This project has received funding from the European Union's H2020 Programme under grant agreement no 633571

www.diversifood.eu

SMART METHODS
FOR DECENTRALIZED ON-FARM BREEDING

AT FIRST GLANCE

Decentralized on-farm breeding requires appropriate methods due to:
- on farms specific conditions;
-collaborative approach with farmers.
A decision tree has been developed to select the most appropriate experimental designs and methods, according to the objectives and the experimental constraints.

Embedding crop diversity and networking for local high quality food systems

A decision tree to identify smart methods

Participatory Plant Breeding (PPB) is based on decentralized on-farm breeding, which requires appropriate experimental methods.

A decision tree (*cf. page 2*) has been developed within DIVERSIFOOD, to match **experimental design** and **statistical methods** to a particular PPB project, according to its objectives and experimental constraints.

Most of the methods have been implemented in an R Package: **PPBStats** *(developed in DIVERSIFOOD deliverable **D3.2** and described in **D3.1**)*, whose code is hosted on: https://github.com/priviere/PPBstats

The decision tree is organised according to the objectives of the experiments. For each, there are several methods based on different experimental designs that require specific conditions *(e.g. number of plots per location; of replicated germplasms within and between locations).*

Identifying the objectives of the experiment

Data analyses from PPB programmes may have one or multiple objectives. The first step is to identify **the objective(s)** of the experiment (*in green on the decision tree*), among the following:
Four **types of information** can be considered: agronomic/nutritional data, sensory data, network topology of the seed circulation and molecular data.

- To improve the prediction of a target variable for selection by analysing agronomic /nutritional traits.
- To compare different varieties or populations (hereafter called germplasms) evaluated for selection in different locations by analysing agronomic/nutritional traits and by sensory analysis.
- To study the response of germplasms under selection over several environments by analysing agronomic traits.
- To study diversity structure and identify parents for crossing based on either good complementarity or similarity for some traits by analysing agronomic traits and molecular data.
- To study networks of seed circulation by analysing network topology.

Experimental designs and statistical methods available

Four **experimental designs** can be used: **D1**: fully-replicated block design; **D2:** incomplete block design; **D3:** row-column design; **D4:** satellite-farms & regional-farms.

Nine **statistical methods** can be used, depending on the design, the type of data and the objectives: **M1**: Non parametric methods; **M2**: Multivariate analyses (PCA); **M3:** Genetic distances & trees; **M4a**: Anova; **M4b**: Spatial analysis; **M5**: Mixed models for incomplete block designs; **M6**: AMMI and GGE; **M7a:** Bayesian hierarchical model intra-location; **M7b**: Bayesian hierarchical model GxE; **M8:** Network analysis; **M9a**: Napping tests; **M9b**: Hedonic tests; **M9c:** Ranking tests.

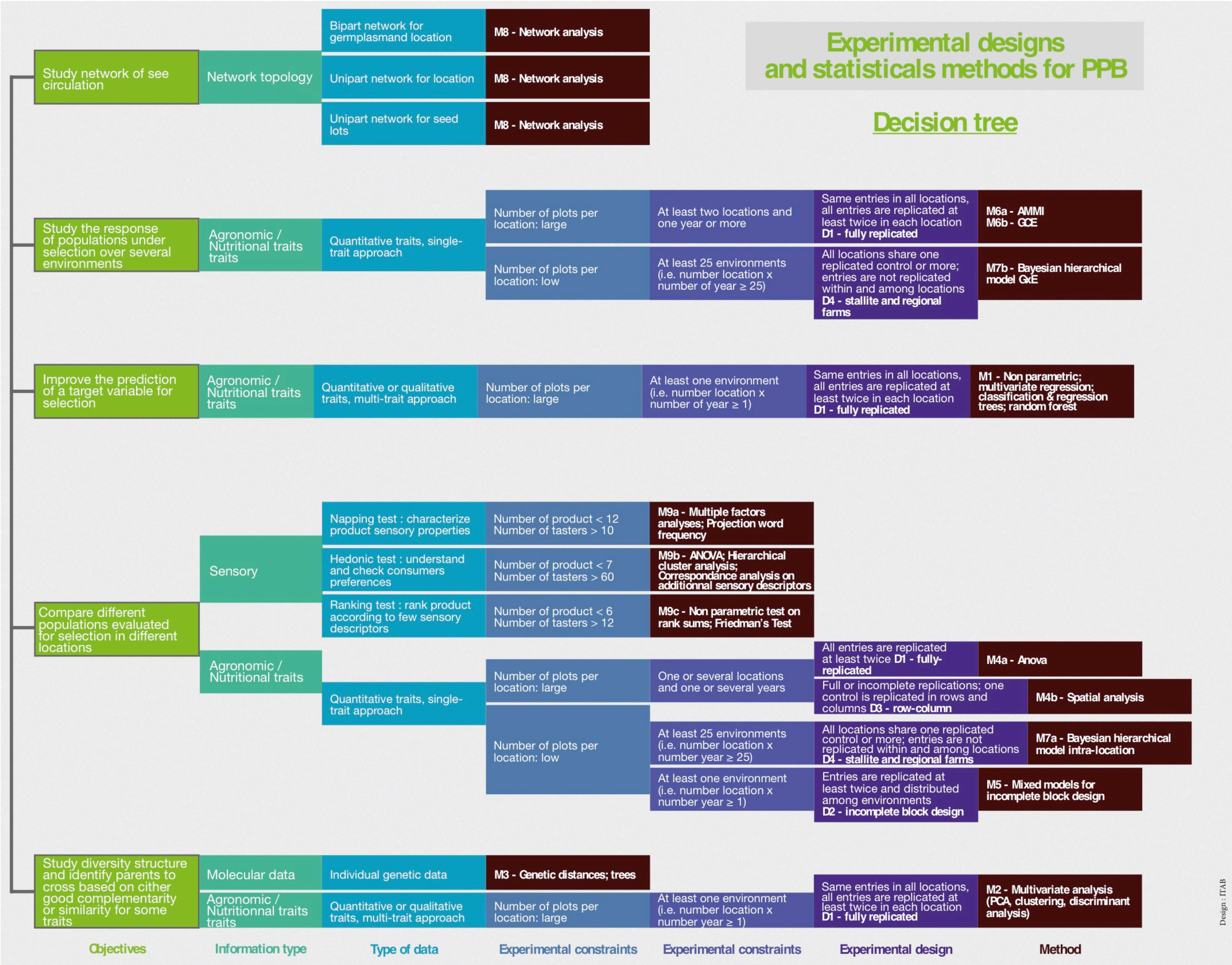
Suggested readings

Rivière, P., J.C. Dawson, I. Goldringer, and O. David. 2015. "Hierarchical Bayesian Modeling for Flexible Experiments in Decentralized Participatory Plant Breeding." Crop Science 55 (3).

Gauch, H.G. 2006. "Statistical Analysis of Yield Trials by AMMI and GGE." Crop Sci 46 (4): 1488–1500.

M. Singh, R. S. Malhotra, S. Ceccarelli, A. Sarker, S. Grando And W. Erskine (2003) Spatial variability models to improve dryland field trials. Experimental Agriculture 39(2): 151-160.

This project has received funding from the European Union's H2020 Programme under grant agreement no 633571



This Innovation Factsheet is the result of the collective work of DIVERSIFOOD partners, coordinated by Isabelle Goldringer (INRA) with the support of Pierre Rivière (RSP), Frédéric Rey (ITAB) and Ambrogio Costanzo (ORC).