ENI CBCMED
Cooperating across borders in the Mediterranean

Project funded by the EUROPEAN UNION

REGIONE AUTÒNOMA DE SARDIGNA
REGIONE AUTONOMA DELLA SARDEGNA

MYSEA - Mediterranean Youth, NEETs and women advancing Skills, Employment and Awareness in the blue and green economy

MYSEA

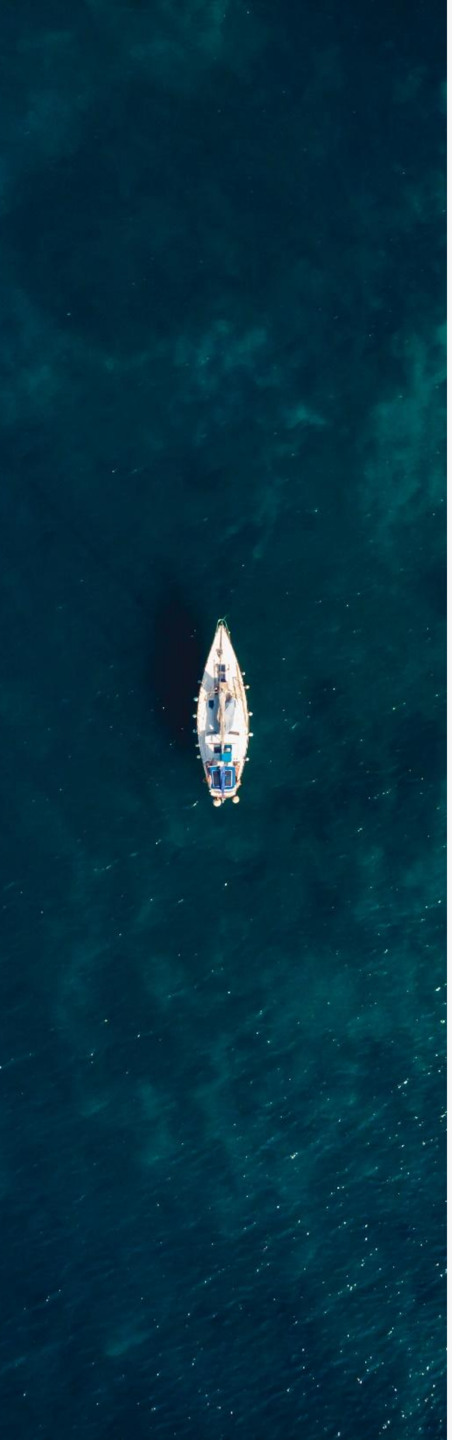
Introduction

This course provides fundamental information on the Blue and Green Economy, an overview of the trends in the agri-food and waste management sectors, information on the supply chain and elements of innovation, sustainability and environmental conservation.

Green & Blue Economy Fundamentals

(Module 1)

