Slow Food®

Slow Food Foundation for Biodiversity

Terra madre®

10,000 gardens in Africa project

Handbook for educators

www.slowfoodfoundation.com

10,000 gardens in Africa project

Handbook for educators

This is a handbook that covers all the topics that are in the Handbook but has been conceived for educators, and, therefore, goes much more into detail. It illustrates the motivations and sense of each operation (why local seeds are selected, why composting or crop rotation is carried out, why many different varieties are cultivated, why educational activities are organized), and explains how to implement each operation (from garden planning to seed selection, from water collection to the making a composter, etc.). This handbook also includes a series of **practical fact sheets** containing examples, photos and illustrations.

The information, suggestions and examples in the Vademecum, handbook and fact sheets are based on the knowledge of real food gardens included in the 10,000 Gardens in Africa project. However, **it is essential that every referent starts from these guidelines and applies them to their individual circumstances, adapting them according to the territory, culture and knowledge of their community. Effective training enables the food garden to become autonomous in the first year, and economically efficient from as early as the second year.**

Creating a seedbed in the first year actually means having free seeds the second year.
Good fertilization management in the first year and making a composter can mean saving money to purchase fertilizers the second year. Proper irrigation management, constructing tanks or gutters and preparing a system of drip irrigation means having a sufficient provision of water the second year. The application of correct cultivation techniques (crop rotation, green manuring, mulching, etc.) means having a balanced garden the second year, with good diversification of yield and plant hardiness. The application of natural protection techniques avoids having to purchase pesticides the second year.

NURSERY	FERTILITY AND COMPOST	IRRIGATION MANAGEMENT	GOOD CULTIVATION TECHNIQUES	NATURAL PROTECTION TECHNIQUES
↓	↓	↓	↓	↓
SEEDS	NO FERTILIZERS	SUFFICIENT WATER	GARDEN RESISTANT TO EXTERNAL ATTACKS	NO PESTICIDES
↓	↓	↓	↓	↓

This is not a handbook on horticulture in the traditional sense of the term, but a "collective" text built on the work carried out in these years (which have led to the launching of the first 1,000 gardens), and, therefore, on the basis of all the experience gathered in different countries (positive, though sometimes negative), and on the basis of numerous considerations made with the national and regional representatives of the project. It is a working tool for those on the ground who organize regular training sessions and for those who are called upon to give answers, day by day, to the communities or schools realizing the gardens.

The technical information contained in these fact sheets refer to the main issues of agro-ecology and have a common goal: to create new awareness, new attention to the environment and to people.

When new subjects become involved in the 10,000 Gardens in Africa project, before dealing with each single matter, it is essential to **illustrate Slow Food** (its philosophy, its goals, its projects) and to **involve all** those who intend to create a garden in the basic decision-making: discussing together the reasons for wanting to create a garden, the characteristics of the area in which they are located, what they want to cultivate and what they want to achieve.

The Slow Food garden is an agro-ecological food garden

Agro-ecology integrates agronomy (crop science) and ecology (environmental science).

The agro-ecological food garden is a balanced system in which the intelligence of man modifies nature in order to be able to utilize its products, without harming and impoverishing it, sustaining the physical, chemical and biological mechanisms that regulate nature's cycles.

"Agro-ecology", used as a scientific term, dates back to the 1970s, but many of its solutions have been applied at different times by rural communities around the world, which, over the centuries, have often conceived farming and production systems in equilibrium with the environment. Nevertheless, this ancient knowledge has been systematically set aside and forgotten with the arrival of the so-called "green revolution", which introduced a model of farming based on high external energy types of input, such as a massive use of synthetic agro-pharmaceuticals and powerful machines powered by fossil fuel.
Over the years, it has become more and more evident that long-term farming with high external inputs is unsustainable, both from an environmental perspective and from the viewpoint of the productivity of farming systems.
Today, agronomic practices and science are being reoriented towards more sustainable practices, and are reconsidering the value of traditional peasant farming that often puts into practice conservative methods of fertility, variety selections and practices of crop rotation and intercropping which, even today, may represent the most efficient and effective way to maintain the productive capacity of farming systems.
In general, the agricultural productive process strongly alters the pre-existent ecological balance:
First of all it replaces a community made up of a large number of wild plant species with a low, sometimes very low, number of species selected by man.
The outcome is an ecosystem with a strongly simplified biodiversity, as far as animal and plant species are concerned, but also as regards the populations of micro-organisms (microflora, microfauna, bacteria, fungi).

Reduced biodiversity means a reduced stability of the ecosystem.
Furthermore, while in natural ecosystems, leaves and fruits fall to the ground, in an agro-ecosystem, in the harvest phase, a major part of the biomass and, therefore, organic matter is removed, which must then be restored.
The poor stability of intensive agro-ecosystems comes from reduced biodiversity and from the high number of inputs and outputs of the system, which becomes heavily dependent on the outside.
The main inputs in an intensive farming system are:

- **fertilizers**, to counterbalance the organic matter removed and the consequent reduction of soil fertility;
- **crop protection products**, to reduce the strain of harmful organisms on crops and to increase yield;
- **seeds or other planting materials** which, in most cases, are no longer reproduced in farms but are purchased on the market year by year.

