NATAE
North African Transition to AgroEcology

Reducing the use of chemical inputs in the Mediterranean

Agroecological zones

Suburban | Cereal plain | Mountains | Irrigated | Oasis

Introduction

Source: INAT, Tunisia

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Reducing the use of chemical inputs (plant protection products and fertilizers) is a crucial issue for modern agricultural systems, particularly in an agroecological transition. In the Mediterranean region, this is essential for preserving natural resources, improving the health of soils and ecosystems, and ensuring farm sustainability despite environmental challenges.

Challenges: dependence on chemical inputs in the Mediterranean

The intensive use of chemical inputs has been widely adopted to increase agricultural productivity in the Mediterranean. However, this dependence has significant negative impacts. Chemical inputs **contaminate soil**, **water and air**, which is particularly damaging in Mediterranean areas, where water resources are limited and soils are often fragile and of low fertility. With the repeated use of chemical inputs, soils lose **organic matter**, microbial and biological diversity, affecting their structure, water retention capacity and fertility.

Pesticides limit the presence of organisms beneficial to agriculture, such as **pollinators**, **natural** pest **predators** and **soil micro-organisms**. They thus increase the vulnerability of crops to disease and pests. The use of pesticides also leads to the development of resistance in pests and pathogens. Farmers and their families are exposed to toxic products and additional costs for the purchase of chemical inputs. Food products may contain pesticide residues that pose public health risks. Groundwater and dam water are contaminated by leaching of fertilizers and pesticides. Finally, the use of chemical inputs contributes to agricultural greenhouse gas emissions and limits soil carbon storage.

Agroecological strategies for reducing chemical inputs

Agroecology proposes a range of strategies aimed at eliminating or reducing the use of chemical inputs. These strategies include soil management techniques, innovative farming practices and biological alternatives.

a. Crop rotation and diversification

Alternating crops on the same plot limits the overexploitation of certain nutrients. Legumes enrich the soil in nitrogen and improve its fertility, reducing the need for chemical fertilizers, including for the following crop. Diversification can be achieved by planting cover crops (**see Permanent soil cover in the Mediterranean leaflet**) or introducing legume-cereal meslin (**see Fodder associations adapted to Mediterranean areas leaflet**). Rotation also reduces phytosanitary pressure by preventing pests and diseases from finding host plants for their cycle. These practices promote biodiversity, which in turn strengthens ecosystem resilience, notably by encouraging crop beneficials.
The **introduction of species adapted to** local conditions broadens the range of species that a farmer can grow, enabling more balanced use of resources and diversification of income. Certain crops with low water requirements, such as quinoa, are being introduced in the Mediterranean. Nevertheless, any introduction of new species into agroecosystems must be preceded by an environmental risk assessment and strict compliance with plant material transfer regulations.

b. Composting and organic matter

Incorporating compost, manure or other organic matter into the soil enriches it with more sustainable nutrients than chemical fertilizers (**see Composting crop residues in agroecology** and **Improved agroecological use of manure in the Mediterranean**). This process improves soil structure and water retention capacity, and promotes the **slow mineralization of** nutrients. Organic inputs improve the soil's biological fertility. Mycorrhizal (fungus-plant) and bacterial (*Plant Growth Promoting Bacteria*) associations are stimulated, contributing to improved mineral and water nutrition of crops.

c. Mulching and organic covers

Mulching reduces water evaporation; limits weed growth and maintains a stable soil temperature. In particular, mulch blocks light, thus preventing weeds from germinating and growing, limiting the need for chemical weedkillers. In addition, as organic mulch decomposes, it enriches the soil with organic matter and bioavailable nutrients, improving its fertility without chemical fertilizers.

d. Varietal selection and improvement

Genetic resistance to crop pests limits pesticide use. In Mediterranean countries, public and private genetic improvement programmes are continuously developing productive varieties with high organoleptic, technological and nutritional quality, and tolerance to the main pests.
Genetic improvement also aims to develop varieties with better nutrient utilization efficiency, thus reducing the use of synthetic chemical inputs.

e. Biological control and natural pesticides

Biological control and the use of natural pesticides offer effective alternatives to chemical plant protection products. Biological control relies, among other things, on the introduction or preservation of natural auxiliaries such as predators (insects, birds, etc.) to regulate pest populations. In the Mediterranean region, **biological control by conservation** is a widely adopted practice. It promotes ecological balance and useful biodiversity, such as the use of companion plants that attract natural beneficials. The production or importation of auxiliaries is also practised, particularly for vegetable crops (hoverflies, ladybugs, lacewing larvae, etc.). In addition, the use of natural pesticides is an environmentally-friendly alternative to chemical products. These products, such as nettle compost tea, are natural phytosanitary preparations that are generally biodegradable and non-toxic to non-target organisms. (**see Plants as alternatives to chemical inputs in Mediterranean agrosystems leaflet**).

Challenges and limitations

Reductions in the use of chemical inputs must be carried out in a reasoned manner, using monitoring and control methods to avoid significant yield losses (**see Integrated crop protection in the Mediterranean leaflet**). Soil and plant analyses are an effective means of reasoning out and monitoring plants' nutritional status (**see sheet Techniques for monitoring the mineral requirements of crops in the Mediterranean**). For phytosanitary problems, it is necessary to monitor pest populations and the appearance of disease symptoms.

The absence of locally available laboratories or products alternative to chemical inputs can limit the reduction in the use of chemical inputs.

Developing itineraries adapted to local conditions and production challenges can take several seasons. Adjustments are regularly necessary as phytosanitary attacks evolve or, on the contrary, as soil health and biodiversity develop. This requires appropriate training and technical advice, as well as regular exchanges between peers.

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