Agri Food Chain

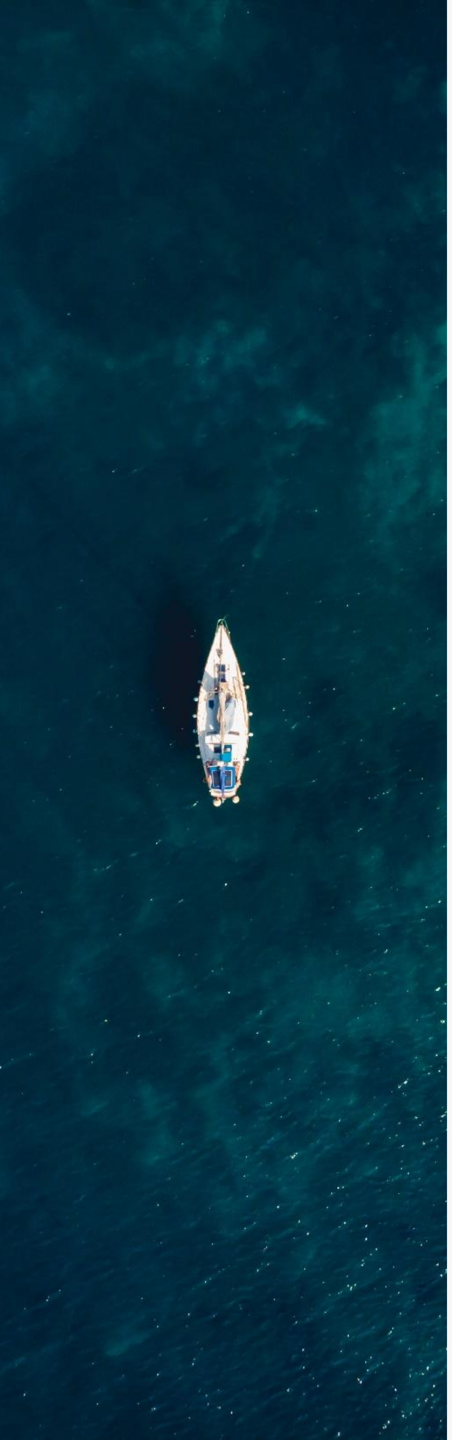


Agri Food Chain

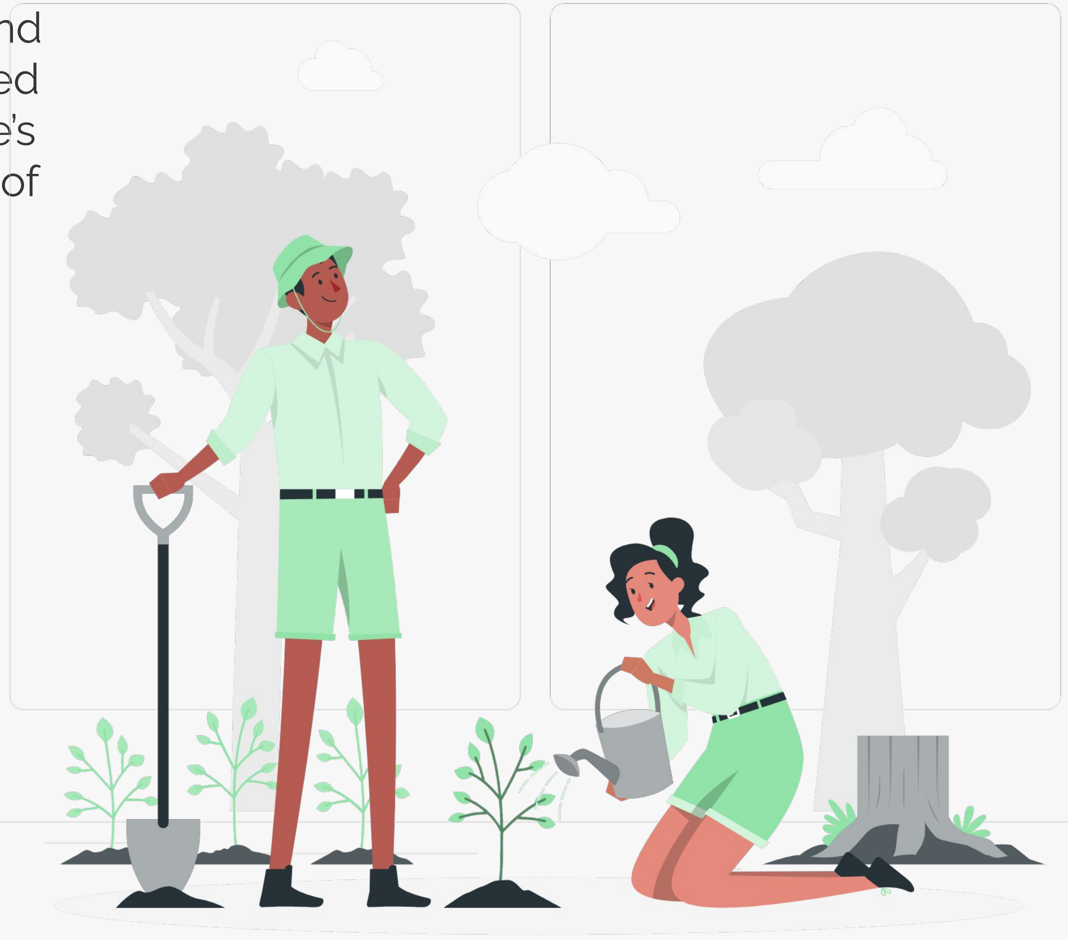
According to the NACE classification ("nomenclature statistique des activités économiques dans la Communauté européenne") Agri Food Chain (AFC) includes the following broad sections:

