Costs and key points of managing fruit trees on pasture

Managing fruit trees on pasture mainly has three types of costs: (1) **costs of planting fruit trees**, which is the price of young trees and that of planting them; (2) **costs of irrigation and protection**, which include an irrigation system extended throughout the plantation and individual protection of each tree; and (3) **costs of the subsequent care of the trees**, which include the corresponding phytosanitary checks and annual pruning, including those of the initial formation and those of the subsequent fruiting.

Quantification of the costs of managing fruit trees on pasture

The quantification of managing fruit trees on pasture (**Figure 1**) is based on calculating different costs:

1. Cost of planting fruit trees.
2. Cost of irrigation and protecting fruit trees.
3. Cost of after-care for trees.

Next, we will describe the different alternatives that we have analysed for each of these processes, indicating the costs involved and their variability (**Table 1**). The cost of installing the pasture or the livestock that will graze on it is not included, as they are part of other Polyfarming elements.

1. Cost of planting fruit trees. This cost has two components:

• The **price of young trees planted varies greatly between species**, but it also depends on the size within the same species. Any nursery can give very detailed values of these prices.

• **The cost of planting the fruit trees first includes** the **cost of making the holes to plant them** in: they have an approximate volume of **0.125 m³ (0.5x0.5x0.5 m)** and must be made with an excavator. The **excavator rental is €45/h** and includes the person who drives it. In each hole, 4-5 logs about 40-50 cm long are first introduced at the bottom (following the technique of trunk beds described in the corresponding sheet), branches and small trunks, a layer of earth and the fruit tree. Then the hole is plugged until it is filled again with the excavator. **The complete time to finish this process is a maximum of 4-5 min per tree**, depending on the rocks on the ground and therefore the time it takes to make the hole.

2. Cost of irrigation and protecting fruit trees. Once planted, there are two more costs to consider:

• There should be an **extended irrigation system that drip feeds all the planted trees**. This system has a large main pipe with a diameter that depends on the number of connected trees. The small tubes are connected to this pipe with the droppers **(€0.36/m tube + €0.2/dropper**) that carry the water to the fruit trees.

• An individual **protection system must also be installed for each tree**. The cost of the materials (three iron stakes and the wire) is **€3/protection** and the time to **install it is 5 min.** if there are no rocks, otherwise it costs more to drive the stakes.

Figure 1. Fruit tree on the Planeses farm. Photo: Javier Retana.

3. Cost of after-care for trees. After-care for fruit trees basically includes two aspects:

• **Periodic reviews** should be carried out to identify possible pests or diseases. The time required per tree is small, but it depends on the number of trees in the plantation. They must be repeated **once every two months or once a month during the growing season**. Products to treat pests or diseases are not included because the cost depends on the treatment that must be applied in each case.

• **Fruit trees should also be pruned annually.** The time devoted to each pruning depends on whether they are the initial formation prunings, which are very fast (**1-2 min per tree**) or whether they are subsequent fruiting prunings, in which case it depends on the diameter and height of the trees and may sometimes require lifting platforms to reach the top of the crown.

From these considerations, we can establish a series of simple calculations to estimate t**he total costs of managing fruit trees on pasture in an agricultural field**. The data are given per fruit tree planted. The overall cost is the sum of three costs:

$$C_{total} = C_{planting} + C_{irrigation\ /\ protection} + C_{after\text{-}care}$$

Planting fruit trees, the sum of three costs:
C_{fruit} = Price/tree (depends on the species and size)
C_{fruit} = 0.08 h x 45 €/h (excavator cost) + 0.08 h x Salary/h (farm worker) (following the process described above)

Irrigation and protection of fruit trees, the sum of two costs:
$C_{irrigation}$ = Main pipe price + (N m x € 0.36/m + € 0.2 (dropper) (tree pipe)
$C_{protección}$ = € 3/protection (materials) + 0.08 h x Salary/h (staff)

Cost of after-care for trees, the sum of two costs:
$C_{revisions}$ = not evaluable (depends on the number of trees
$C_{pruning}$ = 0.03 h/tree x salary/h (formation pruning)/ N h/tree x Salary/h (fruit pruning, depends on the size and the tree height)

Considerations on the optimal strategy for managing fruit trees on pasture

We must consider the following **key points** in the management of fruit trees on pasture:

- **The selection of the species depends on the farm's needs** and the climate of the area.
- **If the trees are to grow in combination with animals, it is crucial to know if these animals will be large** (cows) or not (chickens, pigs) to choose large or medium-sized fruit trees.
- We must bear in mind that, during the **first 5-7 years, fruit trees need care, but they do not produce.**
- **When the holes are made with the excavator, the cost of the excavator must be considered**, including its **driver and a worker from the farm** who is supervising and doing some of the work, such as placing the fruit tree or finishing caking the soil.

Parameter	Unit	Value used	Variability and causes
Price of the young fruit tree to plant	€/fruit tree	-	It varies completely according to the species and size of the trees
Volume of the hole to place the fruit trees	m^3	0.125	We make a hole the size of 0.5x0.5x0.5 m, although it can vary depending on the size of the fruit tree to be planted
Time to excavate and fill the hole of the fruit tree	min	4-5	It includes the whole process: making the hole, placing the logs, applying soil, placing the fruit tree and covering the hole
Rent of the excavator	€/h	45	This includes the person who operates it
Time for filling the hole for the fruit tree	h	23	This includes the whole process, trunk beds
Irrigation system	€/fruit tree	-	The cost of the main pipe depends on the number of trees connected, and that of the small pipe depends on the distance from the tree to the main pipe
Materials for the fruit tree protection structure	€/fruit tree	3	This includes wire and stakes
Installation time of the protection structure	min/fruit tree	5	The time may be longer if there are rocks in the ground that make it difficult to drive the stakes
Time to check for pests and diseases	min/fruit tree	-	This is very quick, but the total time depends on the number of fruit trees in the plantation
Number of revisions per year	number	8-12	Once per month in the growing season and two per month outside of it

Table 1. Parameters used in the calculation of the costs of the management of fruit trees on pasture, indicating the values used in Polyfarming and the possible variability that can occur in these values.