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EasyGrapher v4.6: Software for Data Visualization and Statistical Evaluation of the DSSAT v4.x and the CANB v4.0 models

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Introduction

- EasyGrapher is a software package designed by Agriculture and Agri-Food Canada for graphical and statistical evaluation of the DSSAT (Decision Support System for Agro-technology Transfer) and CANB (Canadian Agricultural Nitrogen Budget) models.
- EasyGrapher v4.6 for DSSAT is designed for DSSAT v4.x. It can graph 16 DSSAT outputs, including plant growth, soil nitrogen, carbon, water and temperature. EasyGrapher calculates evaluation statistics (RMSE, E, EF, and d) to evaluate the simulated results with the measured data.
- EasyGrapher v4.6 for CANB is designed for Canadian Agricultural Nitrogen Budget (CANB) v3, v4 model. It can graph or export data to MS Excel for more than 500 spatial-temporal outputs.

Program design

- EasyGrapher is written using Microsoft Visual Basic .NET. It functions by automatically calling a Microsoft Excel application to perform a series of graphical operations.
- Three files from the DSSAT model are used as input files for EasyGrapher: Time-series, summary, evaluation outputs (.OUT); measured file (.T) and DSSAT label file DATA.CDE.
- The graph outputs from EasyGrapher are displayed in the MS Excel 2002-2016 application as data sheets and graphs.

Program interface

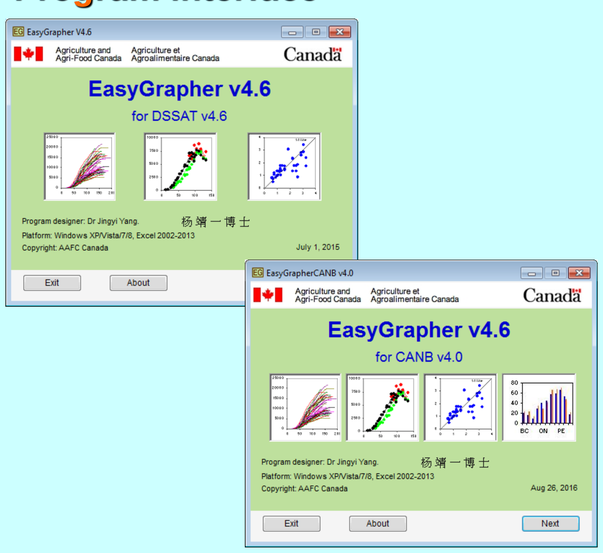

Fig. 1. EasyGrapher startup interface.

Five interfaces are designed for EasyGrapher.

- A startup interface with the initial start options.
- An “Open file" dialogue box is used to select graph files.
- A “Select data to display" interface allows users to select Y, X-variables and treatments (RUN).
- A "Progress" interface is displayed when the program is running.
- The appearance of the MS Excel program on the screen when EasyGrapher ends.

DSSAT time-series graph

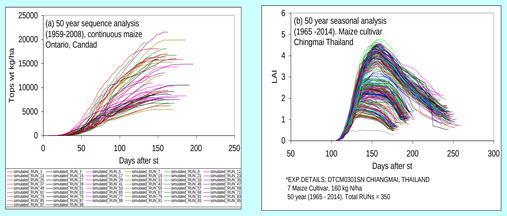

Fig. 2. (a) Time-series aboveground biomass versus crop age (from a 50 year long term field experiment, Ontario, Canada) using DSSAT sequence analysis; (b) leaf area index versus crop age (from 7 cultivars over a 50 year maize experiment, DTCM0301, Changmai, Thailand) using DSSAT seasonal analysis.

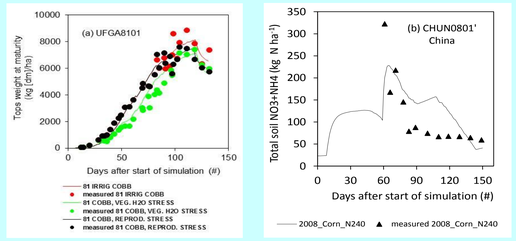

Fig. 3. Time-series graph with measured data; (a) aboveground biomass versus crop age (DSSAT soybean experiment, UFGA0801), (b) soil mineral N (kg N ha^{-1}) versus crop age (maize, CHUN0801, China).

