Managing fruit trees on pasture

Managing fruit trees in combination with pastures and livestock is one of the most widespread agroforestry systems. **Fruit trees are planted in spring** and require a good irrigation system and individual protection for each tree, as well as a series of after-care measures to protect against pests or pruning. The installation of the pastures requires adequate terrain, control of the adventitious plants, sowing at the right time and irrigation when possible. **This combination of fruit trees and pastures with livestock has clear mutual benefits**.

Agroforestry: managing fruit trees on a pasture with livestock

One of the different types of agroforestry systems present across Europe is the **use of high-value trees**. These can be fruit trees or trees grown for high-quality **wood in combination with herbaceous crops or pastures**. In these systems, the value of the production of the trees (in the form of fruit or wood) is added to that obtained from the crops and the use of the pastures for livestock feeding (**Figure 1**).

Figure 1. Agroforestry. Dehesa Boyal in Bollullos Par del Condado (Huelva, Spain), CC-BY.

The use of livestock as a management tool for the system conditions **the species, density and design of the fruit tree plantation in the pasture.**

- **When the animal used is large**, as is the case with cows, it must be considered that the effect of grazing on trees is considerably high. **For this reason, the fruit trees chosen should be those that form a tall habit, such as walnut, apple or chestnut trees**. In these cases, the planting **density is usually low, since the fruit trees are located following the lines that delimit the plots**. In this way, the fruit trees are easier to protect during the first few years and they create better shade to protect the livestock from excessive heat. The planting is done in the dividing lines at the rate of one tree every 10-12 m (**Figure 2**). This implies a plantation of about 100-120 trees per hectare.

- When **medium or small animals** such as chickens, ducks, rabbits or even pigs are used, **the grazing height is not so high**. For this reason, shorter species such as pomegranates, plums or apricots can be planted. In these cases, they are usually planted at **higher densities along parallel lines 5 to 20 m apart** (**Figure 2**). Within the line the separation between trees will vary, 3-6 m from each other, depending on the species.

Installing and caring for fruit trees

Fruit trees should be planted at the start of spring. Once the places where the trees will be planted have been delimited, the holes are excavated, which are normally done with an excavator. These holes are about 50x50 cm wide and 50-60 cm deep. **At the bottom of the hole, several logs are placed following the trunk beds technique** (more information on the technique can be found in the file "Polyfarming system: Cultivation on trunk beds"). **These logs offer a reserve of water and microorganisms to maintain a living soil, they encourage the growth of plants and increase the carbon content in the soil**. Branches and smaller debris are placed on top of the trunks. A layer of soil is placed over them and finally the young fruit trees are placed, which are later covered with soil until the hole is filled.

The fruit tree plantation must have **an extended irrigation system** that drip-feeds each tree. Especially in the first few years and later in the drier seasons, water supply **is essential to ensure the survival and growth of the fruit trees**. Another type of infrastructure that is also essential is an individual protection for each tree, in order to avoid the herbivory of the cattle that will be placed in the pasture (**Figure 3**). These protections are built with the same materials as the rest of the fences, electric wire and poles.

Fruit trees have a long life, and for part of their life they are not productive. Thus, for example, in a well-maintained commercial walnut plantation with grafted specimens, at 5-7 years old they may already produce a few kg of walnuts per tree, but it will be necessary to wait 30 years until they reach their maximum production. **During all this time fruit**

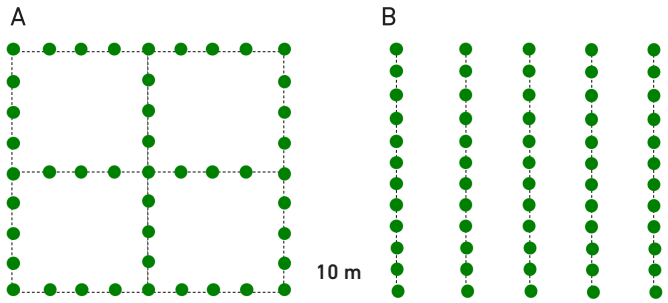

Figure 2. Planting designs of fruit trees on pastures: (a) low density in the dividing lines of the meadow plots, and (b) higher density along parallel lines throughout the meadow.

