PRUNING AND CLIMATE-SMART RESIDUE MANAGEMENT IN OLIVE ORCHARDS

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Pruning is a vital agricultural practice that enhances plant health, productivity and sustainability in crops such as olive, citrus, almond trees and vines. It controls growth, optimises sunlight and improves fruit quality. Amidst climate change, with rising temperatures and erratic rainfall, adaptive pruning is essential to maintain yields and reduce stress. Additionally, pruning residues in olive orchards, such as branches and leaves, can be shredded and spread over the soil to retain moisture, suppress weeds and boost fertility. As the residues decompose, they release nutrients such as nitrogen and potassium, improving soil health and reducing fertiliser requirements, according to guidelines by LOVAPS at HMU, CITAB at UTAD and CIMO at IPB.

WHAT IS PRUNING AND WHY IS IT IMPORTANT?

Pruning is the selective removal of certain parts of a plant (e.g., branches, shoots, leaves) to reduce excessive vegetation to improve structure, health and productivity. In fruit crops, it helps to control the plant's shape, encourages airflow and light penetration and stimulates better fruit quality. Pruning opens the plant so sunlight can reach all the leaves and air can flow through. This helps the plant grow stronger and healthier, like getting fresh air. The pruning of olive trees should be adapted to the local climatic conditions (soil, temperature, humidity, solar radiation), especially in areas vulnerable to climate change. This is important for:

- The regular fruiting and longevity of the olive tree
- A better balance between vegetation and fruiting
- Saving water and moisture (reducing canopy evapotranspiration)
- Optimising tree nutrient requirements by regulating olive tree canopy and growth
- Preventing olive tree pests, leading to improved pest management and reduced pesticide requirements
- Optimising harvesting

HOW TO CONDUCT REGULAR PRUNING IN AN OLIVE ORCHARD?

The cultivar growth habit and vigour and canopy density, as well as the fruit load, should be considered for proper regular pruning. Pruning focuses on maintaining an open canopy to let light into the centre of the tree for good fruit production and making harvesting easier. Olive trees can live for a very long time, so pruning also helps to maintain their shape and productivity over many years. The best time to control the canopy through pruning is late winter to early spring (before new growth starts). Currently, there are three main techniques, as described below, while Figure 1 compares the olive production over three years of different pruning regimes:

- **Classical pruning:** Trees are severely pruned every three or four years. This practice is conducted by removing large branches and leaving about 25% to 50% of the canopy. It may be interpreted as renewal pruning with a major impact on production. It increases the risk of loss of production when there are adverse weather conditions due to climate change.
- **Annual light pruning:** In this approach, an average of 10% to 20% of the canopy is removed yearly. Shoots that produce fruits are removed, as well as branches that alter the optimal shape of the tree canopy. This technique prevents production variability and reduces the risk of adverse effects on production from climate change, but it requires skill and careful consideration to know when to stop cutting.
- **Three-cut pruning:** This is an annual practice that consists of removing three strategically chosen branches. The technique involves looking at the tree and choosing three branches that can be removed, considering their position in the tree, their size, the overall canopy balance, crossed branches, etc. The important thing is never to remove more than three branches. This way, the tree will always have a reasonable volume, and the production will not be affected, i.e., the production remains stable over the years.

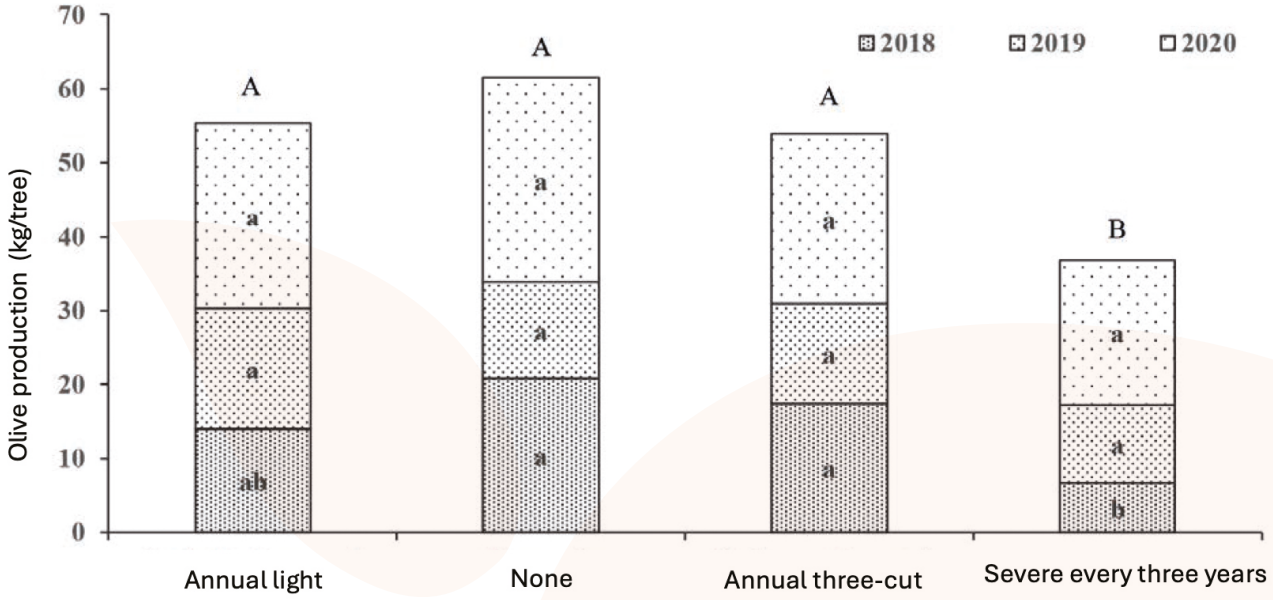

Figure 1. Olive production with four different pruning regimes[1]

