Participatory design and assessment of diversified Mediterranean cropping systems – Method and results for two case studies

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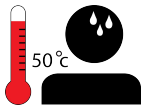
Context in the Mediterranean area

Main issues



- **Adaptation to climate change** : water shortage, extreme events leading to yield reduction (ex. Bindi and Olesen, 2011 ; Maracchi et al., 2005 ; Miraglia et al., 2009)

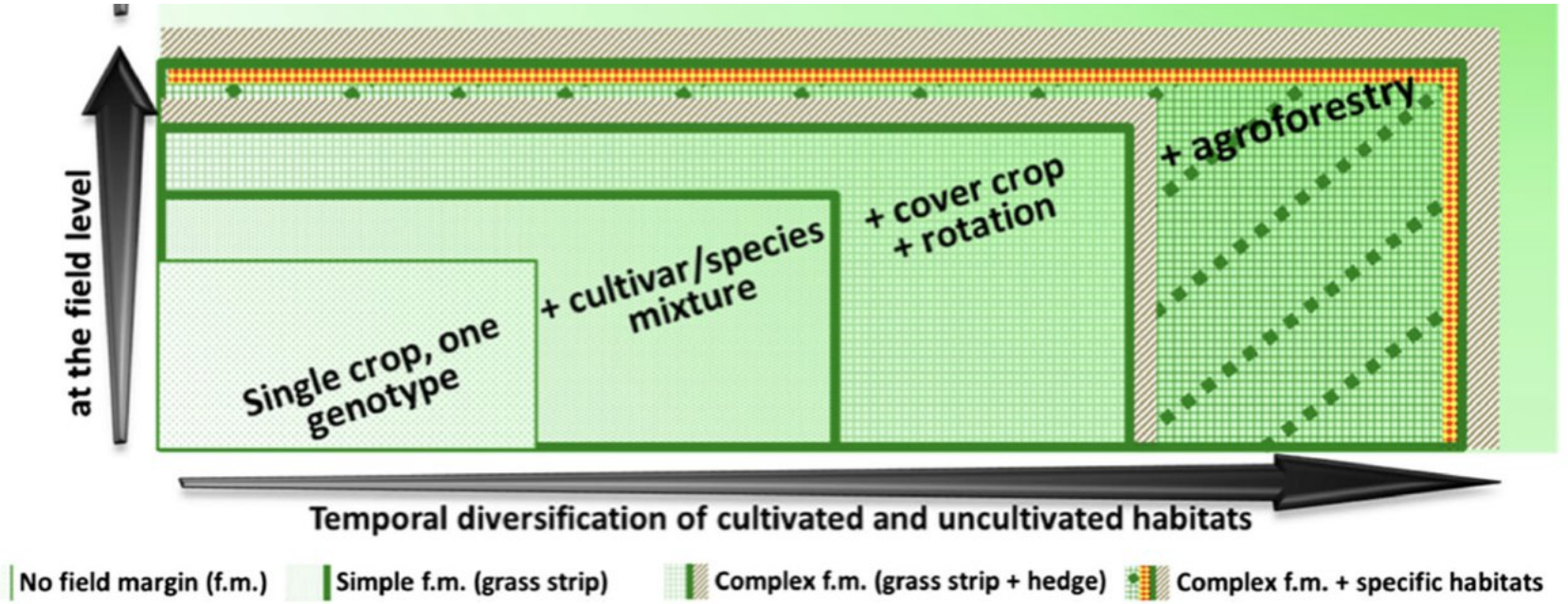
- **Reduction of the environmental impacts of current systems:** water pollution (pesticides, nitrates), risks for the environment and human health (ex. Alavanja et al., 2004 ; Foley et al., 2011 ; Enserink et al., 2013)

=> Need to system redesign (Jacquet et al., 2022 ; Meynard et al., 2012)

- **Diversification as a promising solution (HSD-High Species Diversification)**
- **Here focus on plot scale**

Objective

- **Design and assess**, with stakeholders, new cropping systems using diversification as a main lever, in several case studies



Source : Duru et al., 2015

- **Design a method based on simple tools**, beginning with the definition of the reference cropping system in each case study

8 Case studies

200 km

Cereal-based systems Vineyards Agroforestry systems

Methods

Diagnosis

- Types of farms and cropping systems
- Using existing databases, surveys, and new ones if needed