DSSAT evaluation graph

Thirteen evaluation statistics are calculated by EasyGrapher using both measured and simulated data, four evaluation statistics are shown in the graphs:

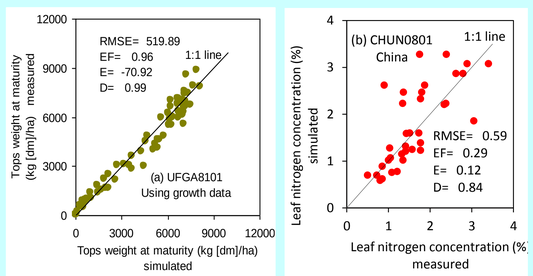

Fig. 4. Evaluation graphs and associated statistics; (a) Evaluating soybean aboveground biomass using crop growth data (USA soybean UFGA8101), (b) evaluating leaf N concentration (%) using crop growth data (China maize,CHUN0801).

DSSAT summary graph

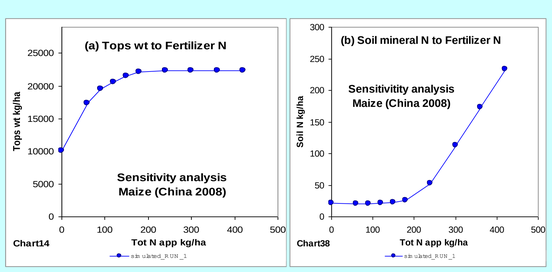

Fig. 5. (a) Sensitivity analysis of biomass and (b) soil mineral N to fertilizer N rates.

CANB graph

The CANB v4.0 has 260 input files, 248 intermediate output files and 150 output files at SLC scale, Eco-regional scale, provincial and Canada scales as below.

	Scales				
File folder	SLC	Ecoregion	Province	Canada	Total
Input	217	1	31	11	260
Inter-out	248				248
Output	124	9	13	4	150
Total	589	10	44	15	658

Editing and managing these data files are time consuming. EasyGrapher for the CANB version is designed to carry out graphical display and data export to MS Excel sheet more efficiently.

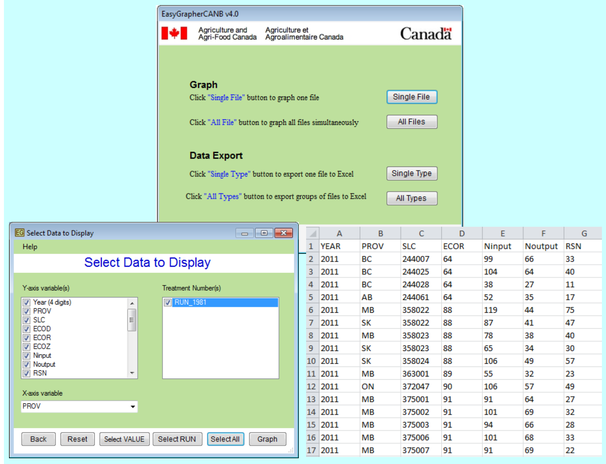

Fig. 6. “Graph” and “Data Export” interface in EasyGrapher v4.6 for CANB v4.0.

Two figures below show graphic examples when clicking “Single File” under “Graph”.

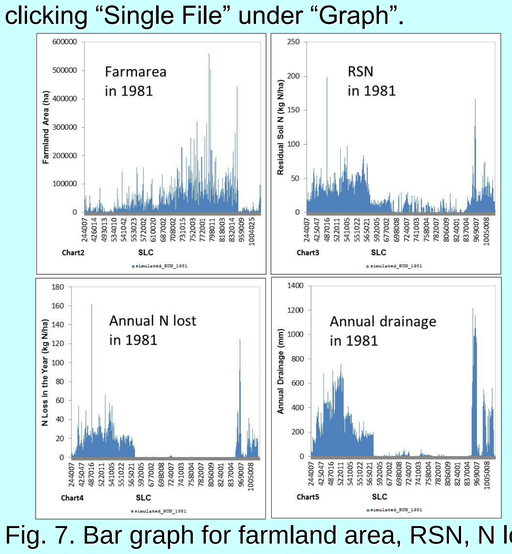

Fig. 7. Bar graph for farmland area, RSN, N lost and drainage at SLC scale in 1981.

