# MIAPPE v1.1 proposal for assessment

An extended set of recommendations for metadata and phenotypic data annotation was developed by the EXCELERATE work package 7 team based on the publicly available version of MIAPPE (Ćwiek-Kupczyńska et al. 2016; DOI: 10.1186/s13007-016-0144-4), as presented below. Some Attributes were edited and new ones were added and the details can be seen in column H of the working document https://docs.google.com/spreadsheets/d/1SiUVvauhdNSpAfHgds-vQpjAXYs34lFD8wSOZdkyCgY/edit#gid=989837895 and the main lines of these proposed changes are summarized below:

- Study metadata section : Attributes, definitions and mandatory status aligned on DOI metadata instead on “Default ISA-Tab list for terms and mandatory fields”
- Biosource section: here we aligned further to MCPD, while being non-redundant with details that would be stored in genebanks catalogs. We also aimed at being more generic and include some forest trees specificities for the identification of the plant material.
- Environment sections: most attributes are not mandatory anymore to keep generic across different types of experiments
- Experimental design section: the section has been revised in depth to take into account when relevant ISA-tab vocabulary but also Important description elements for field experiments of crops and forest trees, and for greenhouse experiments
- Sample collection section: samples attributes have all been grouped here and aligned with BioSample specifications that also have been revised in parallel. The objective is to improve the interoperability between phenotyping and genomic/genotyping experiment made on the same accessions/varieties.
- Observed Variables section: this section has been completely revised to be aligned with the Crop Ontology’s specifications

Definition for Attributes in each of the 10 sections (Study metadata, Timing and location of study, Biosource, Environment-growth facility, Environment-rooting conditions, Environment-nutrients, Treatments, Experimental design, Sample collection, processing and management, Observed variables) were included, as well as examples and ontologies/data types that should be used to describe the attributes. Some general guidelines are also provided below for a consistent use of the standard.

**Conventions for the Sample MIAPPE metadata:**

1) If there is a "**Derived Material**" attribute, it should be unique in each sample of the investigation
2) If there is not unique value or non-existent values for "**Derived Material**", then the "**Material Source**" should be unique per sample in the investigation UNLESS in the investigation there are time series
3) For trees: if there is value for either **latitude** or **longitude** there should be value for both.
4) For trees: if there is value for **altitude** there should be value for all three: **latitude, longitude and altitude**.
5) for the definition of the ontologies, the FULL URL of the term is expected
6) "**Material Source**" and "**Derived Material**" cannot have the same value in 1 sample
7) The "**Environment: XXX**" sections should describe the environmental parameters that are measured but are not modified as an experimental factor
8) The "**Treatment**" section should describe a plant experimental condition (EO:0007359) or set of conditions describing the application of an abiotic (EO:0007191) or biotic plant treatment (EO:0007357) or the combinatorial application thereof. The treatment (or Factor) is declared and described at the study level (e.g. Experimental field X) and varies in the different assays of the study (e.g. different plots or plants in the experimental field).

| MIAPPE Check list | Definition | Example | Ontology/data type |
|---|---|---|---|
| **Study metadata** | | | |
| **Unique identifier of study[1]** | Key-value pair comprising the unique name of the institution/database hosting the submission of the study data, and the identifier of the study in that institution. To be filled by the submitter | EBI:12345678 | xsd:string |
| **Submission date*** | Date of submission of the study data to the host institution (given by the host database) | 02-26-2006 | xsd:date |
| **Title of study*** | Human readable string summarising the study | Adaptation of Maize to Temperate Climates: Mid-Density Genome-Wide Association Genetics and Diversity Patterns Reveal Key Genomic Regions, with a Major Contribution of the Vgt2 (ZCN8) Locus | xsd:string |

