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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](http://www.cropontology.org)
      - Vitis : Grape Ontology
      - Wheat : Wheat ontology
    - INRA Ontologies
  - EO, to be developed
  - Chebi, Brenda Enzyme, Golm Metabolome
  - User specific ontology

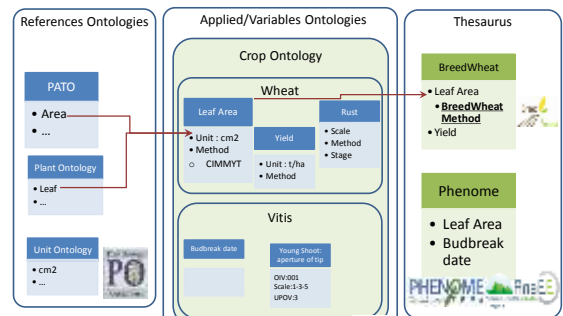



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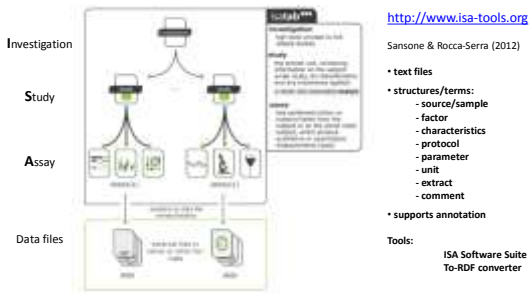
### Recommended ontology set




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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**

**Transversal tools**

- Quick search
- Biomart
- Intermine
- Galaxy

**Thematic tools**

- Genomic
- Synteny
- Sequences
- Polymorphisms
- Markers
- Maps
- QTLs/MetaQTLs
- GWAS, Genomic Selection
- Expression
- Genetic Resources
- Phenotypes

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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

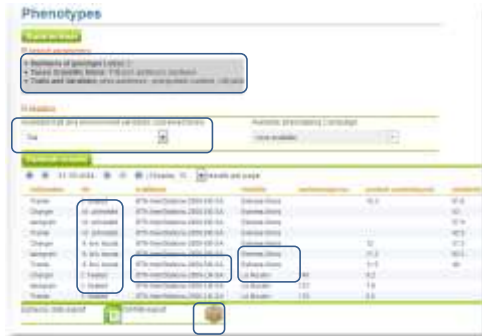


### Trial details tabs

- 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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Thank you

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