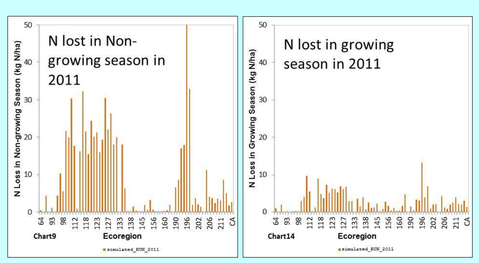

Fig. 8. Bar graph for N lost from non-growing & growing seasons at Ecoregion scale in 2011.

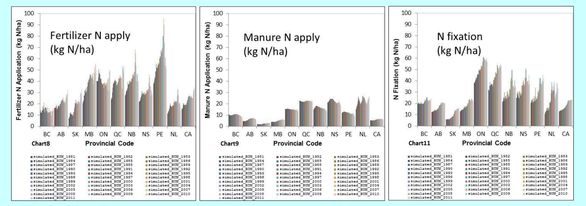

Fig. 9. Bar graph for annual N input from fertilizer N, manure N and N fixation at provincial scale.

CANB data export

By clicking the “Single type” button, all 31 output files from 1981 to 2011 can be automatically saved in one “slc RSN.xlsx” file with one spreadsheet for each year from 1981 to 2011. In summary, total 589 CANB I/O files can be exported to 19 Excel files as shown below.

File folder	Files at SLC	Data Export
Input	7 x 31 year	7 file, each with 31 sheet
Inter-out	8 x 31 year	8 file, each with 31 sheet
Output	4 x 31 year	4 file, eahc with 31 sheet
Total	589 I/O files	19 Excel files

EasyGrapher help manual

Two EasyGrapher help manual were written using the Help and Manual v6.0 program, one for EasyGrapher for DSSAT and the other for EasyGrapher for CANB. The help manual (press F1 key to invoke the help files) contains contents, index and search capabilities similar to other software.

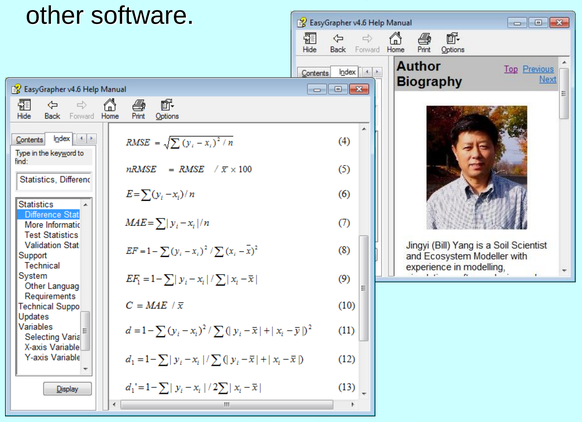

Fig. 10. Example of EasyGrapher help manual.

Program limitation

There is no internal integration of the I/O data between EasyGrapher and DSSAT. When using EasyGrapher to graph DSSAT outputs, users should set up the daily output interval = 1 day in order to match all measured outputs.

Acknowledgements

We recognize financial support from Agriculture and Agri-Food Canada (AAFC). We specially thank AAFC-Harrow Research Centre - IT team for providing us supports in developing EasyGrapher software. We thank DSSAT team for providing support in testing EasyGrapher and integrating it with the DSSAT 4.x package for international use. We also thank our co-op student programmers from the University of Waterloo for updating EasyGrapher to the latest version of the MS Excel, and Visual Studio.NET compiler each year.