In order to reduce the instability of the agricultural system and its requirements for external inputs, with the economic costs and risks of pollution involved, the agricultural systems can be operated in an agro-ecological perspective: considering crops as part of the ecosystem and choosing a method of cultivation fit to maintain the complexity of the environment, and the relative interactions (positive and balanced) between the different agricultural species and between these and natural species, and the environment.
In this way there is less need of external inputs, and a balance similar to that of **a closed-loop system is created, with less dependence on the outside and more stability.**
In an agro-ecological productive system, the inputs are replaced by resources within the system:

- **compost from plant residues, organic fertilizers** from animal manure and **conservative fertility techniques** (crop rotation and intercropping with nitrogen-fixing species, mulching, green manure…) and not synthetic chemical fertilizers;
- **biological control** and not defense set on the use of synthetic chemical crop protection products;
- **self-production of seeds and planting materials** and not the purchase of seeds.

The main goal of the agro-ecological food garden is not to achieve maximum performance, but to stabilize good, long-term productivity developing small, economically self-sufficient agro-ecosystems, operated by technologies adapted to the local context.
This method is based on the conservation and management of local agricultural resources through the participation, traditional knowledge and adaptation to local conditions.

▶ Envisaging the agro-ecological garden

Before creating a food garden, it is useful to meticulously observe and reflect on the environment, micro-climate, landscape, soil and general context in which the garden will be located.

The environmental characteristics, together with the requirements and preferences as to what we are going to produce, are the coordinates on the basis of which the garden will be created.
Apart from the agro-ecological, agronomic and technical assessments of the plot, it is important to have a historic and cultural picture of the activities -agricultural and non- carried out in the area.

If these aspects are perfectly clear to us and if we carefully analyze the advantages and limitations of the context in which we operate, we will be able to set up our garden in the best scenario possible right from the start.

▸ Aspects to take into account

The aspects always to take into account are predominantly: climate, soil characteristics, plot fertility and position (gradient, orientation, etc.).

It is also important to consider the presence of useful and harmful fauna, the presence of farm animals in the vicinity, the spread of diseases on wild flora or on neighboring plantations, the presence of potential weeds, trees or shrubs to be maintained and integrated into the new system, and so on.

Then there are the technical factors, introduced by man, to be analyzed: the presence and type of irrigation, the tools available for working the soil, the presence of protection structures, the availability of mulching material, the availability of premises for storing tools and materials, etc.

▸ Some considerations on environmental aspects

Climate has an evident and decisive influence on the agricultural inclinations of a territory.

The most important climatic aspects for the farming practice are: **solar radiation, temperature, rainfall, wind and atmospheric humidity.**
If, on the other hand, a plot is specifically assessed, then the **microclimate** is to be taken into account, which can vary significantly depending on **localized factors such as: altitude, exposure, soil vegetation cover,** etc.

Solar radiation is an important factor for any ecosystem, as it represents the **primary energetic input**: it is vital for the photosynthesis of plants and it is also the main environment temperature regulator.
The average seasonal temperatures, just as the daily minimum and maximum temperatures, are limiting factors for the life and development of plants and, as a consequence, they restrict the selection of crops.

Light intensity is also an important factor: there are plants that require a great deal of light and others that are damaged by too much light, or middle ways between the former and the latter. It is important to know which plants have a greater ability to withstand shade and which prefer a sunny location instead and suffer in the shade of other plants. Relative shading, for example, is well tolerated by peas, cabbage and radishes, whereas cereals generally suffer in more shaded locations.

The horticulturist can influence luminosity by choosing planting density, row orientation and carrying out intercropping between plants (herbaceous, trees, shrubs), even according to the posture (erect, expanded, creeping or climbing) and useful edible parts (root, fruit, seed or leaf plants).
The total quantity and distribution of rainfall throughout the year, **rainfall** frequency and intensity are determinant factors for the climate and the availability of water for crops, which can be partially improved with water regulation systems, thanks to the natural availability of underground and surface water reserves (lakes, rivers). These, in the long term and on a large scale, territorially speaking, depend to a large extent on rainfall. There are some plants suitable for drought-ridden environments (e.g. cacti, acacias, baobab, millet, sorghum ...), plants adapted to conditions of high humidity with elevated water demands, and plants adapted to alternating dry and wet periods.

Wind is an aspect that influences the climate, above all if frequent. The climate in a windy area is much different from that of an area without wind. Apart from the frequency and intensity of the wind, the direction from which it blows is important: winds arriving from the sea bring more frequent rains and attenuate temperature excursions; winds arriving from areas with warmer or colder temperatures have different effects. The wind influences the microclimate and, in particular, atmospheric humidity and plant transpiration. It can damage crops or farming structures, it transports seeds, pollen, salt, pollutants and pathogens; it positively or negatively affects the spread of certain crop diseases; it is a hindrance to the distribution of certain treatments, causing the dispersion or the drift of distributed substances (such as herbicides). Wind can erode the fertile surface layer of soil, especially on bare soil, playing a role in desertification.

