

# Diversified annual crop rotations in Italy

## Case Study 7

*Experimenting crop diversification and low input farming*

Experimentation plot of 18.1 ha with durum wheat and tomato located in Padania Valley (Italy)

The diversification included changes in land use, technical management, and new business tools to increase agro-biodiversity, reduce impact on soil and water quality and mitigate economic risks, respectively. So, the diversification included are:

- 1 Introduction of a leguminous crop in the rotation (pea for food)**
  - 2 Introduction of tomato as second crop after pea (multiple cropping)**
    - \*The diversified rotation is tomato, wheat, pea/tomato
- + Use of digestate as an amendment and integrated pest management**
  - + Multi-year and multi-crop contracts with allocation guarantee, crop insurance schemes and technical support for the pea cultivation**

### AGRONOMIC BENEFITS

1. Double yield
2. Workload and risk of soil compaction reduction
3. Decrease of bulk density: an indicator of a decrease of soil compaction

### ENVIRONMENTAL BENEFITS

1. Increase of functional agro-biodiversity
2. Reduced tillage uses less fuel energy thereby contributing to lower greenhouse gas emissions
3. Diversification significantly reduced the content of total copper in soils

### SOCIOECONOMIC BENEFITS

1. The economic performance is influenced by the yearly climatic trends and by the quality of the products that have a different market price
2. The yield of tomato as sole crop was higher in diversified systems than in control, the wheat yield was higher in the diversified system in the only comparable year
3. The gross margin was higher in the diversified systems





## WHY IMPLEMENT CROP DIVERSIFICATION?

The proposed diversification has shown to have maintained or increased the gross margin for the farmer and to potentially improve the general environmental performance. Furthermore, the use of digestate in the long term has a double advantage: i) it enables the use of an abundant waste material in the area, and ii) it improves some soil properties (total nitrogen, available phosphorus).



### AGRONOMICS DRAWBACKS

1. The yields of wheat, tomato and pea were unstable in the three years
2. The risk of reduction of yields in the transition period was magnified by adverse meteorological conditions
3. Risk due to strict timing for soil, planting and seeding operation

### ENVIRONMENTAL DRAWBACKS

1. **Decrease of soil organic carbon**
2. No effect of digestate was revealed in diversified systems nor in the control.
3. No positive effects were observed for microbial biodiversity, but this probably needs a longer time to be detected.

### SOCIOECONOMIC DRAWBACKS

1. **The technical problems of growing tomato** as second crop in a very short cycle (under 4 months) can negatively affect the overall gross margin result
2. The re-design of the farms devoted to agri-food production transition costs and to manage the risks due to "unknown" crops and their market

### **FINAL CONCLUSION**

The rotation allowed to increase the gross margin for the farmer, essentially because in three years there are 4 crops and 4 different products to be sold. The use of digestate was positive for the soil quality, increasing the total nitrogen supply, allowing to reduce the mineral fertilizers supply. It is also a clear example of the circular economy. Environmental benefits include the reduction in soil compaction, demonstrated by the reduction of the bulk density of the soil, increase in agro-biodiversity, reduction in tillage.