APSIM Next Generation, an improved environment for crop model development and deployment

Hamish Brown, Dean Holzworth, Neil Huth, Al Doherty, Edmar Teixeira
A Good Model Should Be:

- Accurate
- Documented
- Reliable
- Adaptable
- Available
Building an Accurate Model

1. Collate Crop Data
2. Abstract a Model
3. Implement into Code
4. Create Situations
5. Run Model
6. Compare Model Results
7. Adapt Model
UI facilitates model building

Tuber Yield Comparison

\[ y = 1.00 \times + 310.19, \quad r^2 = 0.94, \quad n = 39 \]

NSE = 0.92, ME = 284.09, MAE = 456.00
RSR = 0.27, RMSD = 573.26

Predicted Fresh Tuber Yield (g/m²)

Observed Fresh Tuber Yield (g/m²)
Collating Observed Data

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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<th></th>
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</thead>
<tbody>
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<td>12.98</td>
<td>5.53</td>
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<td>56.43</td>
<td>63.2</td>
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<td>180.07</td>
<td>413.71</td>
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<td>138.61</td>
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<td>117.59</td>
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<td>87.22</td>
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<td>92.96</td>
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<td>129.45</td>
<td>124.32</td>
<td>419.43</td>
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</tr>
</tbody>
</table>

Simulations complete [30.19 sec]
Implementing Crop Models

[Diagram showing a spreadsheet with columns X and Y, and a graph plotting FT against weighted air temperature (°C)].
Plant Modelling Framework: Software for building and running crop models on the APSIM platform

Hamish E. Brown a, *, Neil I. Huth b, Dean P. Holzworth b, Edmar I. Teixeira a, Rob F. Zyskowski a, John N.G. Hargreaves b, Derrick J. Moot c

a The New Zealand Institute for Plant & Food Research Limited, Private Bag 4604, Christchurch, New Zealand
b CSIRO Ecosystem Sciences/Sustainable Agriculture Flagship, PO Box 102, 4350 Toowoomba, Australia
c Faculty of Agriculture and Life Sciences, P.O. Box 85084, Lincoln University, 7647 Canterbury, New Zealand
Simulating Observed Situations
Comparing Model Results

Tuber Yield Comparison

\[ y = 1.00 x + 310.19, \text{r}^2 = 0.94, n = 39 \]

- NSE = 0.92
- ME = 284.09
- MAE = 456.00
- RSR = 0.27
- RMSD = 573.26

Predicted Fresh Tuber Yield (g/m²) vs. Observed Fresh Tuber Yield (g/m²)
### Comparing Model Results

#### Variable Comparison Table

<table>
<thead>
<tr>
<th>Variable</th>
<th>Test</th>
<th>Accepted</th>
<th>Current</th>
<th>Difference</th>
<th>Fail?</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>to.TotalLive.N</code></td>
<td>n</td>
<td>25.0000</td>
<td>25.0000</td>
<td>0.0000</td>
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</tr>
<tr>
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<td>Intercept</td>
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<tr>
<td><code>to.TotalLive.N</code></td>
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<tr>
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<td>35.0000</td>
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<td>Intercept</td>
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<td>1141.2038</td>
<td>0.0000</td>
<td></td>
</tr>
</tbody>
</table>

Manager script compiled successfully
Comparing Model Results

The graphs show the comparison of model results for different parameters:

- **Tuber Fresh Weight**
- **Tuber Dry Weight**
- **LAI (Leaf Area Index)**
- **Cover**

The graphs display data over time, with dates ranging from 01-Mar onwards, illustrating the dynamic performance of the models under comparison. The graphs are visual representations of the simulation outcomes, highlighting trends and variations in the parameters over the evaluated period.
Model Documentation

Source Code

Model classes

Documentmentor

Crop.xml
Structure
Parameters

Crop.apsimx
Descriptions
Graphs

APSIM User Interface

Model documentation

Overview
Model documentation

Models
- Writing a model
- Coding Style
- Model Testing
- Attributes
- Path specification
- Unit specification
- Model scrape

Documentation for build 309 Friday, March 4, 2016

Maize
OilPalm
SCULM
Slep
SoilArbitrator
SoilNitrogen
Wheat
Report
Menu

The New Zealand Institute for Plant & Food Research Limited
The Build System

**Developers**

- Change code
- Add tests
- Add models

**Users**

1. APSIM
2. Run Simulations
3. Save the world

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The New Zealand Institute for Plant & Food Research Limited

The Build System

**Developers**

- Change code
- Add tests
- Add models

**w.w.w.**

**GitHub**

**Jenkins**

**Users**

**APSIM**

Run Simulations

Save the world

Save the world
The Build System

Developers

- Issue #231
- Change code
- Add tests
- Add models

GitHub

- Pull Master (code)

Jenkins

- Run Simulations

Users

- Save the world

w.w.w.

- Master (code)

APSIM
The New Zealand Institute for Plant & Food Research Limited

The Build System

Developers

GitHub

- Master (code)
- Branch
- Issue #231
- Change code
- Add tests
- Add models
- Pull request
- Pull
- Merge ??
- Issue #231

Jenkins

- Run tests

w.w.w.

- Master (code)

Users

APSIM

- Run Simulations
- Save the world
The Build System

Developers

- Branch
- Issue #231
- Change code
- Add tests
- Add models

GitHub

- Pull
- Master (code)
- Merge ??
- Issue #231

Jenkins

- Run tests
- Release files

w.w.w.

- Pull
- Master (code)

Users

- Pull request
- Issue #231

APSIM

- Run Simulations
- Save the world
Reliability

New model or major change proposed

Submit change request

Review and recommend approach

APSIM Build System

Implement as APSIM prototype

APSIM Reference Pannel
The New Zealand Institute for Plant & Food Research Limited

Reliability

New model or major change proposed

Submit change request

Review and recommend approach

APSIM Build System

Implement as APSIM prototype

Submit model, description and validation for review (as .apsimx file)

Review model quality

APSIM Reference Panel

Released Model
Including validation, documentation and tests
Reliability

New model or major change proposed

Submit change request

Review and recommend approach

Review

model quality

APSIM Build System

Implement as APSIM prototype

Submit model, description and validation for review (as .apsimx file)

APSIM Reference Pannel

Ensure released models and user interface are working as intended

Released Model
Including validation, documentation and tests

Ongoing testing

Oversee APSIM quality
Adaptability

Language Barriers Inertia Colateral damage

APSIM NextGen
Availability

Freely available for non-commercial use

APSIM Initiative Product Registration

To download software you must complete the registration form below. All fields marked with an asterisk (*) are mandatory.

Product to download*: APSIM

Version*: Next Generation

Continious updates
Where to for APSIM next Gen

To replace current version of APSIM

• Transfer crop models from APSIM 7....
  o Recode into Plant Modelling Framework
  o Build validation set
  o Complete documentation

• Transfer other functionality
  o Stock models
  o Soil model alternatives

• Ongoing user interface improvement