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| **Description of study[1]** | Human readable string describing the study | Time series response of potato cv. Désirée, which is tolerant to PVY infection, was analysed in both inoculated as well as upper non-inoculated leaves. Additionally, transgenic plants deficient in accumulation of salicylic acid (NahG-Désirée) were studied in the same setting. | xsd:string |
| **Public Release date*** | Date of first public release of the study data. This is filled in by the database when the submission becomes public | 02-30-2006 | xsd:date |
| **Associated publication/s** | DOI of literature publication where the study is described | DOI: 10.1186/1471-2229-13-123 | DOI |
| **Name and address of the laboratory*** | Name and address of the laboratory where the study took place | Forest Biotech Lab, IBET, Av. da República, Quinta do Marquês, 2780-157 Oeiras Portugal | xsd:string |
| **Data submitter contact (email)** | The mail address of the data submitter | ichaves@itqb.unl.pt | xsd:string (valid email address) |
| **Data submitter identifier** | The ORCiD id of the data submitter | orcid.org/0000-0002-7054-800X | ORCiD id |
| **Study data file link** | This is Study level metadata. It is the link to the data files of the study in the appropriate database | http://www.ebi.ac.uk/arrayexpress/experiments/E-GEOD-32551/ | xsd:anyURI |
| **Timing and location of study** | | | |
| **Timing: start of study*** | Date and, when relevant, time on which the experiment started | 09-27-2006 | xsd:dateTime |
| **timing: end date of study** | Date and, when relevant, time on which the experiment ended | 12-27-2006 | xsd:dateTime |
| **Geographic location of study (country)*** | Defines the country/ies where the experiment took place (list-valued attribute) | Porto (Portugal), Cambridge (UK) | Geonames |
| **Experimental site name** | Natural site/experimental field/greenhouse/phenotyping facility name where the experiment took place (if applicable) | Thurso research station, north field / redwood forest, California, USA | xsd:string |
| **Geographic location of study (latitude)*** | Degrees and minutes followed by north (N) and south (S) of the natural site/experimental field/greenhouse/phenotyping facility where the experiment took place. This can be a random GPS location of the site or the GPS of its entrance. | 39º4'N | xsd:string |
| **Geographic location of study (longitude)*** | Degrees and minutes followed by east (E) and west (W) of the natural site/experimental field/greenhouse/phenotyping facility where the experiment took place | 8º44'W | xsd:string |

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| **Geographic location of study (altitude)** | Elevation expressed in meters (m) above sea level of the natural site/experimental field/greenhouse/phenotyping facility where the experiment took place | 100 m | xsd:string |
| **Biosource** | | | |
| **Organism*** | The taxon id of the species as defined by NCBI | 4577 | NCBI Taxonomy id |
| **Infraspecific name** | Key (name of the rank): value (value of the rank) pairs. Ranks can be among the following terms: subspecies, cultivar, variety, subvariety, convariety, group, subgroup, hybrid, line, form, subform | subspecies:vinifera;cultivar:Pinot noir | xsd:string |
| **Time factor** | Significant date and time, e.g. planting date. key-value pairs to describe the type of date. | http://www.cropontology.org/terms/CO_715:0000033:04-06-2010 | Crop Ontology:'CO_715:0000006' + xsd:dateTime |
| **Life stage** | Describes the life stage of the sample at the time of the experiment. Takes values of BBCH scales or PO ontology | http://www.cropontology.org/terms/PO:0009009;BBCH-17 | BBCH / Plant Ontology |
| **Material Source: Holding Institute/Stock Centre, accession*** | Key value pairs of holding Institute (institute/database that gives the accession number or name), accession number or name (describes a record in a genebank or laboratory). In forestry, provenance or region of provenance may be used when accession is not available. Naming of accessions derived from sexual reproduction in plants:: "mother_accession X father_accession". Only 2 parents allowed only ; if father is unknown, format is "mother_accession X UNKNOWN". | INRA:W95115_inra ; ICNF:PNB-RPI | xsd:string |
| **Material source: DOI** | Digital Object Identifier (DOI) of the accession or provenance for trees | doi:10.15454/1.4658436467893904E12 | DOI |
| **Derived Material[1]** | Key-value pair of derived material identifier and holding institute (institute that gave the identifier to the derived material) ; derived material from an accession: seed or plant lots, any sample collected on or from the accession and that has been phenotyped. | INRA:W95115_inra_2001;INRA:inra_kernel_2351;Rothmasted:rres_GK090847 | xsd:string |
| **Treatment** | Treatment/s made for all the samples of the study | http://purl.obolibrary.org/obo/EO_0007210:PVY(NTN); | Plant Environment Ontology + xsd:string |
| **Derived material for trees: Geographic location (latitude)** | Degrees and minutes followed by north (N) and south (S) of the location of the source sample | 39º4'N | xsd:string |
| **Derived material for trees:** | Degrees and minutes followed by east (E) and west (W) of | 8º44'W | xsd:string |

