MaizeGDB is a community-oriented, long-term, federally funded informatics service to researchers focused on the crop plant and model organism Zea mays.
Traits and Phenotypes

Data standards

1. *Crop Ontology, Trait Ontology Gramene*
2. *Phentotype RCN*
3. *Plant Ontology*
4. *GRIN Descriptors for Maize*
5. *MaizeGDB trait list and categories,*

Current data sources

M Gerry Neuffer  3200 mutant descriptions
Maize Diversity Project panzea.org
Maize Genetics Cooperation Stock Center
Liguleless: Ligule and auricle of the leaf are missing, leaves upright

PO:0020106 leaf sheath auricle
PO:0020105 ligule

1995 phenotypes assigned developmental stages, body parts broader/narrower relationships

2003 zea anatomy terms refined and restructured
Vincent PLD; Coe EH; Polacco ML 2003. Trends in Plant Science. 8:517-520.

2005 PO terms added and associations provided to PO

2012 PATO for phenotypes

<table>
<thead>
<tr>
<th>Qualifier</th>
<th>Name / Symbol</th>
<th>Information</th>
<th>Evidence</th>
<th>Reference</th>
<th>Assigned by</th>
<th>Associated to</th>
</tr>
</thead>
<tbody>
<tr>
<td>202A</td>
<td>stock from Zea mays</td>
<td>IMP</td>
<td>MaizeGDB:892690</td>
<td>MGCSC (via MaizeGDB)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In adapted materials in the US Corn Belt, the collars of leaves 9-11 are visible (some of the lowest leaves may already have degenerated by this stage). By 10-leaf stage, new leaves appear every 2-3 days. Tassel development accelerates, and rapid stem elongation continues.

Traits at MaizeGDB

1995 Over 1000 Traits grouped by categories and refined 2005.

Linked to QTL maps and experimental methods, to germplasm, to phenotypes and to literature.

Very little phenotype scoring data.

Schaeffer M; Byrne P; Coe Jr EH. 2006. Maydica 51:357-367.

Example trait

Anthesis-silking interval

Has phenotypes:

decreased anthesis – silking interval
increased anthesis – silking interval
Trait data soon at MaizeGDB from the Maize Diversity Project (Buckler PI)

GBS - phenotypes ‘atlas’ for maize diversity

Phenotype scores for 154 traits in 27 diverse public mapping populations being genotyped by next-gen methods:

**IBM**

Lee M; Sharopova N; Beavis WD; Grant D; Katt M; Blaid D; Hallauer A. 2002. Plant Molecular Biology 48:453-461.

**NAM**

Flint-Garcia SA; Thuillet A-C; Yu, J; Pressoir G; Romero SM; Mitchell SE; Doebley J; Kresovich S; Goodman MM; Buckler ES. 2005. Plant Journal 44:1054-1064.

Example Flowering traits

Days to anthesis
Days to silk
Anthesis-silking interval
GDD days to silk
GDD days to anthesis
GDD anthesis – silking interval

$GDD = \text{Growing degree days}$
**PATO - Phenotype RCN**

Phenotype "leaves upright" has TRAIT: LEAF ANGLE

ENTITIES: LEAF LAMINA and STEM and

ATTRIBUTE: ANGLE

TO: 0000206 leaf angle
PO: 0020039 leaf lamina
PO: 009047 stem
PATO: 0002326 angle

IN PROGRESS (Lisa Harper with Ramona Walls for maize)

Phenotype "leaves upright" has TRAIT: LEAF ANGLE

PO: 0020106 leaf sheath auricle
PO: 0020105 ligule

**Liguleless:** Ligule and auricle of the leaf are missing, leaves upright

**Plant Ontology Use at MaizeGDB - Phenotypes**

MaizeGDB: 892690 (via MaizeGDB)

Mabee M; Deans A; Huala E; Lewis S. 2012 Standards in Genomic Sciences 6: jul. 2012

PATO – Phenotype RCN

Vincent PLD; Coe EH; Polacco ML 2003. Trends in Plant Science. 8:517-520.


1995 Phenotypes assigned developmental stages and 'body parts' using images and phenotypic descriptions provided by MG Neuffer.

2003 Anatomy and development terms refined and categorized. Detailed maize-specific definitions added.

2005 PO terms added; provide association files to the PO for germplasm, genes/gene models.
Is there room for other relations in an Ontology for Traits?

LEAF ANGLE

Obviously Related Traits: middle leaf angle, upper leaf angle

Other Related traits: yield at high crop density

Is a modifies
Phenotype lookup Tool uses PO and GO to search text descriptions in MaizeGDB.

Harnsomburana et al 2011

http://vphenodbs.rnet.missouri.edu/
New Annotation Tool
MaizeGDB is a community-oriented, long-term, federally funded informatics service to researchers focused on the crop plant and model organism Zea mays.

The team:
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Mary Schaeffer USDA ARS @ Crop Ontology Workshop Sep 13-15 2012 Corvallis OR