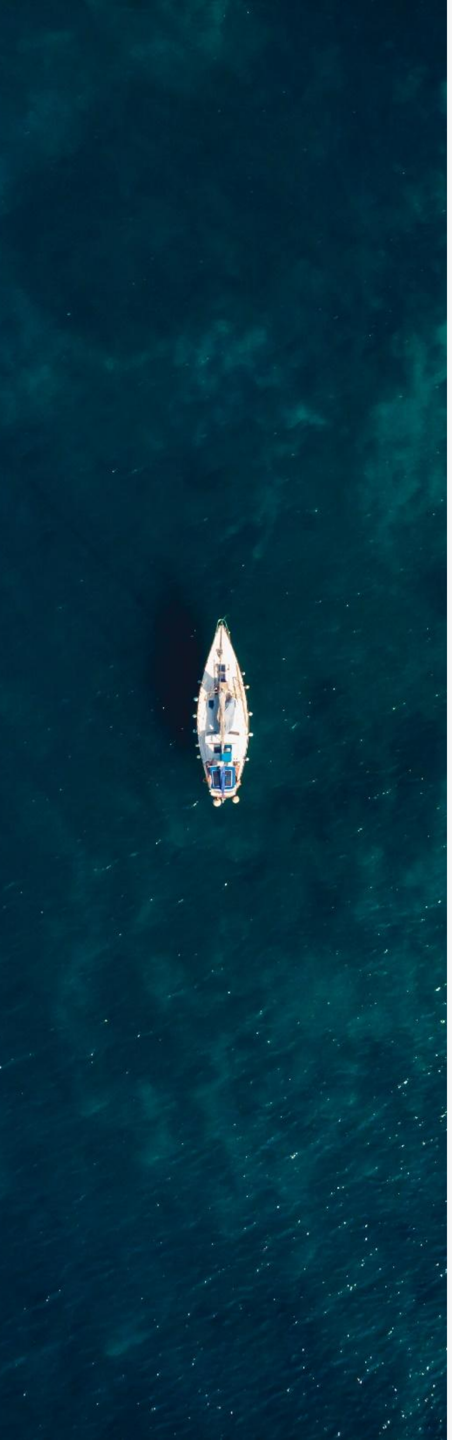
Agri Food Chain

This is to say that in addition to the farm sectors, there're also others involved in the AFC, such as packaging, transportation, and all economic and non-economic food-related activities and services. This means that there's a lot more to consider from the point of sustainability.



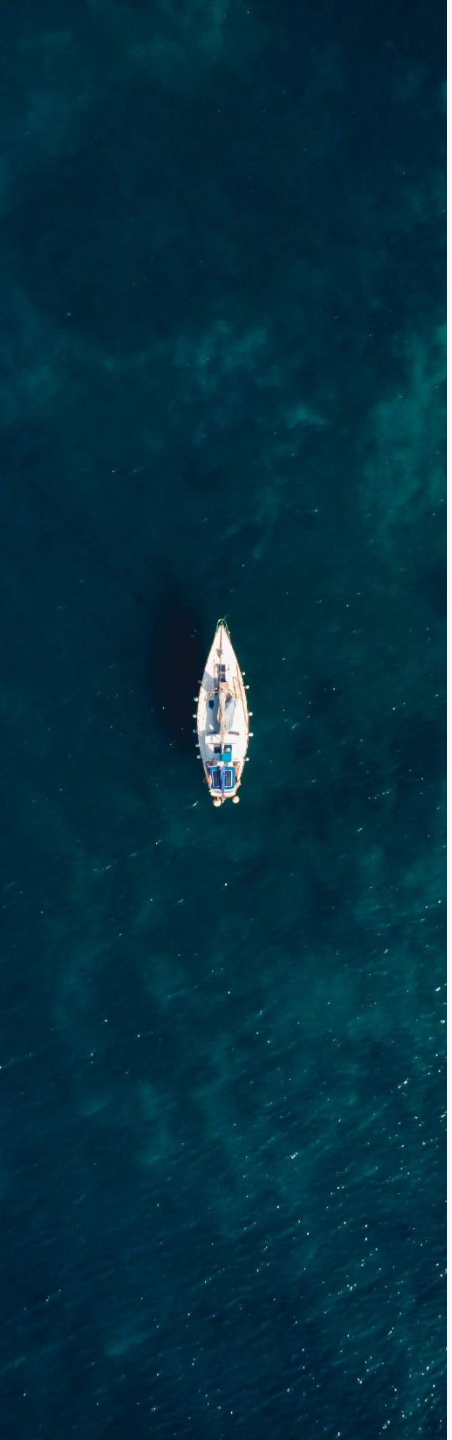
- Section A – "Agriculture, forestry, and fishing"
- Section C – "Manufacturing"
- Section G – "Wholesale and retail trade"
- Section H – "Transportation and storage"
- Section I – "Accommodation and food service activities"





Biologically Integrated Farming Systems (BIFS)

Some examples of biological and cultural practices promoted in BIFS projects include:

