRAM

MARCH 25-29 2013
ICRISAT, INDIA



RESEARCH PROGRAM ON
**Climate Change,
Agriculture and
Food Security**



WASHINGTON STATE
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The Foundation for The Gator Nation





Report on AgMIP Multiple Crop Model Training Program 25-29th March, 2013 ICRISAT, India

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Introduction

The Agricultural Model Intercomparison and Improvement Project (AgMIP) is a major international effort linking the climate, crop, and economic modeling communities with cutting-edge information technology to produce improved crop and economic models and the next generation of climate impact projections for the agricultural sector. AgMIP aims to utilize inter-comparisons of various types of methods to improve crop and economic models and ensemble projections. It also looks to produce enhanced assessments by the crop and economic modeling communities researching climate change impacts on agriculture and adaptation to these impacts. Capacity building is one of the major aspects of AgMIP. To enhance the capacities of the crop modelers in various teams, the AgMIP Multiple Crop Model Training was planned with the objective of providing training on the use of multiple crop models for AgMIP Regional Integrated Assessments. The training program mainly aimed at conducting parallel sessions on DSSAT and APSIM as well as sessions on AgMIP IT tools that facilitate the use of multiple crop models for simulating crop production variations associated with farm survey data. Participants focused on learning one model (either DSSAT or APSIM), and brought results from another model for comparison.

Goals and Objectives

The AgMIP Multiple Crop Model Training Program was organized to assist the South India, Sri Lanka and Sub-Saharan Africa (SSA) teams in the use of multiple crop models for AgMIP Regional Integrated Assessments. The main objectives of this training were to

1. Provide training on Multiple Crop Model Training for each AgMIP regional integrated assessment, mainly focused on APSIM and DSSAT;
2. Review the fast track results and provide suggestions for improvement.

Summary and Impressions of Multiple Crop Modeling Course - ICRISAT

K. J. Boote, C. H. Porter, G. Hoogenboom, and J. Hargreaves

1. The course was clearly needed and valued by the crop modeling participants. It was needed, because some had not truly completed the Fast Track at this point. They worked very hard during the 1-week courses, even after hours.
2. Generally, the courses went smoothly, especially in Nepal as there were smaller numbers for us to handle. The Pakistani team was ready, having completed a thorough report. The Nepalese participants were excellent.
3. The 40 or so participants at ICRISAT center were eager to learn and fairly skilled in their abilities, but the diverse number of crops and regions made this workshop more difficult for us to handle. In addition, there were a number of participants who really needed a beginning crop modeling course, and they struggled.
4. The use of trainers and resource persons was very valuable and worked well, as they assisted small working groups as the four principal instructors could not be everywhere.
5. On Tuesday morning we asked for reports on the Fast Track during both workshops. This was highly valuable, as we discovered a number of problems and issues. Gerrit and Ken had short sessions with each team that used DSSAT for Fast Track,

checking their model input files, set-ups, and initial conditions. We discovered a number of problems such as not setting initial conditions for soil water, crop residue, nitrate and ammonium, and failure to handle rice as paddy. Some teams micro-calibrated to each farmer field in some respects (which was discouraged). Others did the climate scenarios incorrectly. These issues will require re-doing their simulated Fast Track. Many of these problems would not have been evident in the submitted report (that we later evaluated).

6. The IT Tools were successfully used for entry and conversion of survey data to DSSAT files for maize and millet (and during the course to wheat). Conversion to DSSAT CERES-rice did not work as well because the Tools had not previously been used for paddy rice. The tools to convert to APSIM-ready files worked only for maize and failed for all other crops. Manual manipulation (7 hours of work by Subash) got files to run for APSIM wheat. Some teams did not use the IT Tools at all, but did all the work within DSSAT. Even teams that planned on APSIM as Fast Track model, did simulations with DSSAT first, because of the tools. Conclusion is that IT Tool translation tools to APSIM need improvement.
7. No one successfully parameterized soil C modules, either SOM3 or fraction inert soil C for DSSAT and APSIM, respectively. CENTURY SOC was generally not used (never used for Rice), although we need to survey exact numbers on this.
8. Most teams had evolved to one or two point persons doing the crop modeling. The persons starting with strong background in one model benefited most from learning about a new model, but the majority of other participants probably did not get enough basic training in the “new” model to become effective users. They will still need more basic training in that model. So, multiple model training was important to achieve project objectives (use of multiple models for same genetic calibration and survey region), but was not sufficient for true training in that second model.
9. The Regional Teams need advice on what simulations are needed by the time of July Regional Workshops beyond the first Fast Track report (what additional models, additional farm survey regions). They need advice on publications that are anticipated to produce.
10. We discussed the roles of resource persons. Some resource persons need to be encouraged to become more involved.
11. We need a WebEx meeting with the resource persons on how to use the IT Tools. That needs to include some crop modelers (Ken, Gerrit, Jim) to indicate what is expected of the crop model inputs and next steps.