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| **Geographic location (longitude)** | the location of the source sample | | |
| **Derived material for trees: Geographic location (altitude)** | Elevation expressed in meters (m) above sea level of the location of the source sample | 10 m | xsd:string |
| **Environment: Growth facility** | | | |
| **Type of growth facility*** | Environment in which the trial or experiment or characterization or evaluation is carried out. | field environment condition; greenhouse environment condition; greenhouse then field condition; growth chamber (GC) | Crop Ontology: "CO_715:0000005" |
| **Average day temperature** | The air temperature during the day (light conditions). | 22 °C | xsd:float |
| **Average night temperature** | The air temperature during the night (dark conditions).. | 18 °C | xsd:float |
| **Change over the course of experiment** | Difference between the maximum air temperature recorder and the minimum. | 0.75 °C | xsd:float |
| **Average daily integrated photosynthetic photon flux density (PPFD) measured at plant or canopy level.** | Photosynthetic photon flux density (PPFD) over a 24-h period | plant PPFD: 61 mol m-2 d-1; canopy PPFD: 40 mol m-2 d-1 | xsd:string |
| **Average length of the light period** | Average length of the light period in h. | 16 | xsd:float |
| **Light intensity** | Intensity of total light | [µmol m–2 s–1] | xsd:float |
| **Range in peak light intensity** | Range in peak light intensity. | [µmol m–2 s–1] | xsd:float |
| **Fraction of outside light intercepted by growth facility components and surrounding structures** | Fraction of outside light intercepted by growth facility components and surrounding structures. | [µmol m–2 s–1] | xsd:float |
| **Type of lamps used** | Nature of the light source for controlled environments. XEO: 00137 | fluorescent tubes; high intensity discharge (HID) lamps; light emitting diodes (LED) | xsd:string |
| **R/FR ratio** | Red light to far red light ratio. XEO:00036 | [mol mol–1] | xsd:float |
| **Daily UV-A radiation** | Defines the intensity of UVA radiation (320-400 nm); | [W m-2] | xsd:float |

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| | XEO:00037 | | |
| **Daily UV-B radiation** | Defines the intensity of UVB radiation (290-320 nm); XEO:00038 | [W m-2] | xsd:float |
| **Total daily irradiance** | Defines the intensity of total light (XEO:00034). | [W m-2] | xsd:float |
| **Atmospheric CO2 concentration** | Denotes whether the atmospheric CO2 concentrations were controlled during the experiment. | controlled; uncontrolled | xsd:float |
| **Average CO2 during the light and dark periods** | Defines the concentration of CO2 in the air during the light and dark periods (XEO:00023) | light period: 390 mLL-1; dark period: 450 mLL-1 | xsd:string |
| **Average VPDair during the light period** | The Vapour Pressure Deficit in the air defines the difference between the maximal amount of water in the air minus the actual amount during the light period in kPa (XEO:00021) | 2 kPa | xsd:float |
| **Average relative humidity during the light period** | The relative humidity describes the amount of water vapor in the air, generally expressed as the percentage of the maximum water vapor during the light period (XEO:00020) | 30% | xsd:float |
| **Average VPDair during the dark period.** | The Vapour Pressure Deficit in the air defines the difference between the maximal amount of water in the air minus the actual amount during the dark period in kPa ((XEO:00021) | 2.7 kPa | xsd:float |
| **Average relative humidity during the dark period** | The relative humidity describes the amount of water vapor in the air, generally expressed as the percentage of the maximum water vapor during the dark period (XEO:00020) | 33% | xsd:float |
| **Environment: Rooting conditions** | | | |
| **Rooting medium** | An abiotic plant treatment (EO:0007191) involving the use of a solid or liquid substrate for growing plants or tissue-cultured plant samples. | hydroponic plant culture media; in vitro liquid growth medium; in vitro solid growth medium; soil environment | Plant Environment Ontology:'EO_0007147' |
| **Container type** | Defines the type of container used to grow/treat the plants.XEO:00040 | pot; Petri dish; well; tray | xsd:string |
| **Container volume** | Defines the volume that is available to the roots. XEO:00113 | [L] | xsd:float |
| **Container height** | Defines the height of the container. | [m] | xsd:float |
| **Number of plants per containers** | Defines the number of plants per container. XEO:00112 | X/container | xsd:integer |
| **Plot size** | Description of experimental sites. | higher-level landform; land element and position; slope; .... | Crop Ontology:'CO_715:0000058' |
| **Sowing density** | Sowing density. | x/plot | Natural Resource and |

