

Aspects that determine crop management

How crops function, whether fruit trees, garden or extensive crops, is based on a series of aspects related to their management. These **aspects are the following: 1) soil tillage, 2) soil fertility, 3) soil protection, 4) adventitious plant management and 5) insecticide and fungicide use. These aspects vary considerably whether conventional agriculture is carried out or agriculture based on the regenerative production model is implemented.**

To understand crop function, the following aspects of crop management should be reviewed: **1) soil tillage, 2) soil fertility, 3) soil protection, 4) adventitious plant management and 5) insecticide and fungicide use.** This applies to fruit trees as well as extensive or garden crops. Throughout this file, two different situations are compared: (i) **conventional agriculture**, in which the various technological alternatives currently available can be used (**Figure 1**) and (ii) **regenerative agriculture**, in which its principles are taken into consideration (**Figure 2**).

■ Soil tillage

The tillage or not of the soil is **one of the main aspects** that differentiate conventional agriculture from regenerative agriculture.

- In **conventional agriculture**, a large part of the effort spent on cultivation is invested in preparing the soil for sowing by **tilling the soil (Figure 1)**. By ploughing the soil, **the soil loses compaction** and is looser, allowing the roots to break through easily. At the same time, **the soil is aerated**, something necessary for plants to breathe. The plough also eliminates adventitious plants and **facilitates crop germination and growth**.

- In **regenerative agriculture**, **the soil is not cleared or tilled**, which implies keeping it intact (**Figure 2**). In this way, **its structure is not broken and biodiversity is maintained** because the environment microorganisms and fauna live in is not unbalanced. On the other hand, not disturbing the soil reduces the risk of erosion and **avoids the loss of fertility**. In addition, humid conditions in crops are maintained for longer because the **water does not evaporate as much**. Finally, when there are fruit trees, the fact of not ploughing avoids cuts and wounds in the most superficial roots of the trees.

■ Soil fertility

Another of the main aspects that differentiate conventional agriculture from regenerative agriculture is how they are used to improve soil fertility.

- In **conventional agriculture**, fertilisation is carried out to feed the plant directly. Plant feeding is based almost exclusively on the **supply of chemical fertilisers** in



Figure 1. Conventional orchard with ploughed soil and without adventitious plants. Photo: Pxfuel, CC0-BY 4.0.



Figure 2. No-tillage orchard with the soil covered by crops, adventitious plants, and dead plant matter. Planeses farm (Catalonia). Photo: Àngela Justamante.

adequate quantities to achieve maximum crop production. The **excessive use** of these products **causes great problems for the environment and living beings**, since in high concentrations they can be harmful to organisms and can limit the relationships between the plant and the soil trophic network.

- In **regenerative agriculture**, the plants are not fed, but the soil. **Chemical fertilisers are not used** in this type of agriculture. The soil reaches equilibrium with the life cycle of plants and animals. **In the beginning, organic matter**, in the form of dry or crushed matter, is incorporated into the soil, which helps to structure it. Organic matter takes time



Figure 3. Worker applying BRF in the soil of a no-tillage garden, with the objective of increasing the organic matter and helping to structure the soil. Planeses farm (Catalonia). Photo: AVVideo.

to decompose, but little by little it will be available to feed the plant, while promoting soil aeration and the functioning of the food web. In this way, as time passes, **soil fertility increases (Figure 3)**. To help and maintain this process, green manure can be planted in the autumn, cut in the spring and left on the surface of the soil.

■ Soil protection

Soil protection also clearly varies between the two agricultural models.

- In **conventional agriculture**, the objective of ploughing is to leave the **soil bare**, without any vegetation. This facilitates the subsequent germination and growth of crops. The problem with exposing the soil is **direct exposure to sunlight**, which can cause a very **significant loss of water** through evaporation, creating more dependence on irrigation. Another consequence is the **lack of protection of the soil against rain**, which also deteriorates it.
- In **regenerative agriculture**, crop residues remain on the surface of the soil, providing **more protection from the sun's rays**. The **organic matter** on the surface serves as a cushion for the soil and **prevents it from drying out excessively**. At the same time, this layer also protects it from heavy rains and reduces the risk of soil erosion.

■ Adventitious plant management

Adventitious plant management is another point that differentiates both models.

- In **conventional agriculture**, **adventitious plants** are a very important problem because they often grow earlier and faster than crops, and end up consuming a significant part of the nutrients that are provided to improve production. Therefore, **the success of conventional agriculture largely depends on the application of increasingly powerful herbicides** that kill these plants. However, it has been shown that the excessive use of herbicides has **harmful effects** on human health and the environment.
- In **regenerative agriculture**, **adventitious plants** are not radically eliminated, but **controlled**. These plants are considered to **play a role in building soil fertility and in balancing the food web**, as they provide food and shelter for beneficial animals. Therefore, **herbicides are never used** and adventitious plants are allowed to grow until they compete excessively with the crops, at which point they are cut down and left in the field as compost for the system.

■ Insecticide and fungicide use

The use or not of insecticides and fungicides to control diseases and pests of crops also differentiates both systems.

- In **conventional agriculture**, **disease and pest control is based on the use of phytosanitary products** such as insecticides or fungicides. The use of these chemicals has become widespread due to their ease of application and effectiveness. They are usually fast acting, limiting crop damage. The problem is that pesticides, according to the United Nations (UN), are **harmful to human health and the environment**.
- In **regenerative agriculture**, **pests and diseases** are always present in plants, but chemicals should not be used for this reason. In this agricultural model, **disease control is based on growing healthy plants in living soil**: if the plant is fed correctly, it is more resistant to pests. In addition, pest control **is enhanced by predators and natural parasites** that are favoured by the diversity of plants and especially, by the presence of flowering plants. When it is necessary to use products to directly control a pest, for example, to obtain quality fruits, those that have a low persistence in the system should be used.