Pre-workshop Activities

The South Asia (SA) coordination team did the following pre-workshop activities:

- The South India, Sri Lanka and Sub-Saharan Africa teams were informed to prepare on various requirements such as survey data, fast track outputs, and climate data so that they could review the datasets during the training program. To this effect attached is the letter sent to all the participants;



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- Initiate activities to accomplish what is needed for the SA-wide Multiple Crop Model Training Program;
- Develop an inventory of available Data for Calibrating Genetic Coefficients and Data for farm survey yields that are needed for training;
- Select regions, study sites, and teams that are to be targeted, and prepare a summary of each to discuss in the training.

Opening remarks and expectations

Dr. Dileepkumar Guntuku, PI for the South Asia Regional Coordination Team, welcomed the delegates and participants from South Asia, Sub-Saharan Africa, AgMIP Leadership team members, and other AgMIP members and asked to include multiple models, scenarios, locations, scales, crops, and participants to explore uncertainty and the impact of data quality and methodological choices. He requested to collaborate with regional experts in agronomy, economics, and climate to build a strong basis for applied simulations addressing key climate-related questions.

Dr. Peter Craufurd welcomed all and thanked the leaders, trainers and participants of AgMIP for their interest and hard work. Dr. Ken Boote, from the University of Florida, gave an overview on the AgMIP Multiple Crop Model Training Program, its various activities and also briefed about the plan for the 5-day training program.

Day 1: Overview of DSSAT and APSIM crop models

Dr. Ken Boote explained the course objectives and gave an overview of the program. In his presentation he highlighted the importance of Model Improvement and Intercomparison, and Climate Change Multi-Model Assessment. He clearly stated that it is not a beginner's crop modeling course and that the main emphasis would be on the use of crop models to account for yield variability attributed to farm management, soils, and long-term weather. He explained that the results will be used by economists. Later, he presented an Overview of DSSAT growth and phenology.

Dr. John Hargreaves presented an overview of APSIM crop growth and phenology where he covered various aspects of phenological development, leaf development, biomass production, leaf senescence, and root development.

Later, Dr. Boote discussed the principles of genetic coefficient calibration. He explained various ways to determine genetic coefficients and of estimating cultivar coefficients using field data.

Day 2: Overview: consideration of soils and management; parallel DSSAT and APSIM sessions; exploration of soil, weather, management, and crop data; understanding model-specific genetic coefficients; feedback on progress and issues

Day 2 started with Dr. Gerrit Hoogenboom's presentation: Initializing Soils and Management for Reliable Simulations. He insisted in providing accurate soil and crop coefficient inputs for better simulations. He also highlighted the importance of initial conditions and cropping history of the fields which are critical inputs for crop models.

Each participating team (i.e. South India, Southern Africa, Eastern Africa, Sri Lanka, Indo-Gangetic Basin, and CIWARA) presented their fast track results. Then participants broke out into two groups (APSIM and DSSAT) for parallel sessions. In these parallel sessions, teams worked with the collected data for calibration of genetic coefficients and had hands-on exercises in learning procedures for inputting new crop, soil, management, and weather data for their new crop model; and entering new experiments for use in estimating GCs for their new crop model. The trainers in DSSAT and APSIM helped the participants in the exercises.

During Day 2, Ken Boote and Gerrit Hoogenboom met individually with each team to specifically look at model files created by each team, to ensure proper file creation so that crop models correctly considered crop inputs such as fertilizer N, irrigation or paddy, crop residue, and soil organic C pools. They evaluated team methods for setting genetic coefficients for their selected cultivars, as well as simulating farm survey yields.

Day 3: AgMIP Protocols and Integrated Assessments

The teams were satisfied with the idea of parallel sessions as these provided a lot of insight, as well as answers to issues within and across the teams. Ken Boote and Cheryl Porter gave presentations on the Goals of AgMIP Integrated Assessments: creating economic inputs and results for DSS and AgMIP tools and procedures for integrated assessment. Ken Boote explained in detail the steps associated with integrated assessments. He described the AgMIP tools and procedures for using farm household survey data to create input files that are formatted for use in different crop models. He also described the crop model output files that are needed for input to the economic models for integrated climate assessments.

