DIIVA-PR:
Dissemination of Interspecific ICARDA Varieties and Elites through Participatory Research

Work plan

The timeframe of the project allows for only two full crop seasons: 2018/19, 2019/20. Yet, in season 2017/18, the proposed inbred elite material for each crop has been already pre-multiplied in 100m² plots and already pre-tested across a limited number of sites that are indicated in the project plan below. The full set of activities and objectives is described previously. Yet, there are two types of germplasm that are included in this project, each corresponding to different activities: i. segregating germplasm derived from Phase 1 pre-breeding project funded by the Crop Trust, which will undergo breeding selection and field evaluation across sites; ii. Inbred elites derived from CWR produced by ICARDA not as part of a Crop Trust funded projects, which will be field tested across locations in 4 countries, used for on-farm trials, and purified for variety consideration in Morocco and Lebanon. In the case of durum wheat, the CWR-derived elites named ‘Jabal’ and ‘Icaverve’ (Table 5) are ready for submission for variety release in 2019, and hence could be released within the timeframe of the project. Outlook for 2021 is provided to explain the practical output of the project. The following work plan is intended for all three crops.

2018

1) Hire personnel and finalize agreements with national partners
2) Evaluate and fix interspecific crosses from phase 1 pre-breeding projects.
   
   Nb: BC is used to identify both BC (durum) and TC (barley) crosses. In the case of lentil, other generations will be under selection, full details for breeding selection of those are reported above in the text description. Here only the segregating material derived from Phase 1 projects of the Crop Trust are presented.
   
   a. BC₁ or BC₂ F₂: Select 15 spikes from each and thresh in bulk
   b. BC₁ or BC₂ F₂₃: Plant as twin rows in summer season, bulk harvest
   c. BC₁ or BC₂ F₂₄: Plant in plot and short row across environments
3) Multi-location testing across Moroccan sites:
   
   a. Among the list provided in Table 5, 6, and 7: identify most promising wide crosses of durum wheat, barley, and lentil for further field testing.
   b. Prepare a special set of germplasm for multi-location trials including some commercial checks, which are cultivated by the targeted farmers
   c. Conduct the trials under different environmental conditions at different research stations: Marchouch, Sidi el Aydi, Jemaa Shaim, Douyet, Annoceur and Tadla
4) Nutritional value/quality analysis
   
   a. Validate existing protocols for all crops
5) Participatory farmers’ selection
   
   a. For the lines selected for multi-location testing, sow 0.1 ha plots for pre-multiplication
   b. With the help of the Ministry of Agriculture regional representatives, identify 5 farmers that respond to the selection criteria, and sign contracts for conducting participatory variety selection (PVS) in the following season
6) Accelerate variety release in Lebanon:
a. The same set of promising wide crosses of durum wheat, barley, and lentil used for Morocco will be provided to Lebanon.

b. Lebanese commercial checks will be included.
c. Conduct the trials under different environmental conditions at different research stations: Terbol, Kfardan, and Tel Amara.

2019

1) Evaluate and fix interspecific crosses
   a. BC₁ or BC₂ F₂:4 : In each environment select in each best individual plants.
   b. BC₁ or BC₂ F₅ : Plant as plant-to-row in summer season, harvest each selected row.
   c. BC₁ or BC₂ F₅:6 : Plant as preliminary yield trials at one site in plots of 3m²

2) Multi-location testing trials across Moroccan sites:
   a. Collect yield and its components from multi-location testing.
   b. Conduct statistical analysis and identify, for each station, the four most promising genotypes.
   c. Repeat the experiment of year 1 at the field stations of: Marchouch, Sidi el Aydi, Jemaa Shaim, Annoceur, Douyet, and Tada.

3) Nutritional value:
   a. Asses the harvested grains from multi-location trials for nutritional value.

4) Participatory farmers selection in Morocco
   a. Harvest 0.1 ha multiplications and assess yield performances.
   b. From the 0.1 ha multiplications, and using the best 4-6 lines identified from multi-location trials and 2 commercial checks, prepare 5 on-farm trials each with plot size of 0.01 ha.
   c. Organize two farmers day for each of the five lead farmers hosting the trials. Use objective interview sheets to collect farmers appreciation and opinions.

5) Variety release Morocco
   a. Before harvest, collect 12 spikes for durum and barley, and 12 single plant seeds for lentil for each plot and plant it in summer season in Annoceur for line purification.
   b. In summer, plant as spike-to-row and harvest individually the 6 most homogeneous.
   c. In on-season, plant 6 homogeneous spike-to-row in plots of 10m².
   d. Monitor the plots for homogeneity.

