AgMIP Training Program: Multiple Models and Tools


November 2013
Multi-Model Courses in Nepal and India – March 18-22, 25-29, 2013
Multi-Model Course in Nepal
Multi-Model Course at ICRISAT
Reasons for Multi-Model Course

- **Premise:** Multi-model assessments of climate impact and integrated regional assessment are encouraged by AgMIP, with the philosophy that an ensemble of models is a better predictor than any single crop model, along with giving information on uncertainty associated with the models.

- **The Need:** UK-DFID funded scientists wished to learn to use more than one crop model and needed training.

- **The Result:** AgMIP leaders developed training courses for DFID-funded scientists to train in use of multiple crop models (APSIM and DSSAT) along with use of AgMIP IT tools for entering experiment and yield survey data, converting to model-ready files, simulating farm survey fields, and simulating climate-change ratio (future / current).
Brief History of Crop Modeling Courses

- **Early Efforts with Crop Modeling Courses**
  - 1981: Dept TPE, Wageningen Agricultural University, see 1983 book, Simulation of Plant Growth and Crop Production, Penning de Vries and van Laar.
  - 1985: Jones, Boote, Wilkerson, Peart, & Curry taught a 1-week crop modeling course at UF, Gainesville.
  - 1986 to present: IBSNAT/DSSAT conducted 6 to 10-day courses annually, 19 in US, 15 at international sites.
  - Mid-1980s to mid-1990s: Dutch SARP project in East Asia, conducted courses at Wageningen & int’l sites
  - EPIC: in-house training by J. Williams
  - APSIM: (training of some type)
  - CropSys: web-based training
Approaches in Modeling Courses

• **Typically**, lectures interspersed with hands-on use of software, along with exercises and feedback time.

• **Lectures**: Cover principles of crop phenology, crop C balance, crop-soil water balance, soil-plant N balance, genetic traits, model calibration, model sensitivity analyses.

• **Hands-on Use of Software**: Installing, entering data for weather-soils-crops, running the models, visualizing, and analyzing simulated outputs.

• **Exercises**: water-limited production, N-limited production, entering weather, creating soils, evaluating climate-weather effects, calibrating cultivar traits, seasonal risk analyses, crop sequence-rotation, and a special topic.
Planning the Multi-Model Training Course

• **Survey potential participants:** learn extent of their prior experience with crop models, which one, and which model they want to learn (DSSAT or APSIM).

• **Pre-requisites:**
  - Identify & come with sentinel site experimental data (already running for their current model), which they will use for calibrating cultivar traits.
  - Come with farm survey yield data and associated management and soils information.
  - Come with historical yield survey year weather
  - Identify 30-year current baseline weather

• **Come with their own portable computer:**
Multi-Model Course in Nepal
Multi-Model Course in Nepal

12/20/2013
Multi-Model Course at ICRISAT
Multi-Model Course at ICRISAT
Multiple Crop Model Training Program

25-29 March 2013
ICRISAT, Patancheru, Andhra Pradesh, India
Train the Trainers

- **Concept or Goal:** To build crop modeling capacity in these regions, by developing individuals with potential to become future instructors/trainers of other crop modelers.

- **Selection:** Selected candidates having good crop modeling skills, along with good leadership and teaching potential.

- **Honor:** Recognition of perceived ability in crop modeling, leadership, and mentoring ability.

- **Function during course:** Requested to take active role during course to mentor colleagues as appropriate to their model and crop expertise.

- **Instructor guidance:** Instructors gave advice to the train-the-trainers in how to solve problems and mentor.
Train the Trainers (Six)

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Dakshina Murthy, Patricia Masikati, Guillermo Baigorria
The Syllabus: Conducting the Course: Days 1 & 2

• Day 1
  – Course Objectives and Goals
  – Overview of DSSAT (phenology, growth, water dynamics, cultivar traits)
  – Overview of APSIM (same)
  – Principles of genetic coefficient calibration
  – Install new crop models and run them
  – Learn procedures for inputting data in the new model

• Day 2
  – Plenary lecture on soils and crop management
  – Parallel sessions with each crop model: Learn the model, enter soil, weather, management, and crop observations.
  – Calibrate model-specific cultivar coefficients from sentinel experiment data.
The Syllabus: Conducting the Course: Days 3 & 4

• Day 3
  – Plenary: Present results of calibrating genetic coefficients. Get feedback and recommendations
  – Lecture and demonstration of AgMIP IT Tools for entering farm survey data and experimental data
  – Participants entered farm survey yields and management data

• Day 4
  – Plenary lecture on goals of AgMIP integrated assessment and advice on how to analyze farm survey simulations
  – Students continued to enter farm survey yield and management.
  – Assisted students in creating Data Overlay files to fill in assumptions for missing management & soils information.
  – Assisted students in conversion of files into model-ready files, running the models, and interpreting frequency distributions of yields across farmers.
The Syllabus: Conducting the Course: Day 5

- **Day 5**
  - Plenary lecture on seasonal analysis with multiple weather years as a way to analyze risk probabilities.
  - Students conducted multi-year simulations using the seasonal strategy tools with auto-sowing, for both current and one future climate scenario.
  - Students computed climate change ratio per farm (30-yr mean of future / 30-year mean of current).
  - Demonstrated use of IT Tools for putting simulated yields into ACMO harmonized format, ready for economists.
  - Students prepared reports, and presented their results.
  - Participant feedback of what worked and what did not work during the course.
Experiences: What Worked and What Did Not Work

• What did not Work
  – Some participants were not sufficiently experienced & should have had a beginning course first. This course deleted many basic lectures and hands-on exercises.
  – Number of participants (40) was too many at ICRISAT.
  – IT Tools (QUADUI and DOME) worked well for initial entry, but conversion to APSIM files encountered difficulty, working only for maize.

• What Worked
  – Train-the-trainers idea worked well, and provided extra advising-mentoring expertise (on models and crops) to the participants.
  – Installation and model setup on laptops worked well.
  – Separate 20-30 min breakouts were held with each team, to look explicitly at model input files to verify correct entry and setup of the files. Many issues were discovered which would not have shown at face-value in a report.
Experiences: What Worked and What Did Not Work

• **What did not Work**
  – None of the students successfully parameterized the soil C modules, whether DSSAT-CENTURY’s SOM3 pool or the APSIM fraction inert soil C pool.
  – *Conclude:* Correct setting of soil C pools is a major difficulty in crop models for use in degraded soil conditions.
  – Insufficient time for discussing yield distributions of simulated vs observed farm yields, or of climate change scenarios or climate change ratio.

• **What Worked**
  – Feedback at end-of-day was valuable to see progress and resolve problems.
  – Use of IT Tools served as a testbed, encouraging resolution of problems by IT Team.
Conclusions and Next Steps?

• **Success**
  – Additional scientists now capable in using more than one crop model.
  – Modelers learned that concepts across crop models are similar, but may be implemented differently.
  – Scientists were able to learn enough to move on to the multi-model simulations for integrated assessment.

• **Next Steps**
  – Consider distance education training module
  – New Train-the-Trainers return home, to use multi-modeling in their research, host training sessions, and introduce crop modeling in their institutions and universities