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| | | | Environment Ontology |
| **Rooting medium replenishment** | Frequency and volume of replenishment or addition of the rooting medium. | | xsd:string |
| **pH** | Value of soil pH, separated by a colon, the depth (cm) from where soil sample was taken. Multiple values are separated by semicolon. For hydroponics, leave the depth empty. | 7.7:40-60; 6.5; 4.3:10-20 | xsd:string |
| **Porosity** | A permeability quality inhering in a bearer by virtue of the bearer's disposition to admit the passage of gas or liquid through pores or interstices. PATO:0000973 | [%] | xsd:float |
| **Medium temperature** | Temperature of the replenishment medium. | [°C] | xsd:float |
| **Soil penetration strength** | Soil penetration strength as measured by the standard penetration test (SPT; ISO 22476-3), the cone penetrometer test (CPT), in-situ vane shear tests, and shear wave velocity measurements. | [Pa m–2] | xsd:float |
| **Water retention capacity** | Defines the potential energy of water per unit mass of water in the soil.XEO:00126 | [g g–1 dry weight] | xsd:float |
| **Organic matter content** | Proportion of organic matter in the soil. XEO:00117 | [%] | xsd:float |
| **Environment: Nutrients** | | | |
| **Médium composition** | Concentration of the nutrients | Ca (XEO:00058): 5 mg/L | XEML Environment Ontology:'XEO_00042' + xsd:float |
| **Extractable N content per unit ground area before fertiliser added** | Extractable N content per unit ground area before fertiliser added | [mg/m2] | XEML Environment Ontology:'XEO_00054' +xsd:float |
| **Type and amount of fertiliser added per container/m2** | The current practice in field /greenhouse management for fertilization | nitrogen: [concentration]; phosphorus: [concentration] | Crop Ontology:'CO_715:0000204' + xsd:float |
| **Concentration of [nutrient] before start of the experiment** | Concentration of a nutrient at the start of an experiment. | Ca (XEO:00058): 5 mg/L | XEML Environment Ontology:'XEO_00042' + xsd:float |
| **Extractable N content per unit ground area at the end of the experiment** | Extractable N content per unit ground area at the end of the experiment | [mg/m2] | XEML Environment Ontology:'XEO_00054' +xsd:float |
| **Volume and frequency of** | A defined volume of water supplied to pots of a | [L/m2] | xsd:float |