Farmers can influence the microclimate by keeping and/or planting trees which limit the effects of rain, or reduce temperature, wind speed, water evaporation and direct exposure to sunlight. The use of mulch can limit the level of radiation and heat in newly planted areas, inhibiting the loss of moisture. Furthermore, raised beds contribute to the management of soil temperature and reduce water accumulation, thus improving the drainage system.

Planning the food garden

The **size** of the garden should be appropriate to the needs of those who are going to use the products, but also to their ability to take care of it throughout the year. For instance, it is counter-productive, because of the initial enthusiasm, to set up a very large garden if it can't be attended to properly because the time available is too little. If we know we are going to be away in a certain period of the year (for example, during the holidays in the case of school gardens), the garden has to be planned accordingly, not planting vegetables we won't be able to take care of and harvest in that period; or we must organize ourselves from the start by engaging someone who can continue to look after the garden in our absence.

It is important to separate crop spaces (beds or rows), which must not be trampled on, from passages (paths).

The preferable **orientation** is east-west for warm climates, as it enables the plants to shade the soil better.
The **size of the beds** must be such as to allow all the planting operations to be carried out without having to tread on the plants. Therefore, they should not exceed a width of 100-120 cm and, if we are planning a food garden suitable for children, the width of the beds should not exceed 75 cm: the width should actually be twice the length of the arm of the person working on the garden, while length is discretionary.

The width of the passages should range from 30 to 50 cm, but can be designed wider if more people are expected to have access, as in the case of school gardens, or if you want to provide access to disabled people, considering the width of the wheelchair and its turning space.

In addition to the beds arranged to host vegetables from year to year, spaces can be included for **aromatic plants**, annual or perennial, and for **flowers** and plants which, with intercropping, help against adversity, such as marigold, calendula, vetiver, etc.

Along the borders of the garden, on the other side of the **fence**, hedges and plants suitable for human consumption can be arranged, or even an ecological corridor can be provided to maintain the biodiversity of the environment and to offer refuge to useful animals such as insects and birds of prey.
A border with mixed perennials, always present in the garden giving shelter to birds and other animals, enhances both plant and animal biodiversity and extends the garden's productive season.

In limited spaces, certain **fruit trees** can be included, but we have to make sure they do not interfere too much with the vegetable crops.

In the case of school gardens, by exploiting the inclusion of herbs, shrubs, trees and flowers in a part of our garden, we can create a route based on the **five senses**, a useful tool for sensory education activities.

The garden should normally provide a space for the **nursery**, a space for the **composter** and a space for **water collection**.

It is important that each garden has a clearly visible **sign**, as it becomes its identification card. Some specific information must always be indicated: name of the garden, Slow Food logo and name of the person who has incurred the cost of the garden. But some details on the philosophy of the project can be added, there can be an explanation of how the garden is cultivated, and small tags can also be placed on the plants with the names of each variety grown. The signs can be created with imagination, using recycled materials, involving children and young people for the writing and drawings.

Seed management

The selection of seeds and other means of propagation (seedlings, tubers, roots, cuttings, etc.) is extremely important because it determines the variety of the vegetables and of other plants that are to be grown in our garden.

It is important to choose plants suited to the soil, acclimatized to the environment and with characteristics of our liking. Within the same species, we can choose early or late varieties, more or less productive, typical of the area, resistant to disease, with different tastes, shapes and colors.

Differentiating is one way to guarantee a good harvest. If, for example, a late variety and an early variety of the same vegetable are planted, in favorable conditions we will have the advantage of a longer harvest season and our harvest will be safer in adverse environmental conditions.

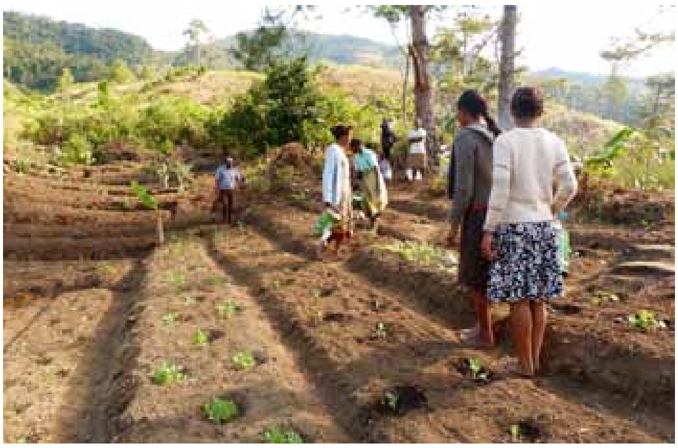
Seeds are a wealth of biodiversity that we can help preserve even by cultivating a small food garden, especially if we diversify our production, cultivating many species and varieties and preferring the old or the local ones.