6) Accelerate variety release in Lebanon
   a. Before harvest, collect 12 spikes for durum and barley, and 12 single plant seeds for lentil for each plot and plant it in summer season in Terbol for line purification.
   b. Collect yield and its components from multi-location testing.
   c. Conduct statistical analysis and identify, for each station, the four most promising genotypes.
   d. In on-season, plant 6 homogeneous spike-to-row in plots of 10m².
   e. Monitor the plots for homogeneity.
   f. Repeat the experiment of year 1 at the field stations of: Terbol, Kfardan, and Tel Amara.

7) Assess performance in the lowlands of Ethiopia.
8) For durum wheat and lentil, assess performance in the heat-prone station of Senegal
   a. Most promising lines to be provided for testing at the heat-prone station of Fanaye in Senegal

2020
1) Evaluate and fix interspecific crosses
   a. BC₁ or BC₂ F₅: Conduct preliminary yield trials in plots of 3m² in Marchouch.
   b. BC₁ or BC₂ F₅: Plant as plant-to-row in summer season, harvest each selected row
2) Multi-location testing across Moroccan sites:
   a. Collect yield components from multi-location testing
   b. Conduct statistical analysis and identify the most promising genotype for each crop and each station
3) Nutritional value
   a. Assess the harvested grains from multi-location trials for nutritional value
   b. Conduct statistical analysis for nutritional value, and express each crop at each site as a function of daily nutritional value generated per ha
   c. Publish a scientific article to describe the achieved results
4) Participatory farmers’ selection
   a. Conduct participatory farmers’ selection with the five communities per site
   b. Harvest on-farm trials and assess yield
   c. Combining farmer’s preferences, multi-location trials on-station, and nutritional value, identify the best genotypes to demonstrate further
5) Variety release in Morocco
   a. Select 3 most homogenous spike/SPS-to-row-to-plot/single plant progenies
   b. Harvest the selected plots, and plant as 100 m² large plots in the off-season.
   c. Harvest the 2 most homogeneous plots individually.
   d. In the on-season, plant 100 m² plots, form one of these it will be collected 300 spikes and 25 Kg for variety catalog submission
6) Accelerate variety release in Lebanon
   a. Collect yield and its components from multi-location testing
   b. Conduct statistical analysis and identify, for each station, the four most promising genotypes
   c. Use two seasons data to identify the best candidates and submit to the Ministry for registration in the catalog.
   d. Select 3 most homogenous spike/SPS-to-row-to-plot/single plant progenies
   e. Harvest the selected plots, and plant as 100 m² large plots in the off-season.
   f. Harvest the 2 most homogeneous plots individually.
   g. In the on-season, plant 100 m² plots. Form one of these it will be collected pure seeds for variety pre-multiplication.
7) For all crops, assess in the high and lowlands of Ethiopia
   a. Collect yield components from two lowland stations
   b. Conduct statistical analysis and identify the most promising genotype for each crop and each station
c. Repeat the experiment at the two stations using only the most promising genotypes

8) For durum wheat and lentil, assess in the heat-prone station of Senegal
   a. Collect yield components from the heat affected station
   b. Conduct statistical analysis and identify the most promising genotype for each crop
   c. Repeat the experiment, adding one more station in Mauritania for the best genotypes.

[2021 Outlook]
1. Evaluate and fix interspecific crosses
   BC$_1$ or BC$_2$ F$_{5:7}$: Conduct multi location advanced yield trials. By now the lines have become >99% inbred, and with 3.2% or 1.5% heterogeneity, respectively.

2. Variety release
   In 2021 varieties are submitted, in 2022 the first year of field data becomes available to the release committee. Only varieties that are less than 0.8 % heterogeneous will be promoted to year 2 testing. Varieties that pass the first year testing are normally released the following year.

3. Assess in the high and lowlands of Ethiopia
   In 2021 the best genotypes will have accumulated 2 seasons of on-field trials and will become now candidates for variety release in Ethiopia.
   This second year testing will be partially supported from TAAT project awarded to Solomon Assefa by the African Bank for Development.

4. Assess in the heat-prone station of Senegal
   In 2021 the best genotypes will have accumulated 2 seasons of on-field trials and will become now candidates for variety release in Senegal and Mauritania.
   This second year of field trials will be partially supported by project U-Forsk2018, awarded to Filippo M Bassi and Rodomiro Ortiz by the Swedish Research Council.