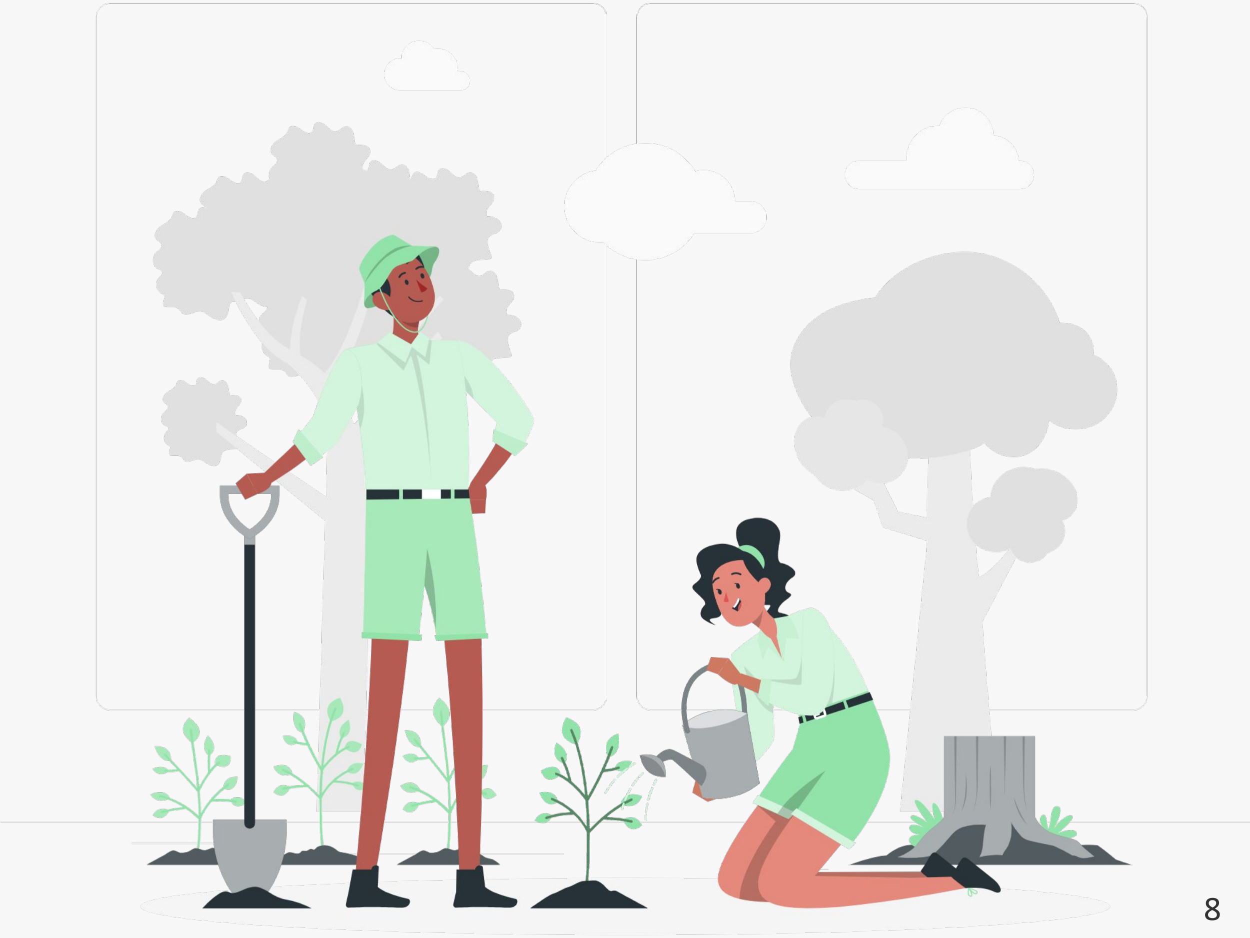


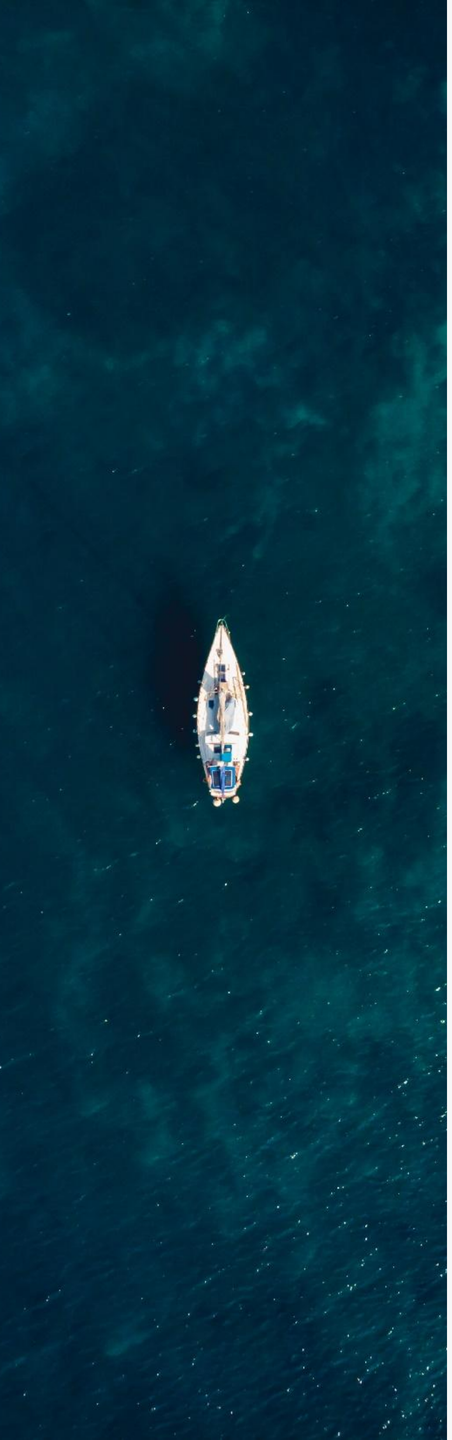
Biologically Integrated Farming Systems (BIFS)

COVER CROPPING

This means growing plants (called cover crops) that are meant not for harvest, but for covering the soil and as a result protecting it.