Co-design

- Discuss diagnosis
- Build SWOT
- Design using SWOT
- Assessment indicators

Co-assessment

- Crop models + socio-eco framework

- Ranking dimensions and indicators
- Discussion

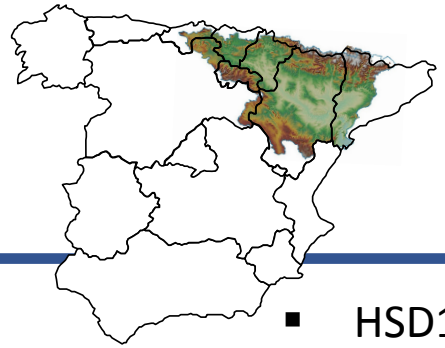
1st results – SWOT elements used in co-design

200 km

Strenghts	Opportunities	Weaknesses	Threats
Profitable livestock	New alternatives crops	Production costs	Herbicide resistance
Stable ferti. availability		Pests and fungal	Nitrogen legislation
Crop knowledge		Cereals only	Climate change
Possibility to diversify			

Strenghts	Opportunities	Weaknesses	Threats
Other activities	Intercropping practices	Low production	Fertilizer costs
Self-seed production	No-till practices	Cereals only	Climate change

1st results – Co-design



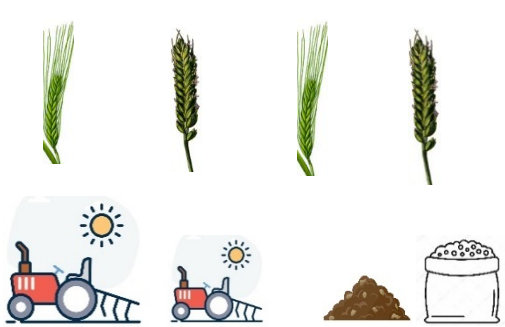
200 km

REFERENCE

- Barley-wheat (*grain, mainly feed*) rotation
- Tillage: intensive vertical with subsoiler + chisel
- Fertilization:
  - pig slurry (pre-sowing) at 85 kg N/ha + N at 85+40 kg N/ha (top-dressing).

Diversified ALTERNATIVES

- HSD1: *Barley-wheat-**pea**-wheat*
- HSD2: *Barley-wheat-**rapeseed**-wheat*
- Tillage: reduction based on cultivator
- Fertilization: emphasis on pig slurry valorization
  - Non-legumes: pig slurry (pre-sowing) at **170** kg N/ha and UAN at **40** kg N/ha (top-dressing).
  - Pea: pig slurry (pre-sowing) at 85 kg N/ha (for P)



1st results – Co-design

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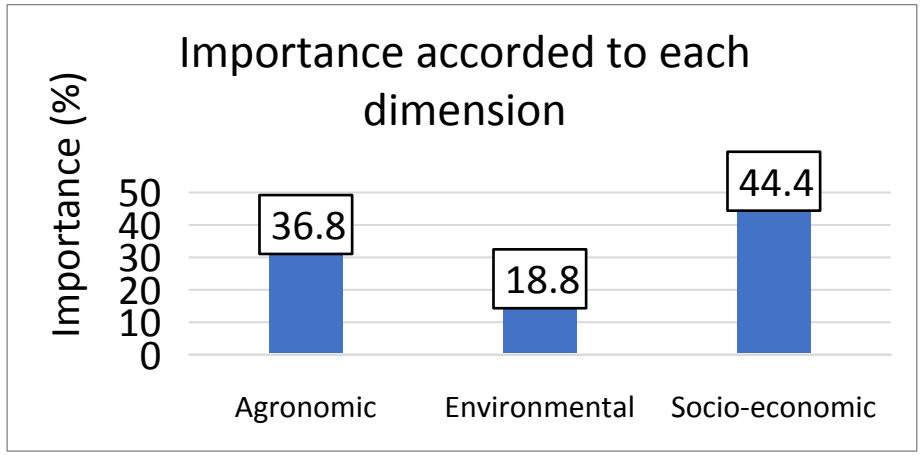
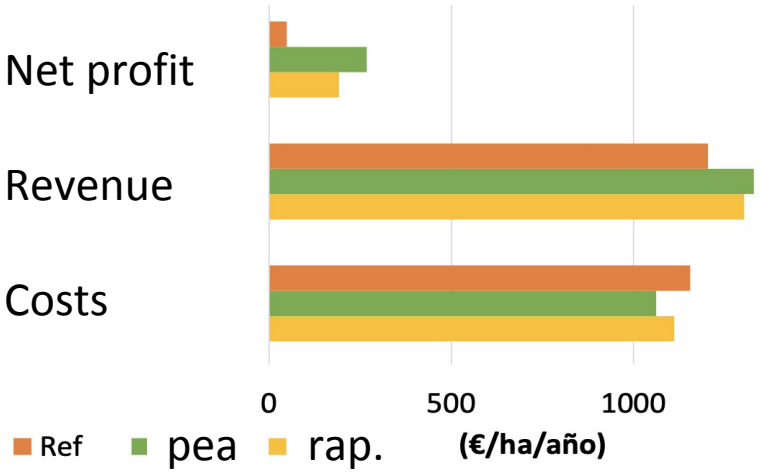
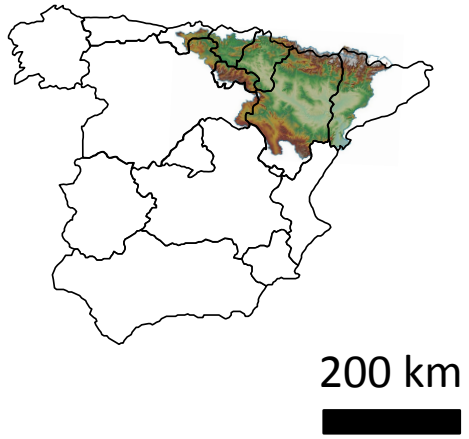
- Barley-wheat