Nowadays many local species are rare and are reproduced by farmers or amateurs or stored in seed banks by universities, institutes or associations, while in markets and shops the supply of seeds is becoming increasingly limited. The most important seeds on the market today have been reduced to a few dozens of varieties marketed throughout the world by the same multinational corporations.
These commercial varieties, in addition to contributing with their diffusion to the reduction of the biodiversity found in agriculture, sometimes are not necessarily an optimal choice because, selected in distant environments, they do not adapt well to all the climates in which they are sold.

After the first year, during which the seeds required have to be found or bought, we can select some plants, the most healthy and attractive, and make them "go to seed". When the seeds are fully developed, they can be picked and stored in a dry place in paper bags from year to year.

If we are forced to buy seeds, it is advisable to avoid F1 hybrid seeds or seedlings because, in the following years, they often become sterile or do not retain the characteristics of the parent plants, with little or no harvest at all.

A good source of varieties comes from the inclusion of perennials, shrubs, hedges and fruit trees in the ecosystem garden, making sure they do not shade the vegetables excessively and that, with their roots, they do not overly compete with the vegetables. Even wild plants, if tolerated along the garden borders, can contribute to plant biodiversity and represent a refuge for useful insects.



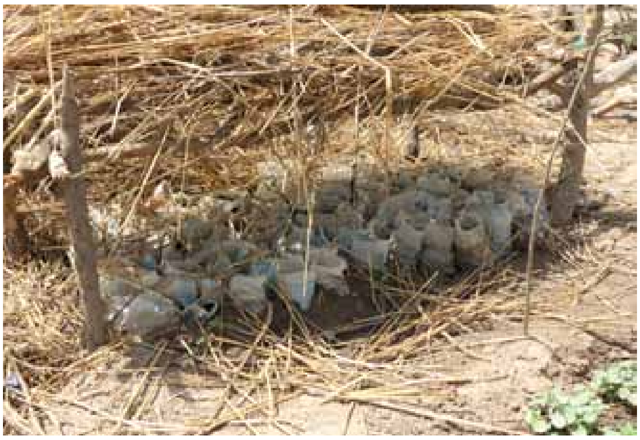
Some spontaneous plants can also be useful because they are edible and/or can be used as a defense against adversity (as is the case with nettles). **The easiest method of cultivation is direct seeding (sowing the seeds directly in the soil).** Direct seeding can be carried out **in rows**, arranging the seeds at regular distances in furrows dug in the ground with a hoe, or **broadcast seeding** (for smaller seeds). Another common technique is seed drilling/dibbling, whereby a number of seeds are arranged in **shallow pits**, always at reg-

ular intervals according to the planting system required by the sown species.
The seeds are placed in the soil after this has been dug over then shredded until soft. They must then be covered with a layer of soil the thickness twice that of the seed. Seeds can be lost when placed too close to the surface because of animals or light and because of excessive heat or insufficient moisture. On the contrary, if placed too deep, the seed may not have the necessary energy to sprout. In any case, especially in the cases of broadcasting and dibbling, the seedlings growing in excess must be thinned out.

For many vegetables, the most appropriate and practical sowing method is that carried out in a protected seedbed followed by transplantation in the garden. Open-field sowing does, in fact, put seeds in conditions that are not always favorable, in some cases reducing the percentage of germination.

A seedbed is a small nursery where the seedlings can come out in **ideal conditions**, protected from animals and atmospheric agents, reached by light but not by excessive cold or heat, and always kept adequately watered.
The seedbed can be built, for example, with a raised table filled with inert material (e.g. sand) and protected from the sun's rays and from rain with a canopy made with wood and straw or with a fabric that filters the sunrays.

A series of jars, or directly a bed of earth and manure or compost, are placed in the seedbed in which to sow varieties to be transplanted later in the garden.