Olive trees should be pruned following a year of heavy fruiting, as should trees that have not been pruned for an extended period. Any infected, dry, etc. shoots should also be removed. In the case of olive varieties with an erect growth habit and trees with sparse and medium canopy density, there should be moderate to light pruning of the centre of the canopy, as well as clearing of infected or dead shoots.

Common mistakes to avoid are cutting too much or too little, pruning during frost-prone periods, leaving stubs or tearing branches and not disinfecting tools between trees.

HOW ARE PRUNING RESIDUES MANAGED?

After pruning, a lot of branches and twigs are left on the ground. These leftover branches and twigs are called residues, and traditionally, farmers would just pile them up and burn them; however, this is not a climate-friendly practice. Moreover, this practice represents a waste of raw materials and nutrients that may be of great service to the soil and the olive trees. Residue management solutions that can contribute to a better environment include:

- **Shredding and mulching:** The branches can be placed in between rows (Figure 2, left) and mechanically managed to become small woodchips or mulch (Figure 2, right). This mulch can then be spread around the base of the olive trees or left on the ground between the olive tree rows. Mulch helps to keep the soil moist; it also helps prevent weeds from growing. As the mulch decomposes, it adds nutrients back into the soil, making it more fertile and healthier. Healthy soil can also store more carbon from the atmosphere, which helps fight climate change.
- **Composting:** Smaller branches and leaves can be added to a compost pile. Over time, they break down into a rich, soil-like material called compost. Compost is a natural fertiliser, and by using it, farmers may not need to use as many fertiliser inputs, thus reducing greenhouse gases. Compost also helps the soil hold more water and carbon.
- **Bioenergy:** In some cases, larger branches can be used to produce energy. If done correctly and sustainably, using pruning residues as a source of bioenergy can reduce reliance on fossil fuels such as coal and oil.
- **Creating biochar:** Heating the pruning residues under specific conditions can create a charcoal-like material called biochar, which can be added to the soil and store carbon.

Figure 2. Left – pruned branches piled between olive tree rows (photo by M. Â. Rodrigues, CIMO – IPB); right – shredded and mulched pruning residues (photo by E. Kabourakis, LOVAPS lab – HMU)

The practice of burning pruning residues wastes valuable nutrients, results in the emission of atmospheric pollutants that pollute and reduce the quality of the olives that are not harvested, and contributes to increased carbon emissions (carbon footprint) in the atmosphere and climate change (environmental pollution). Pruning residues may instead be used to create temporary brush piles (Figure 3). Forming brush piles creates complementary microhabitats and nesting places as stepping stones and patches for functional biodiversity.

Figure 3. Pruning residues used as a brush pile to harbour fauna (photo by E. Kabourakis, LOVAPS lab – HMU)

WHAT ARE THE BENEFITS OF SMART MANAGEMENT OF PRUNING RESIDUES IN TREE NUTRITION, OLIVE ORCHARD BIODIVERSITY AND CLIMATE CHANGE?

Even though pruning may seem like a small action, how the residues are managed can have a big impact on the planet by:

- **Reducing greenhouse gas emissions:** Instead of burning, using residues for mulching, composting or bioenergy reduces carbon and methane. These methods also enhance soil health, supporting climate resilience and reducing olive orchards' environmental footprint.
- **Using resources wisely:** Reusing pruning residues helps to reduce waste and conserves water by shading the soil, which lowers evaporation and retains moisture.
- **Supporting biodiversity:** Avoiding synthetic fertilisers and enriching the soil with organic matter from residues supports diverse soil organisms. This promotes processes such as nutrient cycling and decomposition and provides food for higher-level species, such as birds and mammals, that can help control pests. Small brush piles left in the orchard provide great shelter for small mammals.
- **Heathier soil:** Mulching and composting improve soil fertility and structure (their decomposition releases nutrients such as nitrogen, phosphorus, potassium, etc., back into the soil), reduce erosion and nutrient loss, and support beneficial microbes and invertebrates such as earthworms, which further enhance soil quality and tree nutrition.

TO FIND OUT MORE

Related links and material

- [1] M. Ângelo Rodrigues, Carlos Lopes, Margarida Arrobas and Carlos Correia, "Poda do olival tradicional em três cortes: um novo conceito de poda que reduz os custos e assegura a produtividade", Vida Rural, outubro 2021, 76-82.
- Gucci, R., Cantini, C. 2000. Pruning and Training Systems for Modern Olive Growing. CSIRO. Kabourakis, E. 1999. Code of practices for ecological olive production systems. Olivae 77:46-55
- Repullo; A. M., Carbonell; R., Ordóñez; R., Hidalgo, J., Rodríguez-Lizana A. 2012. Using olive pruning residues to cover soil and improve fertility. Soil and Tillage Research, 124, 36-46 LIFE IGIC video https://www.youtube.com/watch?v=IvGDESfrsmI

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