

Intercropping winter grain-legumes and cereals for increased biodiversity in cropping systems

Problem

The increase of the world population requires analogous increases in food production per area and maintaining the sustainability of agriculture (Justes et al., 2021; Stomp et al., 2020).

Solution

Intercropping winter cereals with legumes i.e. faba bean, pea, etc. is a sustainable practice that can increase diversification and maintain crop yield (Fig. 1-3) (Justes et al., 2021; Stomp et al., 2020).



Figure 1: Mixture of pea and bread wheat.

Applicability box

Geographical coverage

Mediterranean climate

Application period

Autumn

Required time

No additional time during cultivation. The harvested crop needs to be separated at a collection point.

Period of impact

Duration of crop

Equipment

Standard machinery used for wheat cultivation

Outcome

Mixed cropping systems maintain yield, increase biodiversity and maintain sustainability of the agricultural systems with no need to include N fertilizers.

Practical recommendations

- The seed bed should not be too fine-grained after cultivation.
- Test soil samples and amend P and K levels if it is necessary.
- Select cultivars (wheat and grain legume) with the same maturity time according to local seed costs and availability on the market.
- Mix the seeds 70% grain legume and 30% wheat (comparing to the standard sowing quantities of the two crops) in the seed tank (check that the mixture is homogenous) and sow with a conventional seeder.
- Use same row spacing as for cereal.
- Apply weed control as needed (organic or conventional).
- Adjust height of harvester to pick up grain legumes close to ground.
- The success of the intercropping is affected by different factors such as soil and climate conditions, choice of species and cultivars, organic vs conventional management system, weeds/pests/diseases control, technical equipment and type of intercropping.
- Proportion of yield from each species can vary largely from sowing proportion. In most case total yield is higher than the average of sole crops. Also, there is increase in protein content as legumes are responsible for a high protein content and cereals have a high plasticity for tillering /compensation and supporting the legume from logging.

Practical testing/ Farmers' experiences

- If this crop system seems suitable for you, we recommend to test it under your conditions.
- Separate a part of your field before sowing and apply the mixture.
- Cultivate the rest of the field as usual and compare the intercrop to the sole cereals and /or legumes.



Figure 2: Mixture of pea and bread wheat.



Figure 3: Mixture of faba bean and bread wheat.

Further Information

- **Webpage:** <https://www1.montpellier.inra.fr/wp-inra/biodiversify/>
- **Scientific Journal:**

Justes, E; Bedoussac, L; Dordas, C; Frak, E; Louarn, G; Boudsocq, S; Journet, EP; Lithourgidis, A; Pankou, C; Zhang, CC; Carlsson, G; Jensen, ES; Watson, C; Li, L. 2021. The 4C approach as way to understand species interactions determining intercropping productivity. *Frontiers of Agricultural Science and Engineering*, 8, 3.

Stomph, T., Dordas, C., Baranger, A., Bedoussac, L., de Rijk, J., Dong, B., Evers, J., Gu, C., Li, L., Simon, J., Steen Jensen, E., Wang, Q., Wang, Y., Wang, Z., Xu, H., Zhang, C., Zhang, L., Zhang, W.-P., van der Werf W. 2020 Designing intercrops for high yield, yield stability and efficient use of resources: are there principles? *Advances in Agronomy*, 160, 1–50.

About this practice abstract and Biodiversify

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Biodiversify is a PRIMA 2019 project (<https://www1.montpellier.inra.fr/wp-inra/biodiversify/>) investigating how agricultural biodiversification (i.e. mixed cropping, cover cropping and agroforestry) can increase ecosystem services, sustainability and resilience of Mediterranean agriculture.