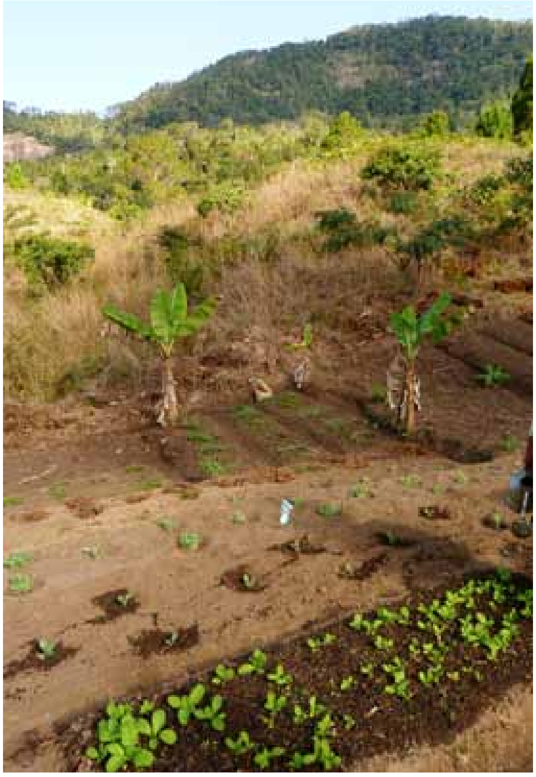


The seedbed can also be made simply with boxes or plastic jars or peat, made from recycled materials such as honeycomb egg cartons, or the cardboard cores of toilet paper.
In school gardens, we can keep the sown jars in a bright place near a classroom window, remembering to water them every day, but to move them to a better place if there is too much sunlight or heat.
As soon as they have grown sufficiently (4-5 leaves for vegetables), they should be transferred to the space reserved for them in the garden.

During transplantation, it is important to maintain the block of soil surrounding the roots as intact as possible and the hole in which the plants are located should be double the size of the block of soil. Compost or well-matured dung can be added to the soil at the moment of transplantation, making sure it does not come into direct contact with the roots. We can dig a hole a little deeper, place the compost in it, cover the bottom of the hole with a layer of soil and then plant the seedling.

Soil management

One of the most important factors to be taken into consideration is the soil. The **characteristics of the soil** are factors to which our choices must be adapted, because they are permanent, they cannot be modified, or can only partially be modified, and only with a high expenditure of time and/or resources.



The best thing to do is to select crops that adapt to the soil and not vice versa. Therefore, before starting to sow, it is important to know the characteristics of the soil at our disposal. Each type of soil can be suitable for certain plants and not for others, and it may or may not benefit from a specific crop technique.
Compared to natural soil, agricultural soil evolves according to human activities.
Various work phases (weeding, harvesting, etc.) involve the removal of a part of plant biomass, and therefore of the organic substance that in a natural ecosystem would decompose on the soil, restoring its fertility.

A lower content of **organic matter** has a negative effect on the structure and porosity of the soil, the capacity to retain water and nutrients useful for the plant and the community of decomposer microorganisms present, thus reducing biodiversity and the rate of mineralization of the soil's organic matter.

The reduction of organic substances in the soil due to agricultural activities must be counterbalanced by organic amendments and fertilizers that return to the soil the resources consumed and removed.

Fertility

Every year on our planet, 5.5% of organic matter that is part of the plant world falls to the ground, meaning that a huge mass of organic matter (25 billion tons of carbon alone) enters the phase of decomposition and humification in the cycle of organic matter.
When we go into a wood or forest and stir the mantle of dead leaves, we notice a pleasant smell, and as we go deeper, leaves, branches, animal and insect remains gradually lose their original shapes and colors: beneath the first layer of leaves and debris not yet decomposed, there is an intermediate layer, under which we find soft soil, dark in color, rich in humus and sweet smelling.
Kitchen scraps kept in plastic trash bags (so-called "urban wet waste") emit unpleasant odors after a very short time, and are to be disposed of.
The difference in behavior between the underworld and our organic waste is related to the fact that forest soil is an ecosystem characterized by a food chain, by a cycle of living organisms that thrive thanks to the reutilization and transformation of organic matter that reaches the ground.

Considering a depth of 30 cm, one hectare of natural fertile soil can hold more than seven tons of living decomposers such as bacteria, fungi, protozoa, algae, nematodes, annelids, insects and even small vertebrates. These organisms feed on organic matter, triggering a long and complex sequence of physical transformations involving chemical and biochemical processes of decomposition, mineralization and humification.

In the food chain of decomposers, the organic matter of plant residues is transformed into **humus**, releasing abundant inorganic nutrients, in particular nitrogen for plants, water and carbon dioxide.

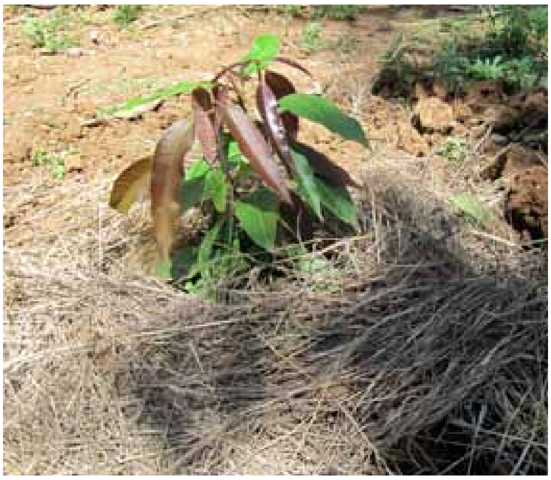
The organic substances present in plant residues (starches, sugars, cellulose, lignin, resins, etc.) become nourishment for the decomposers which draw energy from their degradation, producing carbon dioxide (just like when we breathe). These organisms use the energy thus obtained and they use part of the substances to synthesize new proteins, to grow and to multiply.

