

# Training course outline MODULE 2

# Phenomics: approaches and tools for genetic resources and breeding material characterization

Task 1.4 - WP1

TRAINERS: IPC (lead), UPV, INRAe

# **SECTION 1: Info on the module for** *trainees*

## Identity card and case study data

Below you'll find all the information you need to produce one or more learning activities: the training objective and the pedagogical modality chosen (face-to-face, virtual classroom, self-study), parameters that form the framework of your exercise, a list of learning activities and a list of pedagogical resources from which you can draw (but you're free to invent new ones) to design your learning activity.

#### **1. TRAINING THEMATIC-** Background (Maximum 500 words)

Apart from the conservation of plant genetic resources (PGRs, both cultivated and wild relatives), their phenotyping and characterization are essential: i) to estimate and to manage their diversity and ii) to identify sources of variation with traits of interest for breeding. To accomplish these purposes a plethora of descriptors, tools and strategies are available. These allow to characterize properly and comprehensively the agrobiodiversity in standardized parameters, follow the flow of seeds lots, manage the information in an efficient way and sharing phenomic and agronomic info to other interested actors.

### 2. TRAINING STAKES AND OBJECTIVES

Describe here the training stakes for this audience and the general training goal to achieve at the end of the training

Training stakes and the general training goal for the target audience you have chosen

1. The training course aims to:

Main methodologies for phenotyping PGRs, keep traceability of seeds lots, and tools to manage the phenomic info

2. Structure of the module and training

This module 2 is divided into four units.

- Main descriptors used worldwide in characterizing plant genetic resources
- Intro to ShineMas: a web tool dedicated to Seed Lots History, Phenotyping & Cultural Practices<sup>1</sup>
- Guidelines and examples of good practices in data management
- Methods for phenotyping and selection of agronomic traits of interest in organic farming

3. At the end of the training, the trainee will be able to:

- Know (and know "how-to-use") the main descriptors and traits used in germplasm characterization

- Manage, in a practical way, crop descriptors and tools aimed to trace and keep the track of seeds lots

- Know the most relevant agronomic traits and added-value traits and know how to phenotype varieties with them

<sup>1</sup> An extra practical session to use the tool with own data was scheduled for FEB 10 <sup>th</sup> 2025 (9-12h)

## **3. STRUCTURE OF THE TRAINING MODULE**

#### Insert a summary table showing the module structure, units, and their duration.

MODULE #2 – Phenomics: approaches and tools for genetic resources and	10,5 hours
breeding material characterization	
Unit 1: Main descriptors used worldwide in characterizing PGRs	1,5 h
Unit 2: Intro to ShineMas: a web tool dedicated to Seed Lots History,	1,5h (+3h) <sup>1</sup>
Unit 3: Guidelines and examples of good practices in data management	1,5 h
Unit 4: Methods for phenotyping & selection of agronomic traits of interest in OF	1,5 h

<sup>1</sup> An extra practical session to use the tool with own data was scheduled for FEB 10<sup>th</sup> 2025 (9-12h)

#### **4. TARGET AUDIENCE**

Training is only effective if it is designed for a given audience and related to the problematic work situations for that given audience. A training activity may therefore differ depending on whether it is aimed at an advisor from a small seed company or a network of seed producers.

Check the target audience(s) (preferably one type of audience, possibly 2)

x Farmers' seed (networks) 
Contract seed producers x Handcraft small-scale seed enterprises
Large scale / 
Multinational seed companies

#### Precise the target audience

 Students (mainly undergraduate University and MSc students in Plant Breeding)
 Organic farmers seed networks (wide range, particular interest for farmers committed with agroecology, preservation of landraces and starting in breeding their own varieties)
 Breeders

Specify the target audience, its level of expertise (experts, beginners, intermediates) and whether the training concerns vegetable seeds or cereal seeds.

Check the "pre-requisite" level of the trainees

Beginner X Intermediate 
 Expert

Check the type of seeds concerned by the training

x Vegetables seed x Cereals

#### **5. MODALITIES**

□ virtual classroom / x face-to-face classroom (mainly online) / □ self-paced-training

### **6. EVALUATION METHODS**

x Quiz / 
Presentation of a case study / x add the method (homework: search info online)

# 7. MATERIAL AVAILABLE FOR BUILDING THE LEARNING ACTIVITY(IES)



The learning resources for this topic require that you connect to the internet with your computer, as part of the info showed are online available databases, resources and tools, etc. They will be provided and mentioned during the main presentations. As some examples:

• IPGRI/Bioversity international descriptors: <u>https://cgspace.cgiar.org/collections/835fa638-0167-4669-9532-ffc488facc94</u>

