

SOLIBAM, Task 4.2: Improved performance of diversified cropping systems through (co)breeding

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Involved beneficiaries: TUM (Germany), INRA (France) , ESAC (Spain)

Plant breeding has always considered selection under monoculture conditions. Little is known about populations grown in competition, but we expect that there will be a strong selection pressure towards better adaptation to these conditions. The objective of this task is to identify genotypes adapted to diversified systems and to assess changes in morphophysiological and genetic characteristics of populations. We will identify traits that contribute to higher competitive ability, that are necessary to obtain higher yield under living mulch systems, and to choose the best performing genotypes in cereal-legume systems.

Methods:

Field trials will be performed for this task in Germany, France and Spain. Competition will be managed both through the choice of the genotypes as through the choice the planting pattern: higher distances will reduce competition in crop critical stages (early development).

(a) Breeding the cash crop (wheat experiments in Germany).

- Wheat (TUM): A Composite Cross Population (CCP) will be grown over three consecutive years in a subterranean clover living mulch and as sole crop. The experiment will be performed in different environments (at least one in a Mediterranean environment, and one in Central and Northern Europe). The composite cross should already be adapted to the respective environmental conditions but should have the same origin. Every year, a part of the harvest will be stored to permit comparison of the generation in the fourth year, when changes in the population structure will be investigated at morphological, physiological or molecular level, in cooperation with WP1 and WP3.
- Wheat (TUM): Year 1: 400 single spikes selected from a CCP will be planted separately in narrowly-spaced rows. 150-200 well adapted but morphologically diverging lines will be selected and harvested separately for the assessments to be made in the subsequent years. Year 2: screening of 200 preselected lines in small unreplicated split plots, with or without living mulch. Year 3 and 4: repetition of the screening in the first year, but with a restricted number of selected lines.

(b) Co-breeding of wheat and clover (experiments in France, INRA) and of maize and bean (experiments in Portugal, ESAC).

- Wheat and clover (INRA): Year 1: 400 accessions of wheat landraces will be grown in different environments and at the same time 9 accessions of clover species will be amplified for selecting their attitude to cover crop utilisation. Year 2: selection of 30 accessions and cultivation in small plots with clovers selected for their morphological aspect and frost resistance. Year 3 and 4: repetition of year 2 activities with a reduced number of wheat and clover populations. The aim is to select 5 wheat populations and 3 clover species.
- Maize and bean (ESAC): Year 1: Multiplication of common bean seed stock (100 accessions). During multiplication some pre-characterisation will be done. Based on farmers empirical knowledge, 15 mixes of maize-beans will be chosen for trials to be performed in 10 locations. Year 2: Multisite trials on bean, based on pre-characterisation results, in 10 locations. In parallel, and based on results of year 1, selection of maize and bean for breeding in mixture will be done in two isolations. Year 3: based on results of years 1 and 2, the best five maize-bean combinations (upon their ecological combining ability) will be