

## ReMIX H2020 - Intercrops



## Key traits and cultivar selection for superior mixed cropping systems



**Key traits should have repeatability across environments, affect mixture performance and be easy to measure**

*by Pierre Hohmann*

Current mixed cropping practices neglect the use of plant traits to identify appropriate mixing partners. In order to develop optimal cultivar combinations, it is important to find key traits and ideotypes that can be used for the selection of suitable cultivars. Within WP4, we developed a list of different traits covering traits from morphological, physiological, agronomical, disease and pest resistance and quality characteristics. Key traits should have repeatability across environments, affect mixture performance and should be easy to measure. We conducted various field experiments in different environments and mixed cropping systems (Figure 1 as an example of a pea/wheat mixed cropping trial in France). In general, we identified plant height, wheat tillering ability and pea flowering starting date, heading date of cereals, the number of ears, early soil coverage, plant architecture, and ripening time as important key traits for species mixtures. In addition, traits associated with temporal niche differentiation and plasticity might be of particular interest to optimise species interactions in mixed cropping systems. Further results of the various field experiments point to the importance of cultivar selection to enhance mixed cropping performance. Both the legume and the cereal partner showed significant variation among cultivars for total grain yield. As expected, mixture yields were not always well predicted by pure stand performance, indicating the need to (i) identify cultivars suitable for mixed cropping and (ii) consider mixture performance in breeding programmes. Instead of having to test all possible combinations of legume and cereal genotypes, the tester approach (derived from hybrid

breeding) seems a viable solution for mixed cropping breeding. Besides modern cultivars, we demonstrated that traditional cultivars, populations and also cultivar mixtures can show good adaptation to grow in species mixtures. This is of particular importance for the valorisation of cultivars that are less frequently used in modern sole stand cultivation. Overall, we provided sound evidence for the importance of cultivar choice to achieve high-performing mixed cropping systems, meaning a good complementarity between the two (or more) species intercropped.



FIG 1. Pea wheat mix in France

INRAE continues the development of new phenotyping methods based on plant imagery. A robot designed specifically for in-field plant phenotyping, called Phenomobile, is available on Agrophen phenotyping platform at INRAE-Toulouse (Figure 2). The system takes multispectral images and uses deep learning techniques to differentiate two species in a mixture and determine growth parameters. The phenotyping platform can be used to screen different cultivars in mixtures at early growth stages in order to find superior combinations. More sophisticated data analyses combining distance measuring techniques (LiDAR) and images will allow to also test combinations at mature growth stages.



Phenomobile robot for in-field plant phenotyping, available at INRAE-Toulouse

---

Redaction : INI

Creation date : 24 September 2020

Updated : 28 September 2020