

High diversity of plants: maximum production and variety of food for the soil trophic web

A great diversity of plants allows the maximum amount of organic materials to feed the trophic web of the soil to be provided. Mixing species to achieve greater diversity can be achieved in time or space. In time, it is achieved mainly using rotations. In space, the greatest diversity is obtained with the association of plants that can have a joint use, using companion plants or maintaining the margins with high diversity.

■ Maintaining a high diversity of plants

The **plant** is the engine that directs the functioning of the ecosystem from the organic materials synthesised in **photosynthesis**. These organic materials are the basis for feeding the soil food web and creating the necessary habitat for it to function. **The objective of productive management is to make the system work to the maximum to maximise solar energy capture and carbon sequestration by plants** (through photosynthesis). For this, we must know how to manage a **diversity of plants** that allows us to maintain the maximum contribution of organic materials to feed the trophic network of the soil throughout the year (**Figure 1**). This can be achieved in a number of ways:

- 1. With the presence of active roots at different depths and throughout the year.** The incorporation of organic materials from plants to the soil occurs mainly through the roots. We must know how to manage a diversity of plants that guarantees a good presence of roots throughout the year and with most of the space occupied, with special attention to the presence of roots at different depths.
- 2. With complete ground cover.** We must manage a diversity of plants that allows us to create complete coverage throughout the year, whether with green material or dead material.
- 3. With growing plants throughout the year** (when the area allows it). It is essential to be able to obtain the maximum possible growth all year round to maintain the maximum biological activity of the system and the maximum contribution of organic materials to the soil.
- 4. Providing varied plant material.** The more varied the organic material provided by the plants, the better the feeding of the soil food web.
- 5. Collecting plants at the time of the plant growth cycle** in which they have introduced the greatest amount of carbon into the soil and have the highest reserve content in the roots.



Figure 1. A high diversity of plants (both in the aerial and underground parts) allows the trophic network of the soil to be fed throughout the year.



Figure 2. Crop rotation. Photo: Markus Winkler, CC-BY (Unsplash)



Figure 3. Orchard with different types of crops (polyculture). Photo: MJ Broncano.

■ How to get a high plant diversity

When designing the mixture of different species we must consider different criteria, apart from our own production criteria, such as the **depth of the roots, the ability to produce biomass or the ability to control their growth**. The mixing of these species can be achieved in time or space (or both).

- **In time.** The diversity of plants in time is achieved using **rotations (Figure 2)**. It is important that there are no seasons of the year without cultures (although for climatic reasons the cultivation is stopped). If for climatic reasons there is a time of year without cultivation, we must ensure that the soil is covered so that the biological activity of the soil is limited as little as possible.

- **In space.** We can increase the density of roots in space through the **association of plants** that allow a joint use (polyculture) (**Figure 3**) or through the use of **companion plants** that do not have a direct use, but that improve the production of the plants that are intended to be collected. A similar effect can also be achieved by **maintaining margins** with high diversity. A specific case of great interest is the combination of herbaceous and tree production in different systems that are included in **agroforestry (Figure 4)**.



Figure 4. Agroforestry. Photo: National Agroforestry Center, CC-BY

The regenerative production model: competition versus collaboration

In the **conventional production system** plants **compete** for the soluble nutrients of the fertilisers provided for their nutrition. On the other hand, in the regenerative productive system, all the plants that coexist in the same space **collaborate** in feeding and maintaining a favourable habitat for the soil food web. As a result, there is an overall improvement in the fertility of the site. Thus, the more diverse the production system is, and the more it produces, the more we can increase the production potential of our location.

Competition for light is the main limiting factor that must be controlled to favour the species we are interested in producing. In relation to **competition for water**, we must bear in mind that its use is optimised in structured soil and with a complete soil food web. In dry seasons, however, water limits the system. In this case, water control should not be by interventions in the soil (tillage) but by controlling the aerial part (evapotranspiration control). Thus, we must always maintain complete coverage (alive or dead) of the soil that protects against the direct impact of sun and rain.