- Tomato Analyzer: <u>https://vanderknaaplab.uga.edu/tomato-analyzer/</u>
- SHiNeMaS :
  - o Article : <u>https://doi.org/10.1186/s13007-020-00640-2</u>
  - Project page : <u>https://forgemia.inra.fr/abisoft-gqe/shinemas</u>
  - o Documentation page : <u>https://shinemas2.readthedocs.io/</u>
- Guideline and examples of good practices in data management:
  - Introduction video : <u>https://www.youtube.com/watch?v=66oNv\_DJuPc</u>
  - PostIt tool for interactive game: https://postit.colibris-outilslibres.org/fairdataliveseeding

## **8. TRAINING TECHNIQUES**

Check one or several learning activities you have chosen to develop

Expositive methods –	x Presentation: organized information on a specific topic
which emphasize the	x Demonstration of how a task can be performed
'absorption' of new	x Worked examples with comment and explicit reference to
Information. The learner	the theory
need to listen, read,	x Case studies real, significant cases related to the topic
observe.	🗆 other
	+ with survey and feedback
Application methods –	Demonstration and practice of a gesture or procedure
which emphasize the	

active processes that learners use to perform procedural and principle-	x Analysis and diagnosis of a "virtual" case study (described in writing, audio or video recording) x Guided search for resources and production of a summary
based tasks and build new	x Role-playing or simulation
knowledge	x Project: apply the principles and concepts learned in your
	own environment
Collaborative methods –	x Guided online discussions (chat, forum, video or audio
which emphasize the	conference): debate, exchanges
social dimension of	Collaborative work: application methods involving group
learning and engage	collaboration (longer, more complex tasks)
learners in sharing	x Tutoring or even peer assessment: pairing up, for example,
knowledge and	to assess each other's work/production.
performing tasks in a	
collaborative way.	

## **SECTION 2:** Info on the module for trainers

# 2.1 THE DURATION OF THE PLANNED ACTIVITY, ITS VARIOUS STAGES AND TIMING

Describe the duration, stages, and timing of the activities in each unit

Unit 1: 1) Sharing instructions about the session, and main concepts to be learned – 5-10 min, 2) Main presentation from the trainer, description of useful materials (available online) - 50 min, 3) <u>Evaluation of trainees 1</u> questions relative to issues exposed during presentations (Quiz, 10 min in total; response provided by e.mail to the trainer), 4) Debate, conclusions, follow-up and prospects (what have we learnt today?, 10-15 min). 5) <u>Evaluation of trainees 2</u> (individual homework, use of descriptors from BIOVERSITY International, performed individually during the next week, work provided to the trainer by e.mail)

Unit 2: the unit (*Introduction to SHiNeMaS*) will be divided in two sessions:

Part 1: Presentation of SHiNemaS tool with short sessions of presentation followed by a question/answer session - 1) Overview of SHiNeMaS (15 min.) 2) Description of material manipulated with the tool (15 min.) 3) Manage information with SHiNeMaS (15 min.) 4) Explore data with SHiNeMaS (15 min.) 5) introducing Part 2 – Bring your own data day (15 min.) Part 2 : February 10th 2025. Bring your own data day – the trainees comes with their own data and try the tool (3 h, from 9 to 12)

Unit 3: The unit is divided in 6 sessions for a total of 90 minutes. 1) Context of reproducibility crisis in science (10 minutes) 2) The data management plan and legal constraint regarding data (15 minutes) 3) What is FAIR data (10 minutes) 4) Guidelines to manage data : Standards and metadata, Vocabulary, Licenses, Data warehouse (30 minutes) 5) Short quiz (10 minutes) 6) questions/answers (15 minutes)

Unit 4: 1) Sharing of instructions about the session, and main concepts to be learned – 5-10 min, 2) Main presentation from the trainer, description of methods and parameters for phenotyping and selection of agronomic traits (e.g. HUNTERS method in maize, SeedLinked), phenomics concepts, why we care about agronomic traits for organic?, gaps between BIOVERSITY descriptors and breeders needs, practical examples on maize and tomato, useful materials and publications (available online) - 50 min, 3) practical guided examples with maize (10 min), then 4) Evaluation of trainees 1: explore SeedLinked trials results (10 min in total; response provided by e.mail to the trainer), 5) Debate, conclusions, follow-up and prospects (what have we learnt today?, 5-10 min). 6) Evaluation of trainees 2: individual homework, "study case" considering a crop the trainee is working with and identify the five top traits key to consider in their breeding program (performed individually during the next week, work provided to the trainer by e.mail)

#### INSTRUCTIONS

# Describe the instructions you're going to give trainees for carrying out the activity. Ideally, write down these instructions

UNIT 1 – The structure of the unit will be shortly explained in the first 5-10 min.