Organic substances facilitate the accumulation of moisture and, after a process of mineralization, are transformed into **nutrients** that can be absorbed by plants.

The cycle of organic matter knows nothing about the concept of waste, it reuses everything.
Only the human species, particularly in recent decades, has invented and introduced non-recyclable waste and its storage.

To replicate in a garden the cycle of organic matter that regenerates soil fertility by recovering plant residues (from the garden itself, a neighboring garden, a kitchen or a canteen, etc.), we can make use of **composting**. Another example of "recycling" is the direct incorporation of crop residues into the soil.
A similar function of restoring organic matter in soil is that of applying manure, green manure, and in part, mulch.

▸ Mulching



Mulching is a technique by which **the soil is covered** with a layer of material to combat weeds, to keep the soil moist, to protect it from erosion caused by the action of heavy rain or wind, to avoid the formation of the so-called surface crust, to reduce compaction, to maintain a good soil structure, and to increase the temperature.

There is a variety of materials suitable for mulching, and which can also be combined, ranging from **organic materials** (obtained from shredded crop residues: bark, straw, rice husk, dry leaves, grass clippings, husks, shells, cardboard, etc.) to **aggregates** such as gravel, stones, recycled glass.

Mulching imitates what occurs naturally in the woods, where dry leaves accumulate on the ground at the foot of the tree, limiting the growth of other vegetation. The effect is due to inhibition of a physical type (fallen leaves prevent the penetration of the sun's rays and deprive the weeds of space), and to actions of a biochemical type (bark, for example, due to the content of tannin, releases toxic substances that prevents vegetation from developing). Mulching makes it possible to maintain, at the level of surface roots, a higher temperature in the cold months, while decreasing the need for watering during the hot months.

▸ Green manure

An extremely efficient soil fertilizing practice is applying green manure, which consists of planting certain specially grown **crops in the ground** to maintain or increase soil **fertility**.
Green manure increases organic substances in the soil, slows down erosion, maintains or improves the content of nitrate nitrogen (especially if nitrogen-fixing species are selected, such as legumes).

▸ Crop rotation

Crop rotation maintains and improves soil **fertility**, crop yields, but also the ecological health of soil, without using fertilizers and crop protection chemicals.

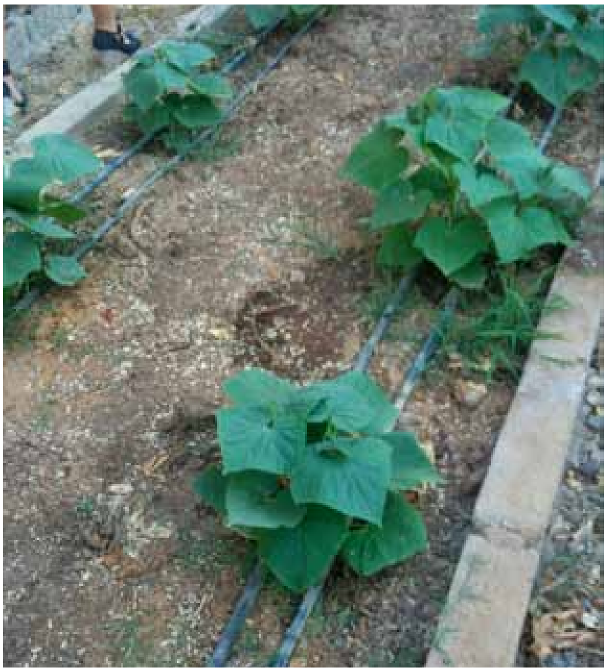
Carrying out crop rotation means **not cultivating the same species year after year in the same area of the garden** (e.g. tomato on tomato), but, on the contrary, alternating plants that deplete the soil with plants that enrich it.

Crop rotation interrupts the life cycle of harmful organisms associated with given crops (weeds or parasites). It improves the structure of the soil and replenishes it with nitrogen, thanks to crops such as legumes (nitrogen-fixing). It avoids the build-up of negative substances released by the roots if the same species are always cultivated in the same soil.
Rotation also makes it possible to let a part of the soil rest, without leaving it uncovered (bare soil degrades easily due to erosion) but allocating it to meadow (or fallow). Meadow cultures can then be planted (thus replenishing the soil with organic matter), or they can be used for animal feed.

With crop rotation, crops are divided into two main groups:
• **catch crops** (mainly legumes, alfalfa, clover...);
• **depleting crops** (usually grasses, such as rice and wheat).

There are biennial, three-year and four-year rotations. Each cycle generally begins with a depleting crop and ends with a catch crop.

Water management



Water is an essential element for plant life. It is the reactant of numerous chemical processes that occur in plant tissues (e.g. photosynthesis); it maintains cellular turgidity of the various parts of the plant; it controls internal temperature (thermoregulation); it allows the transport of nutrients within the plant.

