Stacking practices on-farm: intercropping and cultivar mixtures combined for enhanced pest regulation

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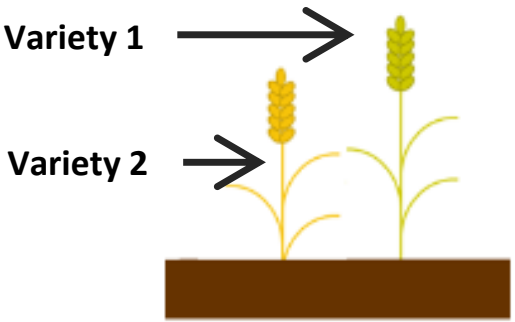
Stacking practices for enhanced ecosystem services

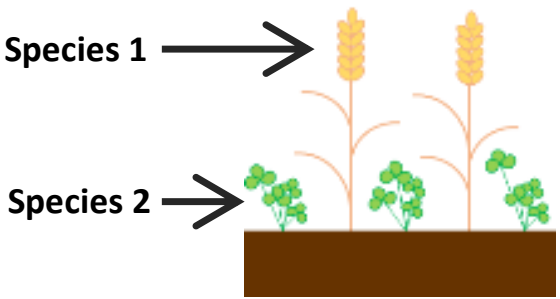
Diversification practices selected from the European Survey
(Alexander Wezel)

Mixture of varieties
(Intraspecific diversity)

Species association
(Interspecific diversity)



Varieties selected through lab experiments
(Vélémir Ninkovic)



Variety mixture and intercropping: in field practices of interest for farmers

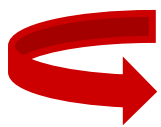
Provision of ecosystem services

Mixture of cereal varieties

- Diseases regulation
- Higher yield
- Reduction of pest abundance

Cereal-legume intercropping

- Weed control
- Improved N management in cropping system
- Prevention of erosion and leaching
- Reduction of pest abundance



Getting synergies from combining practices?

Field experiments of practices stacking

- Large scales experiments & on commercial farms under real farming conditions
- Choice of cereal/legume species/variety according to the pedoclimatic conditions
- Design in collaboration with stakeholders of the supply chains

Spain

Winter wheat for quality bread flour

Shared decision-making scheme

(farmers + flour makers + researchers in the peri-urban agricultural area of Gallecs)

1. Selection of wheat species and varieties	Benefits	Drawbacks
***Triticum aestivum* L. subsp. *aestivum* cv. Florence Aurora** as main wheat variety for bread baking, namely **FLORENCE**	High quality bread-maker flour (350W)	High susceptibility to aphid infestation Prone to outcompeted by weeds (70 cm in height) Early ripening
2. Selection of other companion winter wheat varieties in the mix, more tolerant to aphid infestation, more competitive against weeds, but also interesting for bread baking		
***Triticum aestivum* L. subp. *aestivum* cv. Montcada**, namely **MONTCADA**	Good quality bread-maker flour (200W) Early ripening	
***Triticum turgidum* L. subp. *durum* cv Forment**, namely **FORMENT**	Competitive against weeds (180cm in height)	Low susceptibility to aphids
	Non-bread-maker, but it offers a good aroma to bread (W=43)	
3.Selection of an undersowing crop (*Medicago polymorpha* L.) mixed with main cash crop, well adapted to basic soils and to Mediterranean climate		

W = Grain nitrogen content, extrapolated from gluten strength

Field experiments of practices stacking

- Large scales experiments & on commercial farms under real farming conditions
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Winter wheat for quality bread flour

Spain

Organic winter barley for brewery

France

Field experiments of practices stacking

- Large scales experiments & on commercial farms under real farming conditions
- Choice of cereal/legume species/variety according to the pedoclimatic conditions
- Design in collaboration with stakeholders of the supply chains

⇒ Increased potential for practices implementation
⇒ Relevance of the results for farmers
⇒ Increased interest of professionals
⇒ Relevance for the local supply chains

Ecostack field day event

Field experiments of practices stacking

	Spain	France
Mixture of cereal varieties	3 winter wheat varieties: Florence (FA) alone or mixed with Montcada (MO) or Forment (FO)	2 winter barley varieties: Margaux and Amistar alone or combined
Cereal-legume intercropping	Intercropping with *Medicago polymorpha*	Intercropping with a mixture of 3 clovers (Grimson, Egyptian and White clovers)
	5 organic commercial fields 2 years experiments	11 organic fields on commercial farms 2 growing seasons