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| **water added per container/m2** | defined size. | | |
| **Matrix potential** | Range in water potential for soil. | -10 to -30 kPa | xsd:float |
| **Watering regimen** | The treatment involving an exposure to watering frequencies. | irrigation from top; irrigation from bottom; drip irrigation | xsd:string |
| **Composition of nutrient solutions used for irrigation** | For all nutrients, the ontology term with concentration. | Ca (XEO:00058): 5 mg/L | XEML Environment Ontology:'XEO_00042' + xsd:float |
| **Composition of the salts** | For all nutrients, the ontology term with concentration. | [mol L-1] | XEML Environment Ontology:'XEO_00042' + xsd:float |
| **Electrical conductivity** | A conductivity quality inhering in a bearer by virtue of the bearer's ability to convey electricity. | [dS m–1] | xsd:float |
| **Treatments** | | | |
| **Seasonal environment** | A plant treatment (EO:0001001) involving an exposure to a given conditions of regional seasons. | Spring season; dry season | Plant Environment Ontology:'EO_0007038' |
| **Air treatment regime** | The treatment involving an exposure to wind/air with varying degree of temperature, which may depend on the study type or the regional environment. | 28/25ºC ( Day/Night ) | Plant Environment Ontology:'EO_0007161' |
| **Soil temperature regime** | A physical plant treatment (EO:0007316) involving an exposure to varying degree of temperature, which may depend on regional environment. | 27/25ºC ( Day/Night ) | Plant Environment Ontology:'EO_0007161' |
| **Soil treatment regime** | The treatment (EO:0007049) involving growing plants and exposing them to soil growth media with varying contents | sand content (10% v/v) | Plant Environment Ontology:'EO_0007161' |
| **Antibiotic regime** | A chemical treatment (EO:0007189) involving the use of antibiotic for selection purposes. | actinomycin D; 20mM;20ml per plant; Every week | Plant Environment Ontology:'EO_0007041' |
| **Chemical administration** | An abiotic plant treatment (EO:0007191) involving the application of chemical(s). | Bion; 13,5mM; 5ml per plant; Every 15 days. | Plant Environment Ontology:'EO_0007189' |
| **Biotic treatment** | A plant treatment (EO:0001001) involving the application of a biotic or biological factor such as a microbe, insect, animal, or plant or a combination thereof | rice tungro bacilliform virus (RTBV) 2.5 µl, incubated at room temperature for 10min | Plant Environment Ontology:'EO_0007357' |

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| **Fertilizer regime** | A plant nutrient treatment (EO:0007241) involving the use of a fertilizer, a combination of plant nutrients. | Potassium phosphate; 50 Kg P.Ha/y 50 Kg K.Ha/y | Plant Environment Ontology:'EO_0007085' |
| **Fungicide regime** | A treatment (EO:0007167) involving the application of a fungicide; a chemical entity or mixture of chemical entities. | Benzothiadiazole; 10mM; 1ml; Every month | Plant Environment Ontology:'EO_0007268' |
| **Gaseous regime** | A physical plant treatment (EO:0007316) involving the application of a gas or a combination of gasses. | Carbon Dioxide; 20ppm | Plant Environment Ontology:'EO_0007023' |
| **Gravity** | The treatment involving use of gravity factor to study various types of responses in presence, absence or modified levels of gravity. | Zero gravity (International space station) | Plant Environment Ontology:'EO_0007146' |
| **Growth hormone regime** | A chemical treatment (EO:0007189) involving the use of growth hormones to study various types of responses on their extrinsic and/or intrinsic application. | Jasmonic acid; 1mM;20ml; | Plant Environment Ontology:'EO_0007165' |
| **Herbicide regime** | A treatment (EO:0007167) involving the application of a herbicide; a chemical entity or mixture of chemical entities. | SUREWET (Polyvinyl polymer and nonionic surfactant); 1,75mM; 5ml per plant; Sprayed every month | Plant Environment Ontology:'EO_0007183' |
| **Mechanical treatment** | A treatment involving the application of a mechanical force | Wounding, bending | Plant Environment Ontology:'EO_0007373' / xsd:string |
| **Mineral nutrient regime** | A chemical treatment (EO:0007189) involving the application of inorganic chemical(s). | Cd 0.5 mg/L (Hydroponics), CdCl2 15mg.Cd/kg (soil) | Plant Environment Ontology:'EO_0007044' |
| **Humidity regimen** | A treatment involving an exposure to varying degree of humidity, which may depend on regional environment. | 56%/70% (Day/Night) | Plant Environment Ontology:'EO_0007359' |
| **Non-mineral nutrient regimen** | Treatment involving the exposure of plant to molecular forms of nutrient as supplement to study various types of responses. | Low Carbon - Sucrose concentration | Plant Environment Ontology:'EO_0007043' |
| **Radiation (light, UV-B, X-ray) regime** | A physical plant treatment (EO:0007316) involving an exposure with a radiation type, intensity or quantity. EMR is classified according to the frequency of its wave. The electromagnetic spectrum, in order of increasing frequency and decreasing wavelength, consists of radio waves, microwaves, infrared radiation, visible light, ultraviolet radiation, X-rays and gamma rays. (from Wikipedia). | 200-280nm; 30min; every day | Plant Environment Ontology:'EO_0007151' |