Dissolved in water are the mineral elements present in soil, which are necessary for the normal development and growth of plant species. Plants absorb water through their roots which develop deep in the soil. The water rises to the leaves where it is then largely emitted into the atmosphere under the form of vapor (transpiration).
Furthermore, according to the type of **plant cover** (more or less dense), the soil loses more or less water due to direct evaporation occurring on its surface.

Evaporation is extremely important especially in the early stages after sowing, when the soil is characterized by a minimum presence of vegetation. Each crop develops normally and gives its maximum yield only when water loss, due to transpiration of the leaves and evaporation of the soil, is made up for by water that the roots are able to absorb from the soil. There has to be a sufficient quantity of water in the soil to meet the water requirements of the crops.

Two different types of factors influence the loss of water through evaporation:
- weather: temperature, wind, humidity, solar radiation;
- agronomic: type of crop, cultivation techniques, plant cover, soil moisture, soil type.

Water is an asset of inestimable value and not available in unlimited quantities. The availability of water is one of the central elements to be taken into account when planning the garden, and is often one of the most serious problems, especially in the cultivation of species that grow in periods of little or no rain.

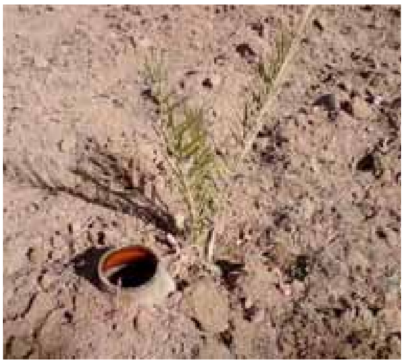
The realization and management of wells and irrigation systems involves high costs for the purchase and maintenance of the plant, for the energy consumed and for maintenance.

Furthermore, an irrational use of water can reduce, even drastically, the utility of irrigation itself and, in some cases, lead to serious damage in the field. Excessive watering can cause damage and rotting, compromise product preservation, and result in waterlogging, deteriorating the soil structure and favoring the leaching of soil nutrients.

Although we believe that the subsoil has a certain availability of water, drilling should not take place without a precise plan (studies are needed to assess the nature of the soil, the structural characteristics and the rate of recovery of the water collected). There is the risk that aquifers and reservoirs filled during the course of thousands of years may dry up (and, considering the scarcity of rainfall, may not easily be recuperated).

To plan and manage garden irrigation well, we must first **know everything there is to know about the availability of water**, based on the presence of nearby streams or ponds and on the basis of rainwater that can be stored during the rainy seasons (through gutters, tanks or cisterns).

Irrigation must be carried out with localized systems (drip) and with some precautions: e.g. watering must be **avoided during the hottest hours** of the day.
Even the arrangement of the soil at the moment of sowing can play a vital role for the proper utilization of water resources. Moreover, the selection of species and varieties suited to different areas (even the driest) allows the use of water to be rationalized.



Crop protection

To protect the garden from adversity (crop diseases, harmful insects, weeds) we can choose methods that do not include substances known to be harmful to the environment and to garden users.

It is important to include in gardens **natural enemies** of organisms that are harmful to crops, and to limit excessive weeds, either weeding by hand or mechanically or with measures such as mulching.

In an agro-ecological garden, the defense measures are limited to what is strictly necessary to regulate the equilibrium of the agricultural production system.
Animals can be a positive, negative, or unimportant presence for the crops, we must know them well in order to benefit from the presence of the useful ones, as it would be useless to struggle unnecessarily with inoffensive animals and to keep under control harmful ones, with the least possible consumption of energy and harmful substances.

There are no good or bad organisms, but there are some environments in equilibrium and others that are not: just one caterpillar in a garden can do very little damage, but ten caterpillars on just one cabbage ruin the harvest!
Aphids are harmful to plants, but they are a prey for ladybugs which can keep them under control. Ladybugs, however, are very sensitive to poisons and to pollution.
Many aromatic plants and many decorative species, if planted in the garden, can increase the capabilities of the vegetables to defend themselves from pests and other adversities.

Some crops act effectively simply because they are present in the garden, while others need to go through maceration and decoction.

- Some examples of the **first group**:
- Marigold and calendula release radical substances that fend off nematodes, therefore they are useful for garlic, it being quite sensitive to the attack of these pests;
- Tropeolo, lavender, savory, chili pepper and nettle repel aphids and lice;
- Artemisia, sage, mint and tomato discourage the cabbage butterfly;
- Fern and horseradish are a repellent to the Colorado potato beetle;
- Tansy keeps ants away;
- Mustard, garlic, and hyssop keep snails at bay;
- Watercress repels carrot flies, and garlic contrasts powdery mildew.

Some examples of the **second group**:

- The decoction of Horsetail (100 g of fresh plant in a liter of water) stimulates plant growth and resistance to fungal diseases;
- Macerated bracken combats aphids, scale insects and snails;
- Neem oil is effective against lice, aphids, mites, mealy bugs.

