

Co-design of locally adapted wheat variety mixtures

Problems

A growing number of organic farmers cultivate **variety mixtures** for their ease of use and their ability to buffer stress and environmental heterogeneity. Farmers have to **choose the varieties for designing their mixtures**, but few guidelines have been proposed so far. In the case of **winter wheat**, mixtures are usually assembled primarily based on yield. It is advised to mix varieties with **complementary levels and sources of foliar disease resistances** and to maintain homogeneity of **maturity** to ensure good quality.

Solutions

To guide farmers with optimised composition mixtures, the approach is to identify **assembly rules** for combining mixtures components (Figure). A **participatory approach**, based on workshops, is particularly suitable for designing locally adapted mixtures. Gathering farmers, researchers and technical experts to **exchange knowledge** allows many and varied ideas to emerge on how to favour complementarities and synergies between varieties within mixtures.

Farmers' point of view, especially in organic farming, is very important for designing assembly rules in accordance with **farmers' practices and production contexts**.

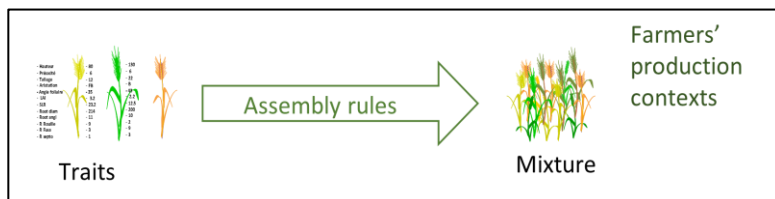


Figure: Designing assembly rules to combine traits within mixtures

Practical recommendations

- **limit disease development** by keeping proportion of **susceptible varieties** < 30%, and by using varieties able to compensate through high tillering ability or high TKW (thousand kernel weight).
- increase **weed control** through **wheat competitive ability** by (i) using varieties with early vigour or high tillering ability, (ii) diversifying varieties for earliness, height and growth habit.
- **face nitrogen stress** by (i) tolerating an early deficit, by complementarity (ii) in time of **nitrogen demand** (diversified earliness), or (iii) for **nitrogen use efficiency**.

Further information

The assembly rules are currently being validated and integrated in a **multi-criteria assessment tool**:

<http://moulon.inra.fr/optimiz/>

1. Barot et al 2017. Designing mixtures of varieties for multifunctional agriculture with the help of ecology. *Agron. Sust. Dev.* 37: 13.
2. Wheatamix project: https://www6.inra.fr/wheatamix_eng/
3. CASABio project: https://www6.inra.fr/basc_eng/Research/Innovation-in-partnership/CASABio
4. Emma Forst 2018 (PhD thesis): <https://tel.archives-ouvertes.fr/tel-02114929>

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