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| **Rainfall regime** | Treatment involving an exposure to a given amount of rainfall. | 79 rainfall events; 15,6mm (mean size) | Plant Environment Ontology:'EO_0007181' |
| **Salt regime** | This treatment may be used to simulate the growth conditions of sea coast regions and saline/sodic soils. A chemical treatment (EO:0007189) involving use of salts as supplement to liquid and soil growth media to study various types of responses on their application. | 150mM | Plant Environment Ontology:'EO_0007185' |
| **Watering regime** | Treatment involving an exposure to watering frequencies. | 20ml every 3 days | Plant Environment Ontology:'EO_0007383' |
| **Water temperature regime** | Treatment involving an exposure to water with varying degree of temperature, which may depend on regional environment. | 20ºC | Plant Environment Ontology:'EO_0007160' |
| **Standing water regime** | The treatment involving an exposure to standing water during a plant's life span. This also results in anaerobic soil conditions for either long or short periods. | Flooding water, Deep water | Plant Environment Ontology:'EO_0007282' |
| **Pesticide regime** | A chemical treatment (EO:0007189) involving the application of a pesticide; a chemical entity or mixture of chemical entities. | Glyphosfate; 1.68 kg acid equivalent (a.e.) / ha | Plant Environment Ontology:'EO_0007167' |
| **pH regime** | The treatment involving exposure of plants to varying levels of pH of the growth media. | acidic pH soil environment | Plant Environment Ontology:'EO_0007171' |
| **Other perturbation** | | | xsd:string |
| **Experimental design** | | | |
| **Spatial coordinates: ID** | name of the column head of the data file giving the spatial coordinates of an assay in the study | ex: latitude, longitude or X, Y | xsd:string |
| **Spatial coordinates: type** | georeference or line/column | can be repeated: ex: long, lat | xsd:string |
| **Unit Spatial coordinates: unit** | Unit used to describe the spatial coordinate of an assay in the study (e.g.degree, minute, number) | | xsd:string |
| **Time coordinates - ID** | Times series or cinetics: name of the column head giving the time at which a set of measures has been collected | | xsd:string |
| **Time coordinates - Unit** | Times series or kinetics: unit of time used | can be repeated.<br>Date<br>Timestamp<br>Growing degree day (GDD) | xsd:string |
| **Experiment description*** | Text description of the unit of observation or assay (= | | xsd:string |

