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Phenotypic Data Exchange and Processing Using ISA-Tab Standard: transPLANT Project Use Case with GnpIS.Ephesis and Bii

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Phenotypic data exchange and processing using ISA-Tab standard

TransPlant project use case with GnpIS.Ephesis and Bii.




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TRANSPLANT, ISATAB FOR PHENOTYPING

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TransPLANT

- 4 year EU FP7-funded project (DG CONNECT) coordinated by EMBL-EBI,
- Until septembre 2015
- An I3 project with elements of coordination, service and RTD
- <http://www.transplantdb.eu/>
- Aims
 - ...
 - Provide of an integrating point of interactive access to diverse data sets
 - Develop common standards for use within transPLANT and a wider community
 - Engage with other related communities to share experiences, tools and roadmaps





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Transplant Standardization

- Work Package 3
 - Community standards for the interoperability of data resources
 - Aim: To develop recommendations concerning annotation and formatting methods of data sets containing phenotypic observations
- Main deliverables
 - Recommended ontology set for use in phenotype description and epigenetic variability
 - Format specifications for data exchange by flat file and web services



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Recommended ontology set

- Ontologies
 - References
 - Plant Ontology, cROP
 - Application Ontologies
 - Species/domain specific
 - Crop Ontology : www.cropontology.org
 - Vitis : Grape Ontology
 - Wheat : Wheat ontology
 - INRA Ontologies
 - EQ, to be developed
 - Chebi, Brenda Enzyme, Golm Metabolome
 - User specific ontology

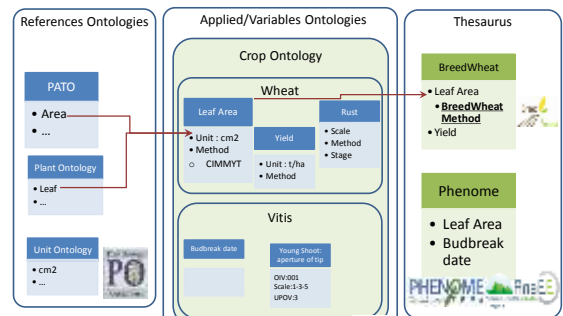



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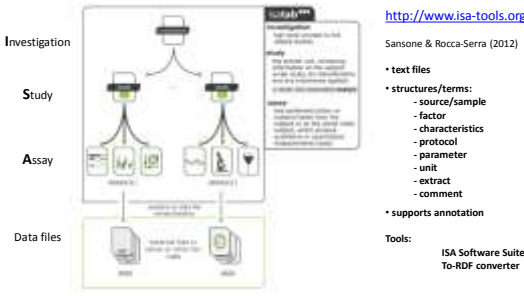
Recommended ontology set




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ISB-TAB format: Investigation/Study/Assay



<http://www.isa-tools.org>

Sansone & Rocca-Serra (2012)

- text files
- structures/terms:
 - source/sample
 - factor
 - characteristics
 - protocol
 - parameter
 - unit
 - extract
 - comment
- supports annotation

Tools:
ISA Software Suite
To-RDF converter



BII USE CASE



Bii

- ISA TAB Archive system
- Index capabilities
- Polapgen/Transplant instance
 - <http://croptnet.pl/transplant-bii/>



Bii manager

- Administrator credentials form



Bii Manager

- Data management



Bii Manager

- Loading ISA-TAB into database





Bii Web interface

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Bii Web interface ISA File informations

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GNPIS USE CASE



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GnpIS

- Integrative information system
 - Plant and bioagressors
 - Multi thematic
 - Genetic
 - Genomic
 - Phenotyping
 - Public and private data : partners, international consortium
- INRA : French National Center for Agronomic Research
- URGI : INRA Research laboratory
 - Production
 - Data integration
 - Development

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GnpIS: user web interfaces

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GNPIS PHENOTYPING DATA



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Phenotyping in GnpIS Ephesis application scientific perimeter

