NATAE
North African Transition to AgroEcology

Crop rotation in the Mediterranean: legumes and cereals

Agroecological zones

Cereal plain

Introduction

Crop rotation (crop sequence) is an agronomic practice that consists of successively cultivating different species on the same plot of land according to a predefined cycle. It applies to both annual and biennial crops. Rotation is a fundamental pillar of the sustainability of agrosystems and is one of the most common agroecological practices, particularly in cereal systems.

Source: INAT, Tunisia

The benefits of crop rotation

- **Improved soil fertility** (physical and chemical benefits): Crops in rotation have different nutritional requirements, enabling better nutrient management and limiting soil depletion of specific mineral elements. Incorporating legumes into the rotation contributes to soil fertility by fixing nitrogen from the air and activating the nitrogen cycle. Crop rotation also improves soil structure thanks to the different shapes and depths of the root systems.
- **Reducing erosion:** Diversifying crops, particularly with the introduction of deep-rooted plants, stabilises and fixes the soil, reducing the risk of erosion. In the context of agroecological transitions, rotations are set up to ensure permanent soil cover, protecting soils against water and wind erosion.

- **Combating diseases and pests:** Rotations interrupt the life cycle of pathogens or pests specific to a crop, reducing phytosanitary pressure and thus reducing or eliminating the use of chemical pesticides.
- **Optimising water use:** Certain crops in rotation require less water and enable better management of water resources by conserving water reserves in the soil.
- **Reducing or eliminating chemical fertilisers:** Using different crops with different root architectures also allows fertilising elements to be fully utilised at different soil depths. Integrating legumes into the cropping sequence improves soil quality and organic nitrogen content, reducing the need for chemical fertilisers, including for the following crop. Combined with the use of organic fertiliser, rotations make it possible to avoid chemical fertilisation.

The role of legumes in rotation

Legumes (Fabaceae) fix nitrogen from the air through a symbiosis between legumes and soil bacteria of the Rhizobium and Bradyrhizobium genera. These bacteria form root nodules that accumulate forms of nitrogen that plants can assimilate. Incorporating legumes into the crop rotation naturally enriches the soil in nitrogen, reducing the need for chemical or organic nitrogen fertilisers.

Source: INAT, Tunisia

The main legumes grown in crop rotations in the Mediterranean

Pulses play a key role in Mediterranean agriculture. Not only are they beneficial for the soil, they are also an essential source of protein for human consumption, and can be used in livestock feed rations. These legumes are particularly rich in protein, with levels generally varying between 18% and 26%.
The main pulses grown in the region are:

- Broad beans and faba beans (Vicia faba major and minor)
- Chickpea (Cicer arietinum)
- Peas (Pisum sativum)
- Fenugreek (Trigonella foenum-graecum)
- Lentils (Lens culinaris)
- Beans (Phaseolus vulgaris)
- Cowpeas (Vigna unguiculata)
- Groundnuts (Arachis hypogaea)

Examples of crop rotations in North Africa

- **Simple or biennial rotation:** This type of rotation is based on the annual alternation of a cereal crop and a legume, providing natural nitrogen via symbiotic fixation and improving soil structure. Durum wheat/beans, durum wheat/chickpeas or fenugreek/durum wheat are relatively common rotations in North Africa.
- **Diversified rotation (3 years or more):** This system incorporates a greater diversity of crops, including cereals, pulses, fodder or industrial crops and sometimes market gardening. These rotations can also include biannual species such as the sulla legume (Hedysarum coronarium). Common rotations in North African field crop systems include faba bean or fenugreek/durum wheat/oat hay; or rape/durum wheat/barley. In irrigated systems, rotations such as industrial tomato / durum wheat / oat / vetch can be established.

Challenges and limitations

Certain cereal-legume rotations have been practised for centuries in the Mediterranean. An agroecological transition often involves adopting longer, more complex rotations, which require both technical adjustments and the development of markets for the new crops in rotation. Specific support from agricultural policies and collective organisation to structure new value chains are sometimes necessary.

The spread of certain diseases, parasites and pests also means that rotations need to be more complex. A combination of complementary agroecological techniques is often needed to be combat phytosanitary attacks effectively.

Funded by the European Union

Project funded by
Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Swiss Confederation
Federal Department of Economic Affairs, Education and Research EAER
State Secretariat for Education, Research and Innovation SERI

Funded by the European Union under Grant Agreement no. 101084647. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them. For the associated partner in the NATAE project, this work has received funding from the Swiss State Secretariat for Education, Research and Innovation (SERI).