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| | genotype * factor combination) in a study. | 1/ each maize line is observed on 15 rows with a density of 6 plant per square meters<br>2/ Observation on the assay are mean values of all repetition for a given genotype * factor combination | |
| **Replication - Technical replication ID** | IDentifier of each level of replication for a given assay | ex: block:1, plot:894, rep:1 | xsd:string |
| **Replication - technical replication level hierarchy** | hierarchy of the different levels between each others (text: no ontology | ex: block>rep>plot | xsd:string |
| **Type of statistical design** | Short description of the statistical design | ex: completely randomized design (CO_715:0000146) | xsd:string |
| **Sample collection, processing, management** | | | |
| **BiosampleID** | When the sample submitted to Biosamples DB this is the unique Biosample id | SAMEA4202911 | xsd:string |
| **Plant structure development stage** | A stage in the life of a plant structure (PO:0009011) during which the plant structure undergoes developmental processes. | Fruit ripening stage | Plant Ontology:'PO_0009012' |
| **Plant body** | Plant anatomical entity | | Plant Ontology:'PO_0025131' |
| **Plant product** | A portion of organism substance that is or was part of a plant | Resin | Plant Ontology:'PO_0025161' |
| **Organism count** | The number/(amount) of entities of this type that are part of the whole | 10 roots; 100mg of roots | xsd:integer |
| **Sample temperature** | Temperature at Collection / Harvesting | 20ºC | xsd:float |
| **Oxygenation status of sample** | A setting datum that specifies the oxygenation inside a container participating in a storage process. | Vacuum | xsd:string |
| **Sample salinity** | A setting datum that specifies the salinity inside a container participating in a storage process. | 20mM NaCl | xsd:string |
| **Sample storage duration** | | | xsd:string |
| **Sample storage location** | Top level of all location classes. | Campus, Building, Room | xsd:string |
| **Sample storage temperature** | A setting datum that specifies the temperature inside a container participating in a storage process. | -18 °C to -35 °C, -60 °C to -85 °C, Liquid nitrogen, Room temperature etc | xsd:string |
| **Sampling time** | The date-time when the sample was collected / harvested | 2005-08-15T15:52:01+00:00 | xsd:dateTime |

| Observed variables | | | |
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| **Trait** | Name of the targeted trait or id in a relevant ontology | ex: Anthesis time (CO_322:0000030) or reproductive growth time (TO:0000366) | Plant Trait Ontology / Crop Ontology / XML Environment Ontology xsd:string |
| **Variable name*** | https://bioportal.bioontology.org/ontologies/CO (Trait_Dictionnary_V5 definition): Name of the variable following the convetion <trait abbreviation>_<method abbreviation>_<scale abbreviation>. Variable name must be unique. | ex: Growing Degree days to anthesis | Crop Ontology / xsd:string |
| **Variable id** | https://bioportal.bioontology.org/ontologies/CO | ex: CO_322:0000260 | Crop Ontology / xsd:string |
| **Source of the variable id** | version of the ontology describing the variable | ex: Maize Trait Dictionary in template 5 - CIMMYT- December 2015 | xsd:string |
| **Variable Method*** | https://bioportal.bioontology.org/ontologies/CO (Trait_Dictionnary_V5 definition): (Short) name of the method | ex: MFLW8 | xsd:string |
| **Method description** | https://bioportal.bioontology.org/ontologies/CO (Trait_Dictionnary_V5 definition): Textual and generic description of the method.<br>Optionaliy : extensaion of the Method of the Ontology with growth stage, inoculation precise organ (leave number) | ex:<br>1/ From Ritchie J, NeSmith D (1991) Temperature and crop development. Modeling plant and soil systems American Society of Agronomy Madison Wisconsin USA. doi:10.2134/agronmonogr31.c4 with TBASE=8°C and T0=30°C<br><br>2/ Extension of Method CO_321:0000456 (Plant Height measured with ruler) : Plant height measure at 5 years, one year after Botritis inoculation. | xsd:string |
| **Reference associated to the method** | https://bioportal.bioontology.org/ontologies/CO (Trait_Dictionnary_V5 definition): Bibliographical reference describing the method. | ex: Ritchie J, NeSmith D (1991) Temperature and crop development. Modeling plant and soil systems American Society of Agronomy Madison Wisconsin USA. | DOI / xsd:string |

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| | | doi:10.2134/agronmonogr31.c4 | |
| **Scale*** | https://bioportal.bioontology.org/ontologies/CO (Trait_Dictionnary_V5 definition): Name of the scale associated to the variable | ex: GDD: Growing Degree-Days | xsd:string |

[1]Mandatory information when preparing a submission to BioSamples database (http://www.ebi.ac.uk/biosamples)
*Mandatory information