- Phenotype and environment Experimental data
 - Whole Trials
 - Generic : Ontology driven
 - Levels: Whole trial, plot, plant data in experimentation
 - Observation variables : traits, environment, ...
 - Multiple factors
 - Genotype factor is mandatory
 - 0 to n other factors : treatments, stress, etc...
 - Punctual observation or temporal series/kinetic



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Phenotyping in GnpIS Ephesis application scientific perimeter

- Raw or elaborated data
 - Alphanumeric or complex, no images
 - Volume limitation
 - archiving system : Phenome example.
- Integration and interoperability based on Pivot scientific objects
 - Phenotype → GWAS, Genomic Selection, Genotyping, ...
 - Germplasm/plant material
 - Ontologies
 - Project
- Functionalities
 - Phenotyping trial archive
 - Dataset builder
 - Multi trial
 - Multi annual
 - For GxE or Genetic studies



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EPHESIS WEB APPLICATION



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Phenotyping Interface Overview Ephesis

- <https://urgi.versailles.inra.fr/epheis>



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Search criterions overview

- Three tabs
 - Genotype
 - Variables
 - Trial
- Query helper
 - Consistent criterion combination
 - Selection in one list limits choices for the other
 - Autocompletions



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Genotype/Germplasm tab

- Taxon
- Genetic resource accession
- Collections
- Panel (soon)



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Variable tabs

- Ontology driven
- Reference Ontologies
- Specific ontologies
 - Trait
 - Environment

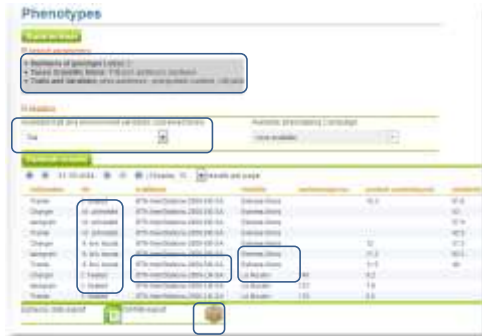


Trial details tabs

- Trial identification
 - ID
 - Name
- Year, Date
- Experimental site



Multi Trial Dataset



Trial Details



GnpIS Ephenis ISA Tab export

- One search result
 - ➔ one ISA archive / investigation
- Each Trial
 - ➔ one study
- Investigation
 - Ontologies declaration
 - Ephenis query parameter, date, version
- Study
 - Trial identification (Number, name, site, date, design, Contacts, ...)
 - Trial Publications
 - Experimental Factors: Cultural practice (itk), nitrogen, water
 - Plant Material list: full Identification (taxon, variety, BRC, Accession Number, Lot Number)+ Isa Archive short ID



GnpIS Ephenis ISA Tab export

- Assays
 - Type: phenotyping
 - Factor Values : low nitrogen, high water....
 - Assay Name : combination of factors : lownitrogen+accession1, lownitrogen+accession2, highnitrogen+accession1, highnitrogen+accession2
- Trait definition file
 - Reference existing ontologies, including Scale, unit, protocol (Crop Ontology, INRA Ontologies, ...)
- Raw data file
 - Not mandatory
 - Not used (volume) can be a pointer/URI to an archive in the future
- Derived Data File
 - Use ID declared in ISA and Trait files
 - Germplasm + Factor = Assay Name
 - Traits
 - As many datafile by assay as needed
 - Trace the transformation protocol (analysis tool, data transformation procedure, etc...)



STANDARDS AND DISTRIBUTED INFORMATIONS SYSTEMS



Transplant
Phenome



GnpIS.Ephesis: Phenome Integrative portal



- French Plant Phenotyping Platform
 - High throughput Phenotyping
 - Field
 - Controlled environment
 - 9 Nodes across France
- Distributed information system
- Open API Web Service
 - Need of a common Phenotyping OpenAPI
 - Need to build a metadata standard
 - PDD
 - Crop research Ontology
 - Distributed index system, document based (SolR, Elastic Search)



Perspectives

- Isa Tab standard dissemination
- Dataset building for analysis
- Phenotype API building
 - Phenome
 - France
 - Europe
 - International
 - Triticeae Toolbox?, IBP?, PDD?, ...

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Aknowledgements

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ZURGI

Thank you

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