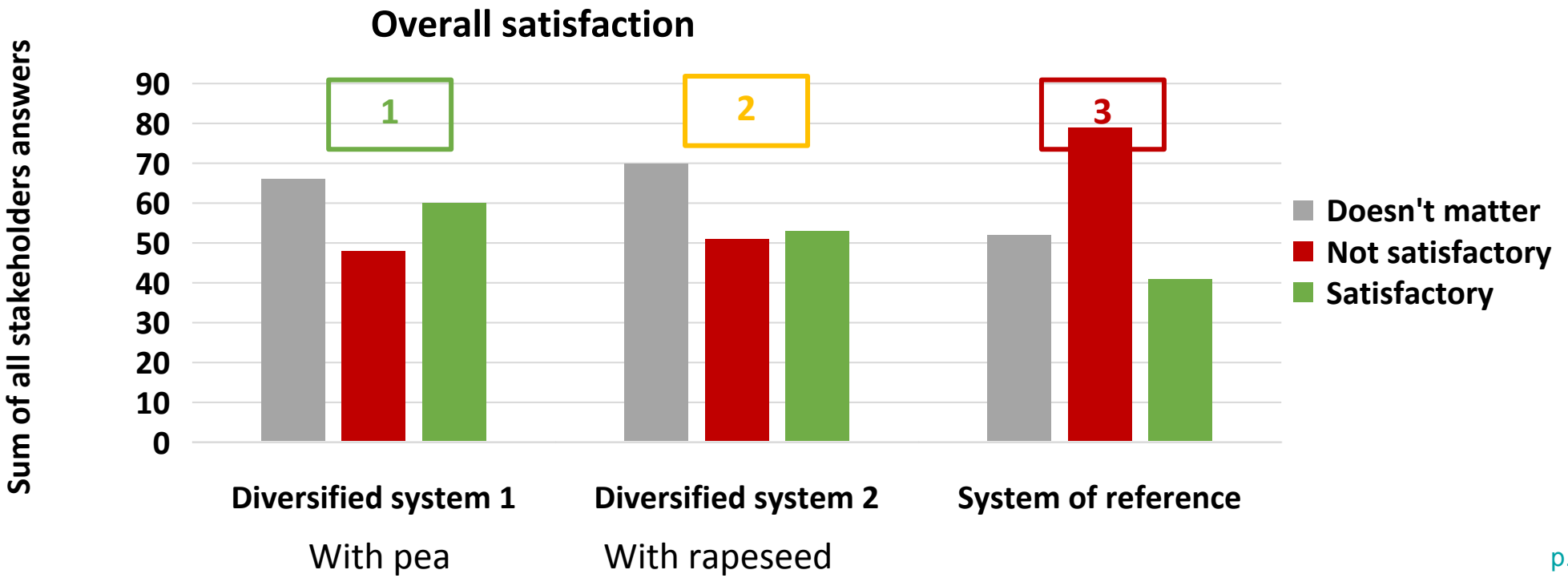
- Intercropping : pea-oat, barley-oat, barley-oat-pea
- 2 to 3-years rotations :
  - Wheat-**legumes**
  - Wheat-**fodder crops** (vetch or pea)-**legumes**
  - Wheat-**market gardening** 💧

1st results – Assessment









Perspectives

- **New systems designed in Spain :**
  - *wheat-pea-barley-rapeseed and wheat-rapeseed-barley-pea*
  - Modify practices (rapeseed fertilization, pesticide applications)

- **New indicators asked :** ratio Earnings/Investment, CAP subsidies, holistic carbon balance

- *To be followed in Spain and in the other case studies...*

- Towards more disruptive changes? More systemic changes?

- Who to accompany those changes? Change scale ?

Thank you for your attention

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