In summary, be ready:

i) to follow online presentation (which will consist of xx, yy, zz parts)

ii) take notes of main issues treated

as iii) there will be a short quiz for evaluation and

iv) finally you will be also evaluated through 1 homework (during the next week) based on a practical searching of genetic resources in online repositories (CGN-Netherlands, COMAV-UPV, ARS-GRIN from USA, World vegetable Center Seedbank from Taiwan, etc.)

UNIT 2

i) Follow the presentation

ii) have a look to the documentation

iii) prepare some basic information and send it to Yannick for the BYOD day

UNIT 3

i) Follow the presentation

ii) take notes of the main issues treated

iii) there will be a short quiz for evaluation

UNIT 4 – The structure of the unit will be shortly explained in the first 5 min.

i) Follow online presentation

ii) take notes of main issues treated and pay special attention to the practical guided examples as iii) there will be a short wrok for evaluation and

iv) finally you will be also evaluated through 1 homework (during the next week) based on a crop you work with and decide the key traits to be considered in a potential breeding program

#### MATERIALS

Describe the materials provided for trainees to carry out the activity (resources, Internet links, etc.) and specify how they will use the resources, and describe the link between the resources and the activity

UNIT 1 – During the presentation, several online resources will be shared with the trainees. Other online presentations (video casts) to widen the info on PGRs phenotyping will be provided. Examples :

- IPGRI/Bioversity International descriptors: <u>https://cgspace.cgiar.org/collections/835fa638-0167-4669-9532-ffc488facc94</u>

- Tomato Analyzer: <u>https://vanderknaaplab.uga.edu/tomato-analyzer/</u>

UNIT 2 – Main materials are:

- Article published in Plant Methods (https://doi.org/10.1186/s13007-020-00640-2)
- The own documentation/link (https://shinemas2.readthedocs.io/en/latest/)

UNIT 3 – Main materials are:

- FAIR principles : https://doi.org/10.1038/sdata.2016.18
- Metadata : <u>https://www.miappe.org/</u> <u>https://fairsharing.org/</u>
- Controlled vocabularies :

https://agrovoc.fao.org/browse/agrovoc/en/ https://cropontology.org/

- Data Management Plan: https://dmp.opidor.fr/ https://ds-wizard.org
- Interoperability : https://brapi.org/
- Licenses : https://creativecommons.org/

- Data warehouse : <u>https://zenodo.org/</u> <u>https://recherche.data.gouv.fr/fr</u>

UNIT 4 – During the presentation, several online resources and publications will be shared with the trainees. Some for being considered in the sessions, some others to learn further details in the topics treated. Examples:

Some shared data from real trials for practicing:

https://app.seedlinked.com/en-US/trial/analytics/guest/MjA0Nw

Degustação de Tomate - LIVESEEDING- ESAC 2024 analytics view - SeedLinked Papers:

- Blundell, R., Schmidt, J. E., Igwe, A., Cheung, A. L., Vannette, R. L., Gaudin, A. C., & Casteel, C. L. (2020). Organic management promotes natural pest control through altered plant resistance to insects. Nature plants, 6(5), 483-491.

- Hohmann, P., & Messmer, M. M. (2017). Breeding for mycorrhizal symbiosis: focus on disease resistance. Euphytica, 213(5), 113

- Moreira P.M.M., Pêgo S.E., Vaz Patto C., & Hallauer, A.R. (2008). Comparison of selection methods on 'Pigarro', a Portuguese improved maize population with fasciation expression. Euphytica, 163, 481-499.

- Rempelos, L., Barański, M., .... & Leifert, C. (2023). Effect of climatic conditions, and agronomic practices used in organic and conventional crop production on yield and nutritional composition parameters in potato, cabbage, ...; results from the long-term NFSC-trials. Agronomy 13(5):1225.

#### PLANNED INTERACTION BETWEEN TRAINEES AND/OR WITH THE TRAINER

Describe it and specify in particular if it's remote (virtual class, self-training) the support used (chat tool, collaborative writing document, collaborative whiteboard, survey, etc.).

The four units: Remote virtual class (synchronous, through TEAMS or similar platforms), chat tool for questions during presentation (questions not replied during the virtual online class will be

replied later in a document, which will be shared to the mail list of trainees), some guided examples with real data from trials, platforms, data management, etc.

#### **EVALUATION**

Describe how you are going to assess what you have learned. Please note that the skills assessed must relate to the training objective you have formulated. If it's a quiz, true/false, MCQ, etc., write down the questions you might ask.

The four units: fast quiz (5-10 min) during the lesson + individual homework (during the week after the lesson, provided to the trainer once finished for evaluation; alternatively, extra session on Unit 2)