They may grow between season harvests (including winter) and manage soil erosion, soil fertility, soil quality, water, weeds, pests, diseases, biodiversity and wildlife in the agroecosystem





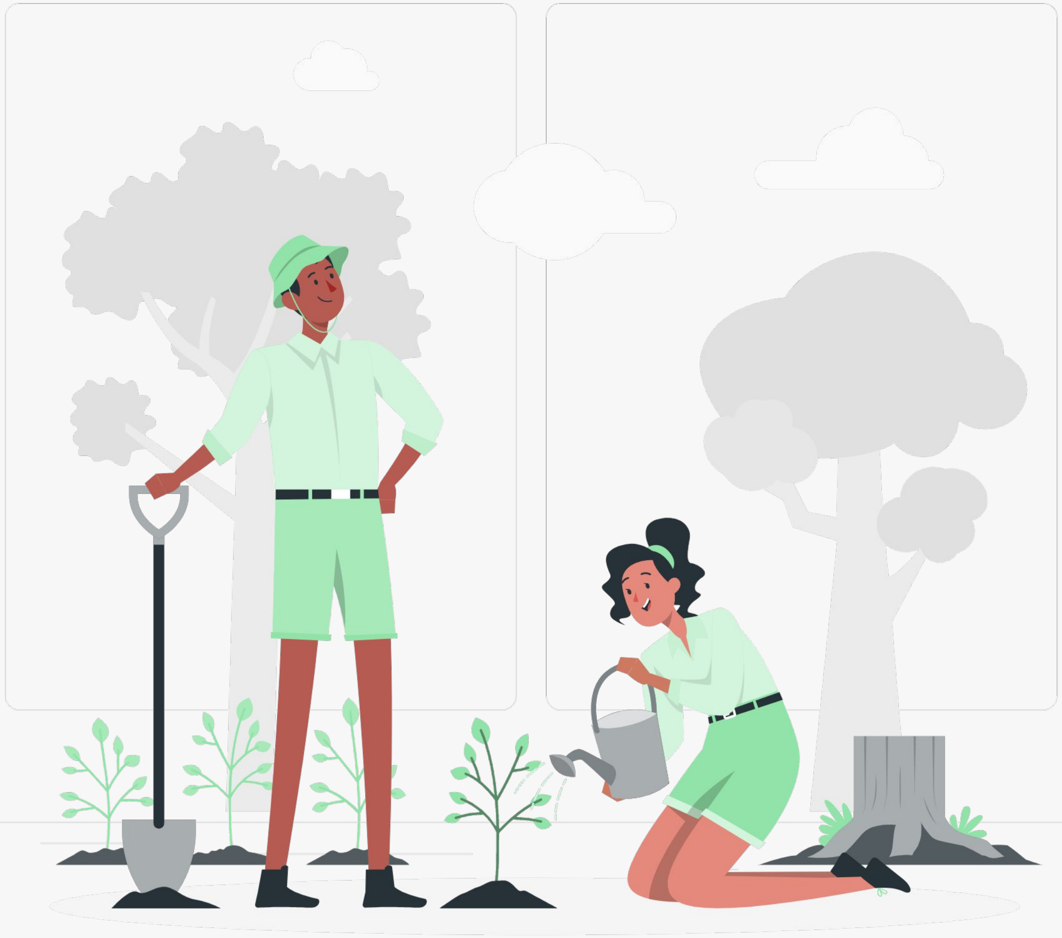
Biologically Integrated Farming Systems (BIFS)