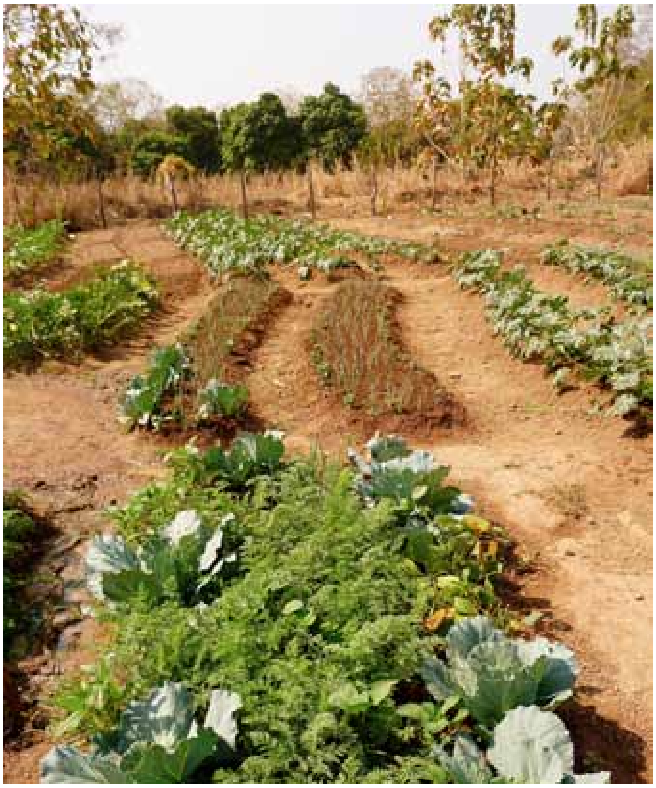
There are many plants and preparations useful for crop protection, and are linked to territories and local cultures

Intercropping

The intercropping of two or more crops, if done well, minimizes the risk of crops competing with each other and stimulates mutual support between the different crops.

Intercropping is a term meaning the **contemporary cultivation of different vegetables in the same space of garden**. Thanks to the characteristics of substances released by roots, resins and the essential oils produced, certain plants are able to stimulate or, in some cases, to suppress the development of the plant species growing in their immediate vicinity, to ward off pests, or to attract useful ones.

The principle of mixed cultivation was introduced in farming on the basis of what happens in nature. In fact, **there are no examples of natural ecosystems in which there is only one plant species.** The agro-ecological method is actually based on the assumption that all plants benefit from growing in a complex agro-ecosystem, which is not limited to a single crop, but in which two or more species



are grown contemporaneously. Not all crops, horticultural or less, can be intercropped; many crops do, in fact, compete negatively, while others benefit from being intercropped. We can speak, therefore, of real models of intercropping, as results from experimental evidence and experience.

Intercropping allows **better exploitation of the various layers of soil**, combining plants with root systems of different depths (an example in this sense is given by intercropping carrots and onions); and it enables the space available to be maximized, combining short-cycle crops with other long-cycle ones.

The soil best used is more covered with vegetation, which limits the proliferation of weeds and reduces soil erosion. Some plants also release substances that have a repulsive action against insects that are harmful to other species. An example of this phenomenon is given by intercropping carrots and onions. The carrot fly, whose larva eats roots, is rejected by the odor of onions and no longer lays its eggs on the carrot collar.

Similarly, the onion fly, whose larvae enters the pulp of this vegetable and rapidly turn it into a rotten and malodorous mass, avoids flower beds in which carrots are grown. In extremely sunny areas, by intercropping tall crops with shorter crops, the former shade the latter. When we create our garden and transplant seedlings, we must respect the seeding order (**optimum distance between plants**) for each species, and take into consideration positive intercropping and avoid negative intercropping.

Intercropping not only between vegetable species but also with trees and shrubs, creates a mixture of vegetables, fruit trees and flowers.

In addition to the methods described above, it is important to know that crop protection (without the use of agrochemicals) is based on a set of practices:

- **Selection of varieties more resistant to pests**, selected by farmers over the centuries;
- **Management of certain weed species** (some weeds, for example, provide an alternative food and/or shelter for natural enemies of pests);
- **Soil care:** soil that contains a good amount of organic matter normally has fewer diseases;
- **Management of shade:** the intensity of certain diseases are reduced or increased according to shading;
- Use of clean and healthy **seeds** and other propagating material;
- Management of the **density of plants or crops:** there is a general increase in diseases in crops grown too densely;
- Management of the **depth** at which seeds and/or propagating material are positioned (sowing on the surface is often effective for the control of diseases, as the plants emerge quickly from the ground);

- Tolerance of **uncultivated periods**, useful to reduce losses caused by plant diseases, especially soil diseases;
- Use of **mulch**, which reduces plant diseases, as it influences the soil's moisture content and temperature, and increases the microbiological activity;
- Creation of **beds in relief (convexing)** and other systems that may improve drainage and increase fertility, thus contributing to the management of soil-related diseases;
- Use of **crop rotation**, which interrupts the life cycle of pests associated with a given crop.