Some results…

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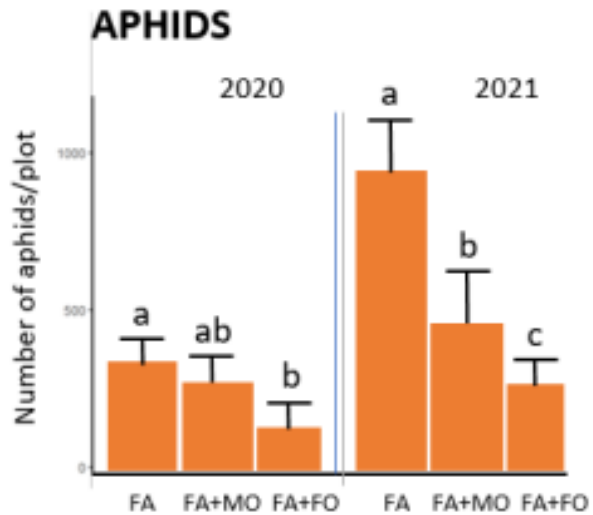
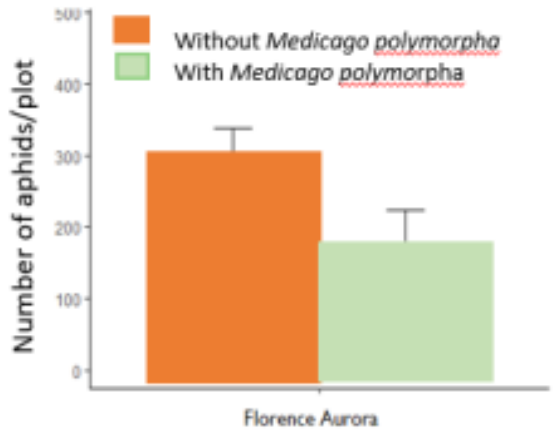
⇒ **Mixture** of Florence variety with aphid's tolerant wheat varieties **reduces the infestation** level of aphids



⇒ **Intercropping** of Florence variety with *Medicago polymorpha* **reduces the aphid's abundance** on wheat



Some results…

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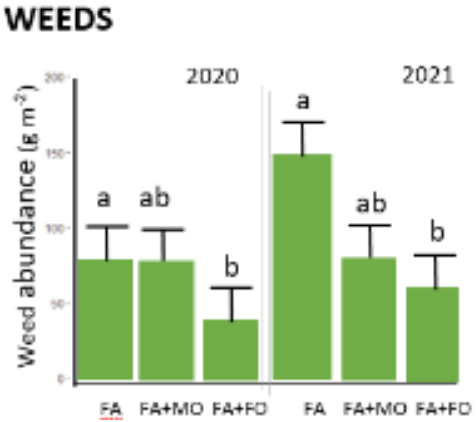
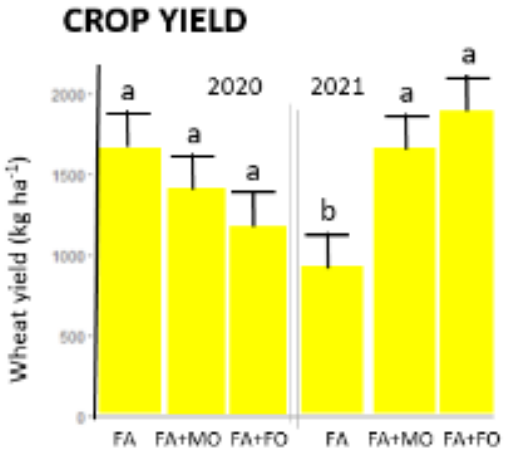
⇒ **Mixture** of Florence with wheat varieties with high competitive ability against weeds **reduces the weed** abundance



⇒ **Mixture** of Florence with other wheat varieties allows to maintain crop yields in severe conditions

(e.g. high pressure of aphids and weeds, even drought)



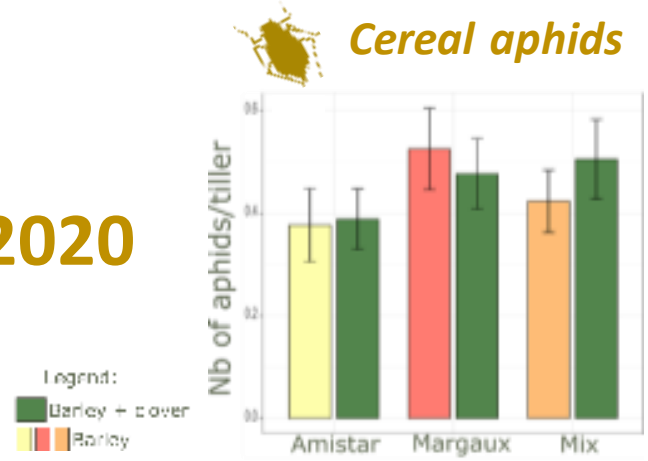
Some results…

⇒ **Mixture in-between** the most and the less aphid sensitive barley variety

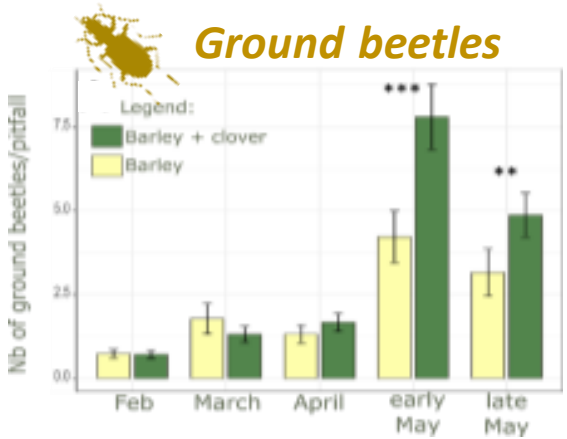
⇒ **Intercropping** has contrasted effect depending on aphid species