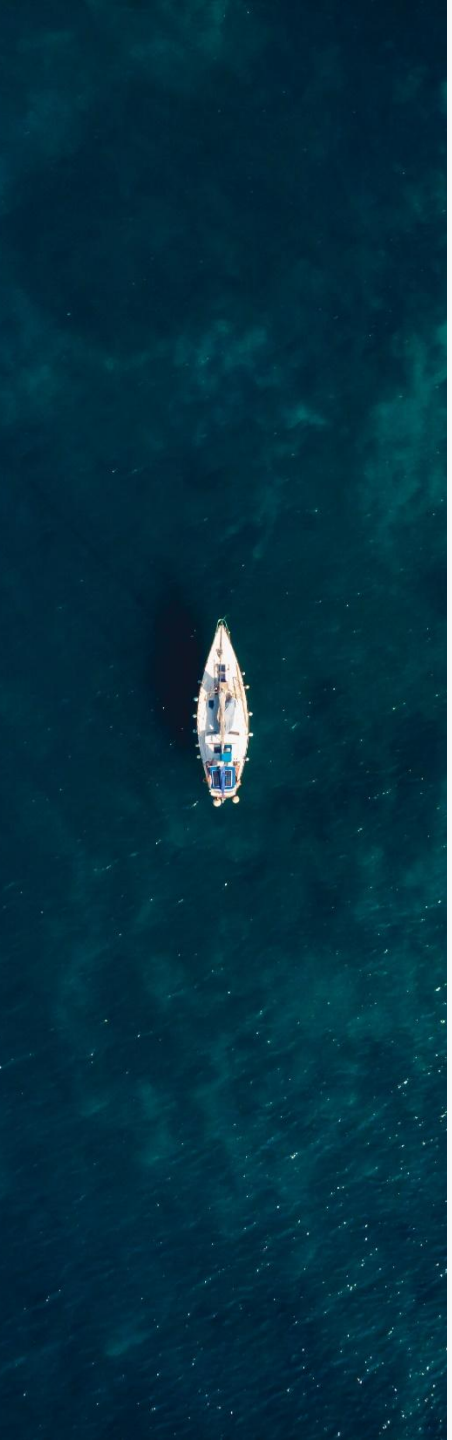
CROP RESIDUE

These are the materials that remain after a crop. There are two major types:

- Field residues (leaves, stems, seed pods) are valuable in tilling, watering, and erosion prevention

- Process residues (seeds, husks, molasses, roots, bagasse) can be used as animal fodder, fertilizers, and soil amendment.