trees require different care without which subsequent production suffers greatly. The first key aspect is to carry out periodic reviews to **identify possible pests or diseases** and, if they appear, establish the methods to act against them. **The second fundamental aspect is pruning**. The best time to prune fruit trees is in late winter when the first shoots have not yet appeared, or just after the fruit is picked. It takes quite a bit of experience to prune trees well, especially in tree shape formation pruning, which is done during the first few years, or fruiting pruning to prepare the tree for the following year's harvest, which is done every year.

Figure 3. Young walnut with individual protection to protect it from the herbivory of cattle on the Planeses farm (Girona). Photo: Marc Gràcia.

Figure 4. Cows grazing on a high-quality pasture in Santa Pau (Girona). Photo: MJ Broncano.

Installing and caring for pasture

A quality pasture can take several years to form, and **requires a series of steps to develop adequately**:

- **Adequacy of the area and soil preparation.** The area must be adapted by removing all stones, logs and other debris that hinder the establishment of the pasture. The soil must be moderately humid to facilitate adequacy works.

- **Control of the vegetation present**. Before planting, the vegetation present in the area must be removed. This can be eliminated mechanically, using hammer brush cutters, or using livestock to graze the vegetation to be removed.

- **Sowing the pasture**. Whenever possible, **sowing should be done with a direct seeding seeder machine**. If this is not possible, broadcast sowing is done, but trying to do it at the time of year when the seeds will have maximum protection. **The ideal time to distribute the seeds in the field is in autumn** because the seeds will be able to maintain humidity for longer. In addition, in winter the plant does not grow in the aerial part, but it does in the underground part. The biggest problem at this time is that the seeds can be preyed upon by flocks of birds. **The combination of species to be sown depends on the climate in the area and the farm's needs**. In this seed mixture the following is recommended: (**i**) plant species that grow fast, (**ii**) include some legume, and (**iii**) introduce species such as rye (with a very dense root system) that allow better control of adventitious plants.

- **Irrigation of recently established plants**. Seedlings in their early stages are very susceptible to a lack of water. For this reason, if it does not rain enough in the first few days, if water is available and it is possible to install an irrigation system without high costs, it is best to irrigate the surface of the future pasture until the new seedlings are properly established.

- **Reseed if necessary**. On occasion, especially when the seeds have not been well protected, sowing results in a pasture with a very low coverage (less than 4-6 plants per m^2). In these cases, the pasture should be reseeded, focusing on areas where the pasture has more patches without vegetation, and reviewing the factors that prevented adequate initial germination.

- **Control of resprouting species.** When the new grass plants are installed, the cattle must enter. But if many sprouts of shrubs or trees have appeared, just after the livestock leaves the plot these sprouts that the livestock do not consume should be cleared with a manual brush cutter.

From then on, livestock management should consolidate and improve the pasture (**Figure 4**). If at first there is not enough food for cattle, the feeding should be completed in the plots, because this food ends up improving the fertility of the plot. **The basis of good pasture is correct management of the cattle that graze on it.**

Benefits of integrated management of fruit trees on pasture

Managing fruit trees on pasture has **clear benefits both for the environment and for the agricultural farms** that carry it out.

• In different agroforestry studies, **a positive synergistic relationship has been seen between fruit trees and pastures** in relation to soil water content and nutrient retention.
• The presence of trees in the meadow **increases the total carbon stored on the farm,** both in the soil and in the vegetation.
• Biodiversity in integrated fruit tree and pasture systems also **increases.**
• **Trees provide shade for livestock** when they grow.
• **Livestock droppings help improve soil fertility** for fruit trees.
• The integrated management of fruit trees and livestock in the pasture increases income and **improves the profitability of farms.**