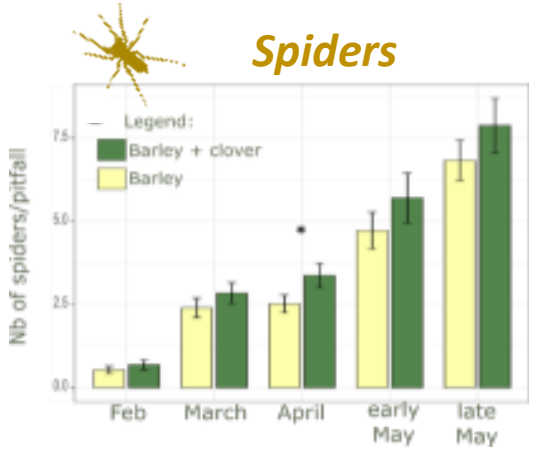
⇒ **No synergistic effect** of practices

2020



⇒ **Intercropping increases ground beetles and spiders** abundance



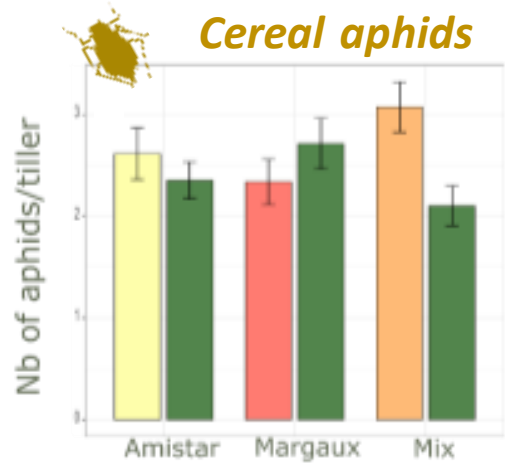


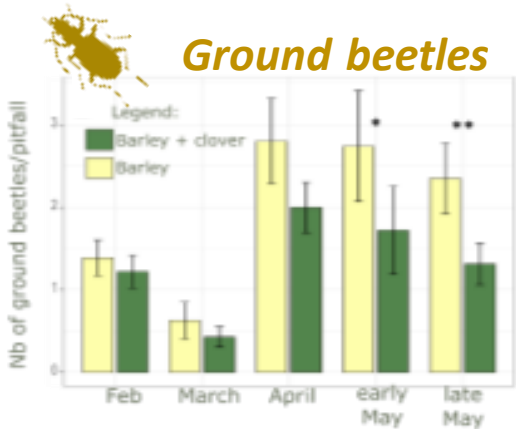
Some results…

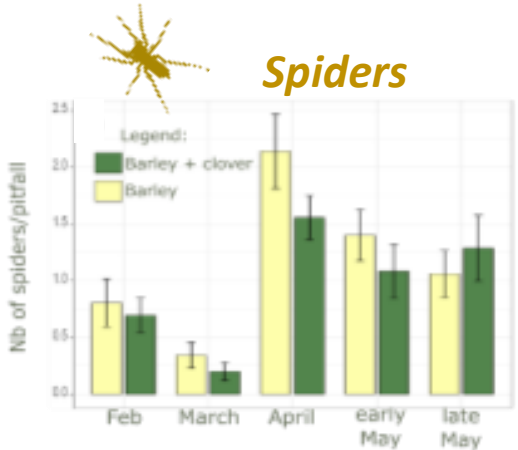
⇒ **High variability** of results depending of the **year**

⇒ Effect of the practices depends of the **climatic conditions** and of the **clover cover development** (biomass)

2021

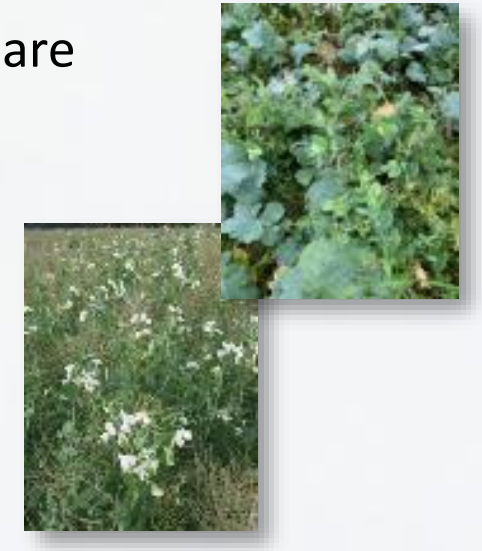






- ✓ Increasing within field plant diversity shows promising results
- ✓ Additional experiments with mixture of cereal varieties + association with legumes are on going in other partner countries
  (England/Rothamsted, Sweden/SLU, Finland/Luke, Bosnia/ULB)
- ✓ Experiments of increasing plant diversity are conducted also in oilseed rape systems
  (Germany/Kön, England/Rothamsted, Finland/Luke)

Intercropping with different companion plants: peas, clover, oat…



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Thank you!

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