**Minimum Information About a Plant Phenotyping Experiment (MIAPPE)**

Attributes (concepts, subconcepts - in terms of ontology) marked by asterisk (\*) are essential for a description of experiment (e.g. by Poorter et al. [26]); the rest forms an extended description. For some attributes possible values are listed.

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| --- | --- | --- | --- |
| **Checklist section** | **Attributes** | **Source list** / Biosharing ID / Reference | **Recommended ontologies** |
| General metadata | Unique identifier\*  Title\*  Description\*  Submission date  Public release date  Publications  Laboratory address and contact details | Default ISA-Tab configuration [1] | OBI, Ontology for Biomedical Investigations [2]  CRO, Crop Research Ontology [3] |
| Timing and location | Timing:  Start of experiment (date)\*  Duration (days/months/years)\*  Experiment location:  Geographic location\*  Latitude and longitude  Altitude  Inclination and aspect  Habitat | Poorter et al.[4]  Morrison et al. [5]  CIMR [6] : Environmental Analysis Context [7] | OBI, Ontology for Biomedical Investigations [2]  GAZ, Gazetteer [9] |
| [Biosource](http://purl.bioontology.org/ontology/GAZ) | [Organism (taxon)\*](http://purl.bioontology.org/ontology/GAZ)  [Infraspecific\_name\*](http://purl.bioontology.org/ontology/GAZ)  [Infraspecific\_rank](http://purl.bioontology.org/ontology/GAZ)  [Common name](http://purl.bioontology.org/ontology/GAZ)  [Genotype](http://purl.bioontology.org/ontology/GAZ)  [Organism age](http://purl.bioontology.org/ontology/GAZ)  [Life stage](http://purl.bioontology.org/ontology/GAZ)  [Seed preparation](http://purl.bioontology.org/ontology/GAZ):  [Seed source\*](http://purl.bioontology.org/ontology/GAZ)  [Pretreatments](http://purl.bioontology.org/ontology/GAZ)  [Conservation conditions](http://purl.bioontology.org/ontology/GAZ) | [MIxS Plant-associated environmetal package](http://purl.bioontology.org/ontology/GAZ) [10]  [Yilmaz et al.](http://purl.bioontology.org/ontology/GAZ) [11]  [FAO/Bioversity Multi-Crop Passport Descriptors V.2 (MCPD V.2)](http://purl.bioontology.org/ontology/GAZ) [12] | [UNIPROT Taxonomy](http://purl.bioontology.org/ontology/GAZ) [13]  [NCBI Taxonomy](http://purl.bioontology.org/ontology/GAZ) [14] |
| Environment | Growth facility\* (growth chamber, GC / greenhouse, GH / open top chamber, OTC / experimental garden / experimental field)  Aerial conditions\*  CO2  for GC and GH:  Controlled/uncontrolled  Average CO2 during the light and dark period (µmol mol–1)  Air humidity (moisture)\*  Average VPDair during the light period (kPa) or Average humidity during the light period (%)  Average VPDair during the night (kPa) or  Average humidity during the night (%)  Daily photon flux (light intensity)\*  Average daily integrated PPFD measured at plant or canopy level (mol m–2 day–1)  Average length of the light period (h)  for GC:  Light intensity (µmol m–2 s–1)  Range in peak light intensity (µmol m–2 s–1)  for GH and OTC:  Fraction of outside light intercepted by growth facility components and surrounding structures  Light quality:  for GC and GH:  Type of lamps used  R/FR ratio (mol mol–1)  Temperature (°C)\*  Average day temperature  Average night temperature  Change over the course of experiment  Rooting conditions\*  Rooting medium\*: aeroponics / hydroponics (water-based, solid-media based) / soil type (sand, peat, clay, mixed, ...)  For greenhouse:  Container type\*,  Volume (L)\*,  Height,  Other dimensions\*,  Number of plants per container\*.  For field:  Plot size\*,  Sowing density\*  pH\*  Frequency and volume of replenishment or addition  Soil parameters:  Soil penetration strength (Pa m–2)  Water retention capacity (g g–1 dry weight)  Organic matter content (%)  Porosity (%)  Rooting medium temperature  Nutrients  For hydroponics:  Composition\*  Concentration  For soil:  Extractable N content per unit ground area before fertiliser added\*  Type and amount of fertiliser added per container or m2\*  Concentration of P and other nutrients before start of the experiment  Extractable N content per unit ground area at the end of the experiment  Watering  Irrigation type: irrigation from top/bottom/drip irrigation\*  Volume (L) and frequency of water added per container or m2\*  For soil:  Range in water potential (MPa)  Salinity  Concentration of Na, Cl and Mg in the water used for irrigation  For soils and hydroponics:  electrical conductivity (dS m–1)  Aquatic environment  If sample was submerged and emerged  Depth  Time  Water temperature  Tidal phase  Biotic environment  Description of interacting organism (pathogens, mutualists, herbivores, endophytes, etc.) | Poorter et al.[4]  Hanneman et al.[15] | XEO, XEML Environment Ontology [16]  ENVO, Ontology of environmental features and habitats [17]  Crop Research Ontology [3] |
| Treatments | Seasonal environment  Air temperature regime  Soil temperature regime  Antibiotic regime  Chemical administration  Disease status  Fertilizer regime  Fungicide regime  Gaseous regime  Gravity  Growth hormone regime  Herbicide regime  Mechanical treatment  Mineral nutrient regime  Humidity regime  Non-mineral nutrient regime  Radiation (light, UV-B, X-ray) regime  Rainfall regime  Salt regime  Watering regime  Water temperature regime  Standing water regime  Pesticide regime  pH regime  Other perturbation | MIxS Plant-associated environmetal package [10]  Yilmaz et al. [11] | XEO, XEML Environment Ontology [16]  CRO, Crop Research Ontology [3] |
| Experimental design | Spatial coordinates  Plant ID  Plot ID  Plot (x, y) coordinates  Time coordinates  Day  Time  Blocking  Block ID  Sub-block ID  Sub-sub-block ID  Superblock ID  Row ID  Column ID  Other ID  Replication  Biological replication  Technical replication  Experimental unit |  | OBI, Ontology for Biomedical Investigations [2]  STATO, Statistics Ontology [18]  CRO, Crop Research Ontology [3] |
| Sample collection, processing, management | Plant body of interest (organ)\*  Plant product  Organism count  Sample temperature  Oxygenation status of sample  Sample salinity  Sample storage duration  Sample storage location  Sample storage temperature  Sampling time | CIMR [6] : Plant Biology Context [8]  Fiehn et al. [19]  List exist for assays in CIMR, MIAPE, MIMARKS (ISA-Tab configurations) + new attributes for phenotypic assays |  |
| Observed variables | Phenotypic variables  Trait\*  Method\*  Scale\*  Environmental variables  Trait\*  Method\*  Scale\*  Data processing protocols | “Trait/Method/Scale” triplet approach applied by Generation Challenge Program, Crop Ontology [20]  Shrestha et al. [21]  Poorter et al. [4]  Hanneman et al. [15] | TO, Plant Trait Ontology [22]  PO, Plant Ontology [23]  CO, Crop Ontology [20]  PATO, Phenotypic Quality Ontology [24]  XEO, XEML Environment Ontology [16] |

**References\***

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23. PO, Plant Ontology. <http://www.plantontology.org>
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\*Online resources accessed 30 March 2016.