



**INTERCROP  
VALUES**



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## PRACTICE ABSTRACT N° 29

# Cereal-legume intercropping: how cultivar, environment, and management shape performance

### Problem

Intercropping systems rely on interactions between component species; however, the performance of intercrops is governed by complex genotype × genotype × environment × management (G\*G\*E\*M) interactions, which remain insufficiently understood and rarely integrated into species and genotype selection.

### Solution

Understanding how G\*G\*E\*M interactions affect intercrop performance can help inform crop cultivar choice, growing environments, and management practices to optimise intercropping productivity.

### Benefits

G\*G\*E\*M interactions indicate that genotype suitability is highly environment- and management-specific, demanding integrated breeding and agronomic approaches. Disentangling these interactions provides a framework for designing resilient and productive intercrops tailored to local agroecological conditions, contributing to more sustainable cropping systems.

### Practical recommendations

#### Considerations for cultivar choice:

- Cereal and legume cultivars for intercropping systems should be carefully selected to maximise complementarity and cooperation, while reducing competition to optimise intercrop performance
- Cultivar selection criteria may include many traits, such as species growth synchronisation, especially at maturity, abiotic and biotic stress tolerance, growth habit, cultivar vigour, lodging resistance, and other morphological aspects such as leaf size and plant and root architecture
- Crop cultivars can be highly plastic in their response and can adapt to their growing environments
- Differential sowing densities of the two crop species will affect crop interactions and individual crop species performance

#### Recommendations:

- Farmers should test several cultivar mixtures and sowing densities under their own conditions, while considering experiences and recommendations from other farmers and external advisors
- Integrated breeding approaches for cultivars better suited for intercropping should be encouraged and supported through research and policy

### Applicability box

#### Theme

Cropping systems, Arable crops

#### Keywords

Cereal crops, Legumes

#### Context

Temperate, subtropical and tropical areas

#### Application time

Autumn and summer crops

#### Equipment

Standard machinery used for cereal cultivation

#### Best in

Cereals and legumes under low input conditions





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**Figure 1:** Different spatial arrangements in field trials of white lupin-cereal intercropping at a 50:50 sowing ratio (alternate rows). Photo: Luciano Pecetti, CREA, Lodi, Italy.



**Figure 2:** Cultivar testing within an intercropped system in an organic farmer's field. Photo: Christos Dordas, AUTH, Giannitsa, Greece.



**Figure 3:** Testing of different spring wheat and faba bean varieties as both sole and intercrops at 50:50 sowing ratio. Photo: Pascal Winten, UBonn, Klein-Altenendorf, Germany.

### Further information

#### Further readings

- Justes, E, Bedoussac, L, Dordas, C et al. (2021): The 4C approach as a way to understand species interactions determining intercropping productivity. *Frontiers in Agricultural Science and Engineering*, Vol. 8 (3). <https://doi.org/10.15302/J-FASE-2021414>.
- Kiær, L, Weedon, O, Bedoussac, L et al. (2022): Supply chain perspectives on breeding for legume-cereal intercrops. *Frontiers in Plant Science* 13:844635. <https://doi.org/10.3389/fpls.2022.844635>.

#### Weblinks

- Check the [Organic Farm Knowledge Platform](#) for more practical recommendations.

### About this practice abstract

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**IntercropVALUES** aims to exploit the benefits of intercropping to design and manage productive, diversified, resilient, profitable, environmentally friendly cropping systems acceptable to farmers and actors in the agri-food chain. As a multi-disciplinary and multi-actor project, it brings together scientists and local actors representing the food value chain. It includes 27 participants from 15 countries (3 continents) from a wide diversity of organizations and stakeholders. The project will run for four years and started in November 2022.

**Project website:** <https://intercropvalues.eu/>

