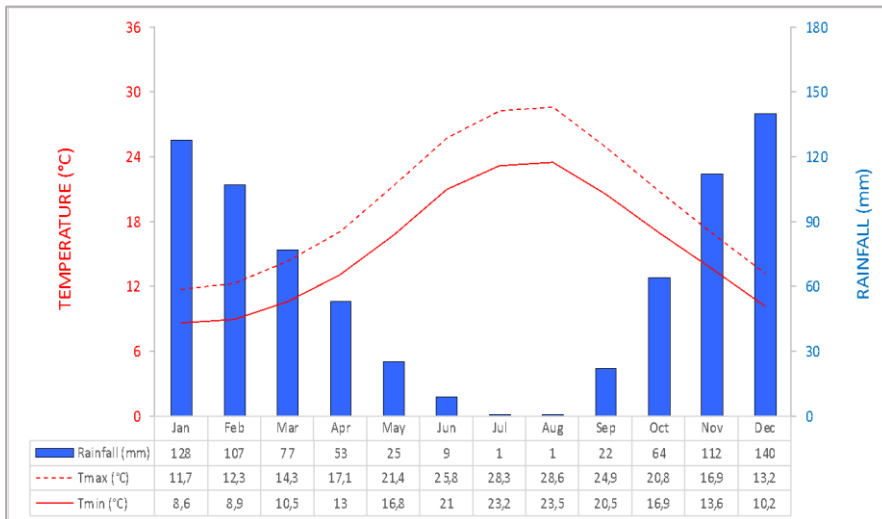


Testimonial video and associated training material

3. Green manuring and mulching



Antonios Tirpintiris, Kostas Iosifellis and Zenovia Kogia are olive growers in Lesvos, a Greek island in the northeastern Aegean Sea. In their olive orchards, they apply the agro-ecological practices of green manuring and mulching for over 15 years to prevent soil degradation and improve natural soil fertility.



The climate is a temperate hot summer Mediterranean climate. The rain in falls mostly in the winter, with relatively little rain in the summer. The temperature averages 17.6 °C and the annual rainfall is 739 mm. Lesvos has a mountainous terrain that covers a significant portion of the island. On the island of Lesvos, the olive cultivation areas are mostly mountainous soils are poor and there is an acute shortage of water. For these reasons, the cultivation is often made in terraces.

Green manuring in practice

The practice of green manure consists of growing a herbaceous crop for a short period of time with the aim not of harvesting the product, but of turning into the soil undecomposed green mass.

The main aim of green manure is to increase the organic matter content of the soil and, if the species used is a leguminous one, to make a certain amount of nitrogen available for the next crop.

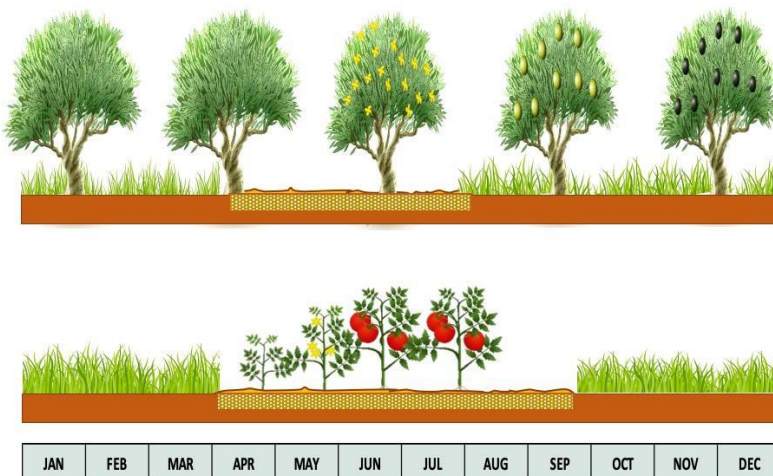
The most important benefits of a green manure crop on soil fertility are:

- ∅ green manure can be sown when the soil would be kept bare, for example between July (harvesting an autumn-winter crop) and May (sowing a spring-summer crop). This reduces soil erosion, humus mineralization, nitrogen leaching and weed development. Also, the crop uses for its growth any residual nutrients that were not consumed by the previous crop.
- ∅ the addition of easily fermentable organic matter into the soil stimulates the growth and activity of microorganisms in the soil; this results in faster decomposition of residues from previous crops and a lower incidence of diseases caused by soil pathogens and diseases.
- ∅ green manure can help the fight against pests, an example is the cultivation of cruciferous plants resistant to root nematodes, such as some varieties of horseradish.

Legumes are suitable for soil fertilization, especially to increase nitrogen availability.

Grass-legumes mixtures are suitable for soil conditioning, to improve soil structure.

Grass-legumes-cruciferous mixture are suitable for soil remedial (soil-borne pathogens, nematodes).

