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

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Farming System Design, 31st of October, 2022 – Session 3

Spanish Grant PCI2020-112297 funded by:
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

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

Source: Duru et al., 2015
8 Case studies

- Cereal-based systems
- Vineyards
- Agroforestry systems

Map of the Mediterranean region with case study locations marked.

200 km scale bar.
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

**Strengths**
- Profitable livestock
- Stable ferti. availability
- Crop knowledge
- Possibility to diversify

**Weaknesses**
- Production costs
- Pests and fungal
- Cereals only

**Opportunities**
- New alternatives crops

**Weaknesses**
- Production costs
- Pests and fungal
- Cereals only

**Threats**
- Herbicide resistance
- Nitrogen legislation
- Climate change

**Weaknesses**
- Low production

**Threats**
- Fertilizer costs
- Climate change

**Strengths**
- Other activities
- Self-seed production

**Opportunities**
- Intercropping practices
- No-till practices
**1st results – Co-design**

**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-rape-seed-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

**REFERENCE**

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**Diversified ALTERNATIVES**

- HSD1: *Barley-wheat-pea-wheat*
- HSD2: *Barley-wheat-rapeseed-wheat*
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  - Pea: pig slurry (pre-sowing) at 85 kg N/ha (for P)

- 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

Importance accorded to each dimension

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<th>Importance (%)</th>
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Overall satisfaction

Net profit
- Ref
- pea
- rap.

Revenue
- Ref
- pea
- rap.

Costs
- Ref
- pea
- rap.

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Overall satisfaction

Net profit
- Doesn't matter
- Not satisfactory
- Satisfactory

Revenue
- Doesn't matter
- Not satisfactory
- Satisfactory

Costs
- Doesn't matter
- Not satisfactory
- Satisfactory

Overall satisfaction

Net profit
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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

References


