The Crop Ontology (CO) and Trait Dictionaries of the Integrated Breeding Platform

www.cropontology.org

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Bioversity International
Generation Challenge Programme - Project PI
Crop trait ontology workshop, OSU, 13-15 September 2012
The CGIAR Generation Challenge Programme

http://www.generationcp.org/

- use genetic diversity and advanced plant science to improve crops by adding value to breeding for drought-prone and harsh environments.
- assist developing-world researchers to access technologies and access a broader pool of plant genetic diversity.
CGIAR
Generation Challenge Programme

a network of more than 200 partners
Integrated Breeding Platform

- one-stop shop for services to design and carry out integrated breeding projects.

- [https://www.integratedbreeding.net/](https://www.integratedbreeding.net/)
The Crop Lead Centers of the GCP Crop Ontology

With their Crop Communities of Practice
11 crops online

http://www.cropontology.org/

- Banana
- Cassava
- Chickpea
- Common beans
- Cowpea
- Groundnut
- Maize *
- Potato
- Rice
- Sorghum
- Wheat *

Soybase Ontology, USDA & Solanaceae Ontology (SGN)
From Trait Dictionaries to the Crop Ontology

Field trial management

**IB Fieldbook**

- **Category**: Data management and experiment setup
- **Usability**: Easy to use
- **Platform**: Windows
- **Version**: 2.0.0
- **Developers**: Hector Sanchez-Villegas (CIMMYT), Tito Marcon Sanchez (CIMMYT), Oziel Lugo (CIMMYT), Gamaliel Camarena (CIMMYT)
- **Technical Support**: Arlet Portugal, Clarissa Pimentel

The Integrated Breeding Fieldbook (IBFB) designs field trials and produces field books, field plans and labels. Phenotyping data can be saved into a local crop database and submitted for analysis.
Trait Dictionary developed by data managers and Breeders using the GCP Trait Template

Template version 4 for Submission of New trait or modification of exiting trait

This sheet is for submission of details for many traits by rows. Use one row per each new or modified trait. For modifications to the trait list with specified Trait ID you only need to give new/changed values. Eg a new scale or method.

You can find Trait IDs for existing traits in the lists on "Trait Dictionaries for Fieldbook Development" at http://mbp.generationcp.org and http://www.cropontology-curationtool.org/.

<table>
<thead>
<tr>
<th>ibfieldbook</th>
<th>Name of submitting scientist</th>
<th>Institution</th>
<th>Language of submission (only in ISO 2 letter codes)</th>
<th>Date of submission</th>
<th>Crop</th>
<th>Name of Trait</th>
<th>Abbreviated name</th>
<th>Synonyms (separate by commas)</th>
<th>Trait ID for modification, Blank for New</th>
<th>Description</th>
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<tbody>
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Example default INGER Global Coordinator IRRI EN 21/01/2010 Rice Panicle Exsposition EXS Panicle exosposition of male sterile lines CO_320:00000074

Degree of emergence of male sterile flag lines
Upload Trait dictionaries online for curation and sharing
Online Trait Dictionary with methods and scales

Allocation of a unique identifier

Identifier: CO_320:0000275

categorical scale (flag leaf angle)

Creation date: 2011-10-24T11:05:33Z

Created at: Fri Jun 01 13:12:29 UTC 2012

def: '1' Erect
3 Semi-erect (intermediate)
5 Horizontal
7 Descending* [RD:7.3.22]

name: Categorical scale (flag leaf angle)
Edit the Trait Dictionary
Click to edit Master text styles

- Second level

- Third level
  - Fourth level
    - Fifth level

Editing the general information

Editing the list of terms & relationships
Editing the Attribute information

• Click to edit Master text styles
  – Second level
  – Third level
  • Fourth level
  – Fifth level
Standard Traits list for the IB Fieldbook

The most frequently measured or most important traits
Online language versions per crop

<table>
<thead>
<tr>
<th>Crop</th>
<th>Standard list</th>
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</thead>
<tbody>
<tr>
<td>Cassava</td>
<td>ENG, SPA, FRA, POR</td>
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<tr>
<td>Chickpea</td>
<td>ENG</td>
</tr>
<tr>
<td>Common bean</td>
<td>ENG, SPA, FRE</td>
</tr>
<tr>
<td>Cowpea</td>
<td>ENG, FRE</td>
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<td>Groundnut</td>
<td>ENG, FRE</td>
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<td>Maize</td>
<td>ENG, CN</td>
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<td>Rice</td>
<td>ENG, CN</td>
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<td>Sorghum</td>
<td>ENG, FRA, CN</td>
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<tr>
<td>Wheat</td>
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</table>
Access to the available linguistic versions

Language parameter
Building the Crop Ontology from the Trait Dictionary with OBO-EDIT or online

Creating multi-relationships
• Click to edit Master text styles
  – Second level
  – Third level
  – Fourth level
  – Fifth level
Programmatic use of the ontology

Application Programming Interface (API)

Downloadable in RDF (Wageningen collaboration)

PUBLIC & OPEN SOURCE
Cross Referencing and annotation
for data integration across data sources per crop
Legacy Trait names in the Crop databases mapped to the Ontology by curators in the databases
Cross referencing CO to Gramene

Crop Ontology Curation Tool

QTL Associations for Trait Term "anthesis silking interval" from species "Zea mays"

Back to Term TO:0000463

<table>
<thead>
<tr>
<th>Term Name</th>
<th>Object Type</th>
<th>Object Accession ID</th>
<th>Object Symbol</th>
<th>Object Name</th>
<th>Object Synonyms</th>
<th>Object Species</th>
<th>Evidence</th>
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Pheno
Trait identifier of CIMMYT database

xref [Gramene Plant Trait Ontology:IMIS_TRAITID:0000463]
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<th>Max Position</th>
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Cross referencing variables measured of Agtrials
Looking Forward for CO

• Add new crops: barley, pigeon pea, sweet potato, yam
• Add translations
• Add the Crop wild relative ontology
• Cross reference with main data sources
• Used as data search tool for the Integrated Breeding Platform- iPlantCollaborative
• Automatic submission to PO and TO
• Contribute to the Reference Plant Trait Ontology
Crop Ontology Community of Practice