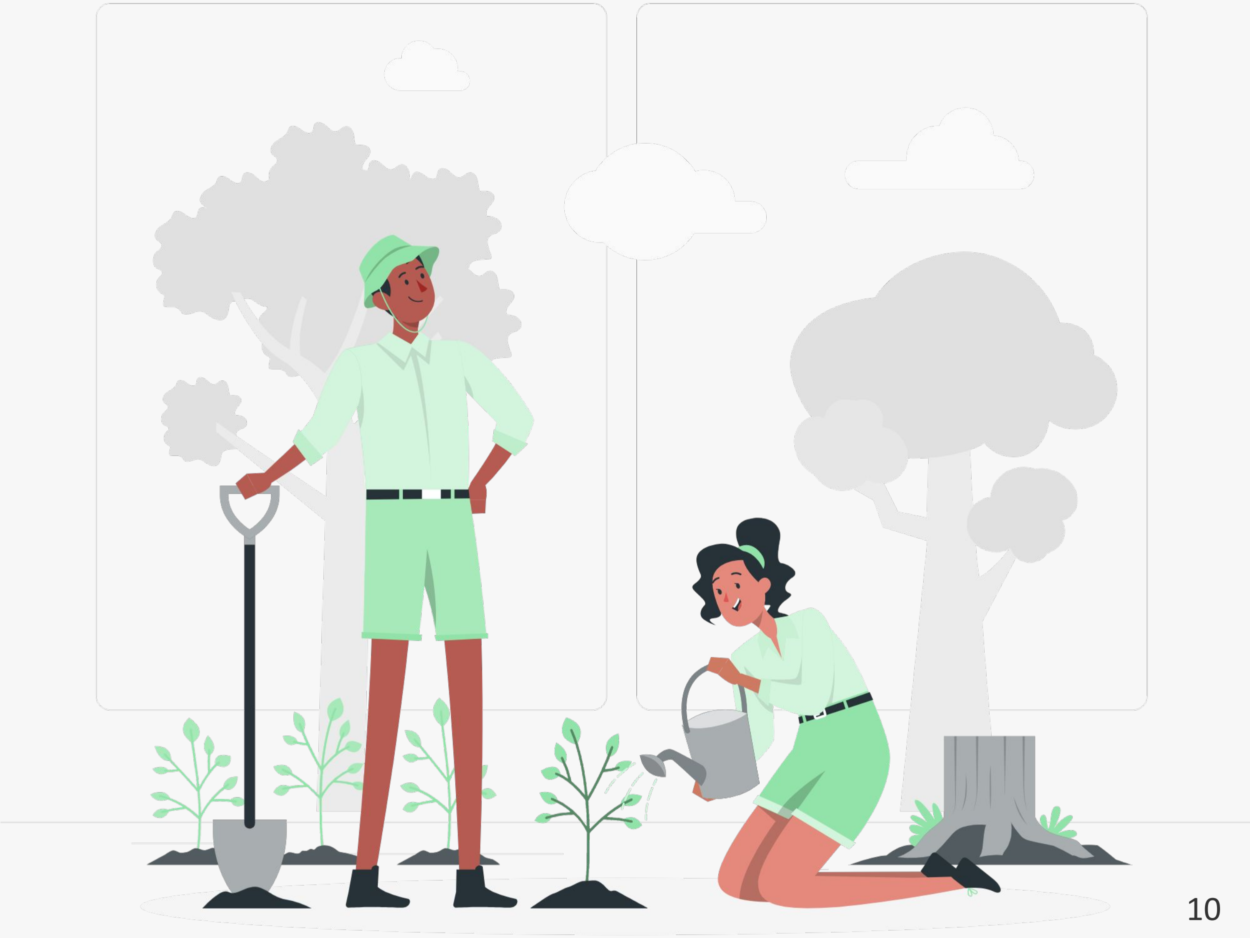


Biologically Integrated Farming Systems (BIFS)

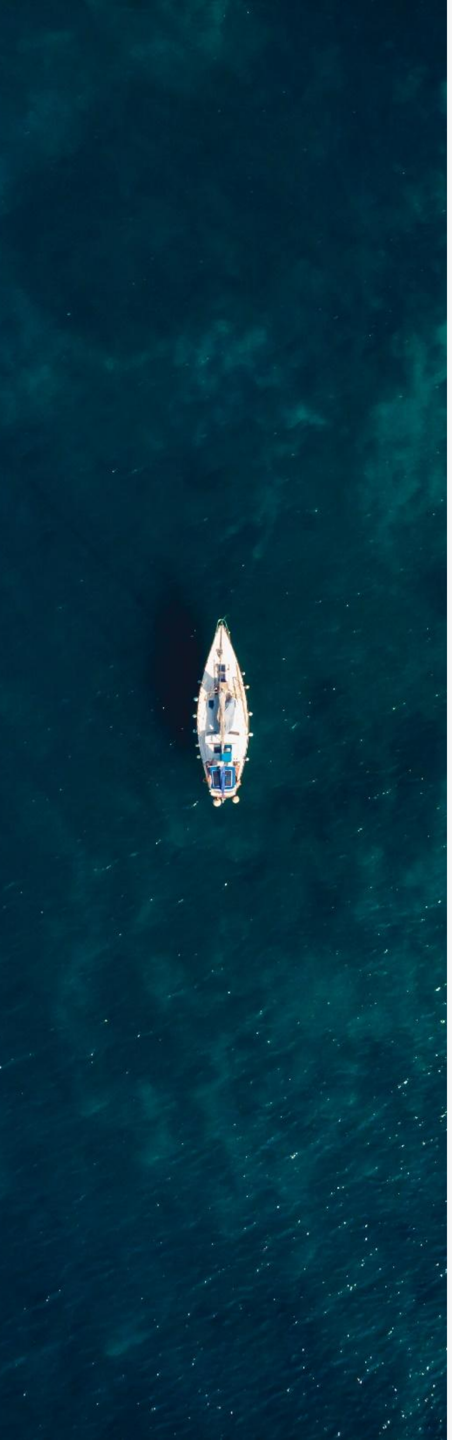
HABITAT PLANTING

Growing certain plants and flowers can encourage animal species to find their dwelling within your farm.

As a result, you control both pests' population, and avoid using as much pesticides on your crops for the same reason.