Cheryl Porter explained the IT Tools used for creating model-ready files using DOME, QuadUI, and ACE-ACMO-DOME Desktop utilities. She also talked about the types of Simulations for Integrated Assessments and the steps to survey data simulations. Finally, she informed of the changes in IT Tools since the regional workshops.

In the afternoon, AgMIP leadership members reviewed the fast track results of each team and clarified issues related to model calibration and the Matched Data Approach in simulating survey data.

Day 4: AgMIP integrated assessments; analyzing farm production; using AgMIP tools to handle missing data; verify inputs and simulate productivity

Day 4 started with a plenary session by Ken Boote, with the presentation Methods for Analyzing Farm Survey Observed and Simulated Production.

In his presentation, Dr. Boote explained in detail the steps involved in integrated assessment. He explained the distinction between matched observed and simulated data and unmatched data. He also highlighted that the Data Overlay for Multimodal Export (DOME) is a file type that is used by AgMIP tools to provide additional data needed for the crop models, but which is missing from the field survey data. Further in his presentation, he also explained the Guidelines for Analysis of Crop Model Simulated Outputs for Matched Fields and bias correction.

Participants worked in break out groups and parallel sessions continued. They also had hands-on exercises on the use of AgMIP IT tools using their respective team's farm survey data.

Day 5: Seasonal analyses; multiyear simulations, ACMO files, collaborative preparation of reports

Dr. Hoogenboom gave a presentation on Seasonal Analyses with Multiple Weather Years, Evaluating Uncertainty and Risk Using Models. The parallel sessions continued and teams worked with their survey data to conduct multiple year simulations using IT tools with two crop models (DSSAT/APSIM). After successful calibration of the models, each team ran the two models with survey data using AgMIP IT tools. Finally, each team presented their brief report on their model outputs for each climate change scenario.

Appendix I: AgMIP SA and SSA participants identified issues relevant across the different project teams.

1. Team-wise fast track analysis data was reviewed by AgMIP leadership.
2. The concept of MCM training worked well as the majority of the participants expressed their satisfaction over the structure of the training program.
3. The concept of trainers training trainees was very effective and needs to be replicated by the respective teams by conducting boot camps based on specific needs.
4. Availability and access to data, especially climate data (temperature and radiation), and farm survey data is needed for economic models.
5. Reliance on existing datasets: cannot conduct new experiments to acquire data as required for calibration and validation. Accessing already available datasets such as crop yields and genetic co-efficient is a big challenge because most of the teams are having issues with the data.
6. Development and Training on new AgMIP tools, especially for rice crop, is the topmost priority (DOME for Rice is needed that incorporates puddling aspects)
7. Sri Lanka team required further training on DSSAT model and required to obtain good data sets for calibration of sugarcane crop.
8. South India (AP) & Sri Lanka teams need refresher on TOA-MD Model and Climate analysis.

Opportunities for training

As the members in the different teams had hands-on exercises in different crop models, they can plan to replicate these trainings to build capacity within the team and beyond:

Target groups	Mode
Graduate Students	Creating interest and awareness on climate analysis and crop modeling, either by providing training or including topics in their curriculum.
Senior Research Fellow and Fellow Scientists	Providing hands-on training regularly to build the team on crop modeling/climate.
Policy makers	Keep informed about the outcomes by short training/meeting through status reports, fact sheets.

Suggested further capacity building (Team wise)

Sri Lanka	South India	IGB	Pakistan & SSA
DSSAT and Climate modeling	Climate modeling and Infocrop	Climate modeling and Infocrop	Climate modeling

Appendix II. Workshop agenda and detailed program



AgMIP Multiple Crop Model Training Program

25-29 March 2013

ICRISAT
Andhra Pradesh, India

Program

Day/Date/Time	Session	Facilitator
Day 1 Monday 25 March	Overview: Overview of DSSAT and APSIM crop models, specifically how phenological development, growth and yield, and soil water dynamics are modeled, and overview of the genetic coefficients needed for each model.	
0800-0830	Registration	
0830-0900	Plenary Session - Welcome	G Dileepkumar
	Introductions – each participant	All
	About AgMIP Project	Peter Craufurd
0900-0940	Course objectives, overview of program	Ken Boote
	A broad overview and discussing APSIM, DSSAT including AgMIP Integrated Assessment perspective	
0940-1000	Group Photo, Tea/Coffee break	
1000-1100	Overview of DSSAT growth and phenology	Ken Boote
1100-1200	Overview of APSIM growth and phenology	John Hargreaves
1200-1300	Lunch	
1300-1400	Principles of genetic coefficient calibration	Ken Boote
1400-1430	Discussion – Issues with data and calibration	Instructors
1430-1445	Tea/Coffee Break	