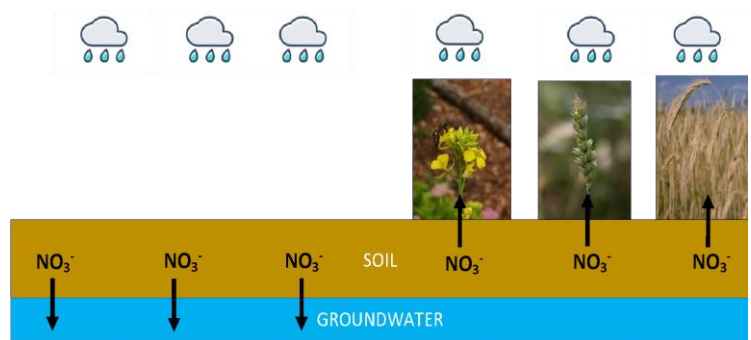


The guiding principle for the choice of green manure is to achieve rapid soil cover and produce maximum biomass in the time available. Both autumn-winter and summer green manure can be done, and it can be sown in the main crop or on stubble.

In extensive horticultural farms (e.g. tomatoes), the free intercropping period for green manure crops is from October to April. The same can be said for orchards that are dormant during the autumn-winter period and for maize-based cropping systems, where green manure can already be sown in September, and generally terminated by March.

The best time for mowing and burying is generally during the flowering. A fresh green manure buried too deep in the soil that is poorly drained or compacted can cause anaerobic fermentation harmful to the next crop. It is therefore advisable to first chop the organic material, in order to favor rapid air-drying in the air, and then after a couple of days bury the mass superficially. In the case of no-tillage, the plant mass is destroyed in advance of sowing the following crop and left on the surface as a mulch.

A special case of green manure are the **catch crops**, represented by grasses and cruciferous species cultivated during the rainy season to protect groundwater from leaching of nitrates. Widely used are species such as perennial *Lolium perenne*, *Brassica juncea* and *Secale cereale*, which are able to **reduce nitrogen leaching by up to 60-70%**, intercepting up to 50-60 kg per hectare.



The example of Antonios green manuring

He makes a first cut at a height of 10-15 cm.

The plants grow again and flower, and when seeds are ready to fall, he makes a second cut.

The fallen seeds grow up again in the next season, and the cycle start again.

Creation of an organic layer on top of soil surface, which retains soil moisture in dry periods.

Fertilization of soils with plant organic matter.

Crop diversification.

Reduced irrigation.

Elimination of fertilizers.

Increased biodiversity.

Significant yields.



In order to reduce the competition for water in the summer period, annual, self-seeding leguminous plants, such as *Trifolium* or *Medicago* species, which vegetate from October to May are used, offering a **dead mulch** function during the dry period.

The burying of pruning residues can also be seen as a green manure technique. In this case, the main problem is the C/N ratio and the high lignin content, which makes this material poorly degradable. A high C/N ratio leads to the so-called 'nitrogen starvation' phenomenon in the soil microflora.



Organic mulching in practices

Organic mulching is the technique of using organic materials to cover and protect the soil surface under the cultivated crop. Organic mulches, that includes a wide variety of materials, such as straw, leaves, wood chips, compost, and manure, offers several benefits, such as:

- ∅ **Erosion prevention:** mulch helps to prevent soil erosion by reducing the impact of rain and wind on the soil surface.
- ∅ **Temperature regulation:** mulch helps to regulate soil temperature, keeping it cooler in the summer and warmer in the winter.
- ∅ **Weed suppression:** mulch helps reducing weeds pressure by shading out weeds and competing for resources such as water and nutrients.
- ∅ **Soil moisture conservation:** mulch reduces soil water loss through evaporation, thereby reducing the irrigation needs.
- ∅ **Soil health improvement:** organic mulch gradually decomposes over time, adding nutrients and organic matter to the soil, which can improve soil structure and fertility.

Dead mulch refers to organic material such as straw, leaves, or other plant debris that is spread on the soil surface after the main crop has been planted or is already growing (such as in a tree cultivation).

This material does not continue to grow and decompose slowly, so it acts as a protective layer to prevent weeds from growing and to conserve soil moisture. Dead mulches can also help to moderate soil temperature and prevent soil erosion.



Living mulch refers to a **cover crop** that is planted alongside the main crop and left in place during the growing season.

The cover crop remains alive and actively growing, providing a living mulch between the rows of the main crop.

Cover crops can be introduced into crop rotations as living mulch, establishing cover crops in cash crop and letting them grow together in an intercropping association.

On the other hand, living mulch can also compete with the main crop for resources, such as water and nutrients, potentially leading to reduced yields if not managed properly.



The termination (killing) of the living mulch affects temperature, moisture and nutrient dynamics in the soil, the result of soil tillage and the effect of allelopathic substances on the main crops.