1445-1700	Parallel Sessions: DSSAT and APSIM Groups Model installation and operation Example calibration of genetic coefficients Procedures for inputting new crop, soil, management, weather data. Entering new experiments for use in estimating GCs	
1700-1730	Plenary Session: Discussion of progress, issues	Instructors
1830	Welcome Dinner	
2030-2130	Optional Session for review and refinement of data, prior calibrations, methods	
Day 2 Tuesday 26 March	Overview: Consideration of soils and management; parallel DSSAT and APSIM sessions; exploration of soil, weather, management, and crop data; understanding model-specific genetic coefficients; feedback on progress and issues; optional evening session for review and practice.	
0830-0930	Plenary Session: Initializing soils and management for reliable simulations	G. Hoogenboom
0930-1200	Parallel Sessions: DSSAT and APSIM Groups Work with participant's data (use AgMIP IT tools as available to convert files); review their prior simulations. Soil Weather Management Crop observations Verifying inputs and simulations	
1200-1300	Lunch	
1300-1700	Continue Parallel Sessions: DSSAT and APSIM Groups Model-specific genetic coefficient lectures Calibrate model for genetic coefficients	
1700-1730	Plenary Session: Discussion of progress and issues	
1930-2100	Optional Session for review, work, and practice	

**Day 3
Wednesday
27 March** **Overview:** Continue parallel sessions, undertaking genetic coefficient calibrations; present findings in plenary; utilize AgMIP tools and procedures for integrated assessment; initiate field survey data analysis; optional evening session for review, work and practice.

0830-1200	Parallel Sessions: DSSAT and APSIM Groups Participants complete estimation of genetic coefficients Prepare summary graphs, report	
1200-1300	Lunch	
1300-1400	Plenary Session: Presentation of genetic coefficient calibrations (5 minutes each)	
1400-1445	Discussion of calibrations, feedback, recommendations to teams for follow-up	Instructors
1445-1500	Tea/Coffee Break	
1500-1530	Plenary Session: Goals of AgMIP integrated assessment (creating economic inputs & results for DSS)	Ken Boote
1530-1630	AgMIP tools and procedures for integrated assessment Use AgMIP Tools to complete entry of field survey data Create Overlay for “missing” initialization/management Convert field survey data into model-ready forms	Cheryl Porter
1630-1700	Individual Study in Plenary: Participants working on their field survey data	
1700-1730	Discussion	
1930-2100	Optional Session for review, work, and practice	

**Day 4
Thursday
28 March** **Objectives:** AgMIP integrated assessments; analyzing farm production; using AgMIP tools to handle missing data; verify inputs and simulate productivity; analyze, bias correct, interpret, question reliability/believability of findings.

0830-0900 **Plenary Session:** Ken Boote
Methods for analyzing farm survey observed and simulated production

0900-0915 Discussion

0915-0930 Tea/Coffee Break

0930-1200 **Parallel Sessions: DSSAT and APSIM Groups**
Verify inputs (management, soils, IC, cultivar) & simulate
Analyze simulated results, mean, cumulative probability
Compute bias and determine if adjustments are needed
Are results reliable? Believable?

1200-1300 Lunch

1300-1700 **Parallel Sessions: DSSAT and APSIM Groups**
Verify inputs (management, soils, IC, cultivar) & simulate
Analyze simulated results, mean, cumulative probability
Compute bias and determine if adjustments are needed
Are results reliable? Believable?

1700-1800 **Plenary Session:**
Discussion of problems and issues

**Day 5
Friday
29 March** **Objectives:** Seasonal analyses; multi year simulations, ACMO files, collaborative preparation of reports (for presentation by selected trainees); presentation; feedback on training.

0830-0900 **Plenary Session:** G. Hoogenboom
Seasonal analyses with multiple weather years

0900-1030 **Parallel Sessions: DSSAT and APSIM Groups**
Conduct multi-year simulations for integrated assessment

1030-1045 Tea/Coffee Break

1045-1200	Participants create ACMO files from survey year and Multi-year simulations (ready for economists)	C. Porter
1200-1300	Lunch	
1300-1500	Participants collaborate to prepare summary graphs and short report for presentation by selected trainees	
1500-1600	Plenary Session: Participants present reports (10 min each) Trainers will critique and discuss results	
1600-1630	Participant Feedback: what worked, what is needed, follow up actions	
1630	End Training	

Appendix III. Participants for the first AgMIP South Asia workshop on integrated regional coordination in ICRISAT, India, 25-29th March 2013.

List of Participants

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