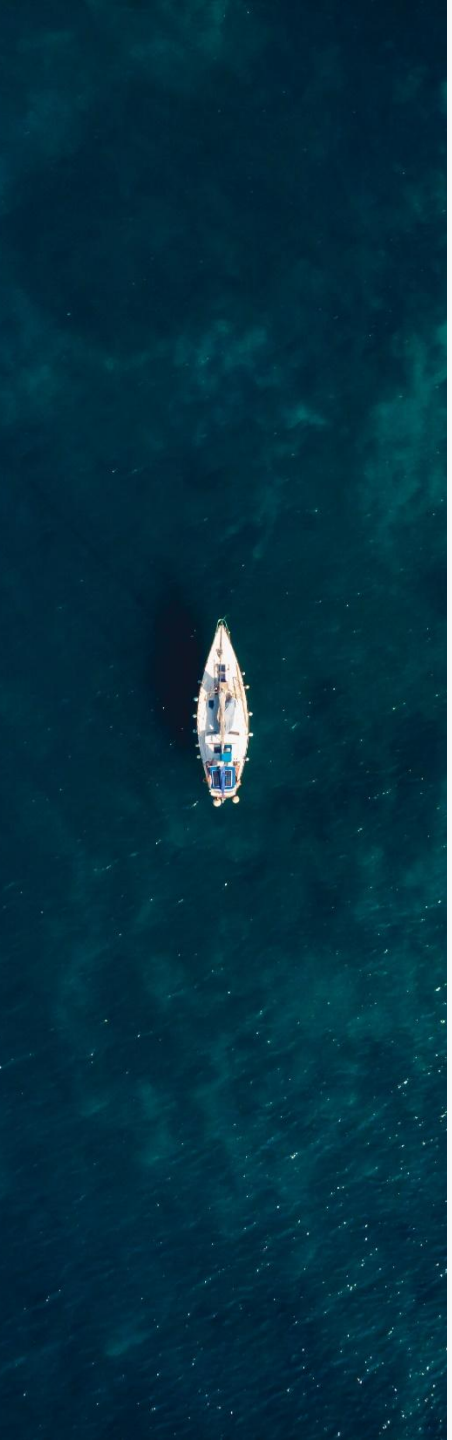
Organic Farming



Organic farming

Organic farming (also known as “ecological farming”, “biological farming” or “organic agriculture”) is an agricultural system that uses fertilizers of organic origin.

“According to The International Federation of Organic Agriculture Movements (IFOAM - Organics International) "Organic agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved..."

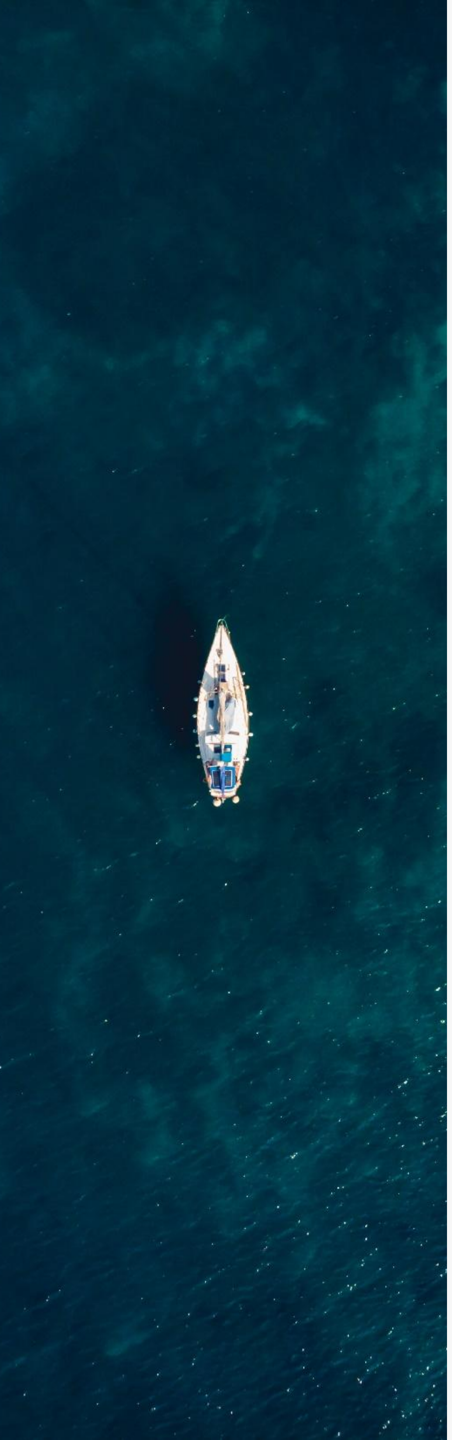


Organic farming

FALLOW

As a result of ongoing agriculture, the soil can lose its fertility.

In order for the land to restore its natural fertility, it is periodically left fallow for a period of time.

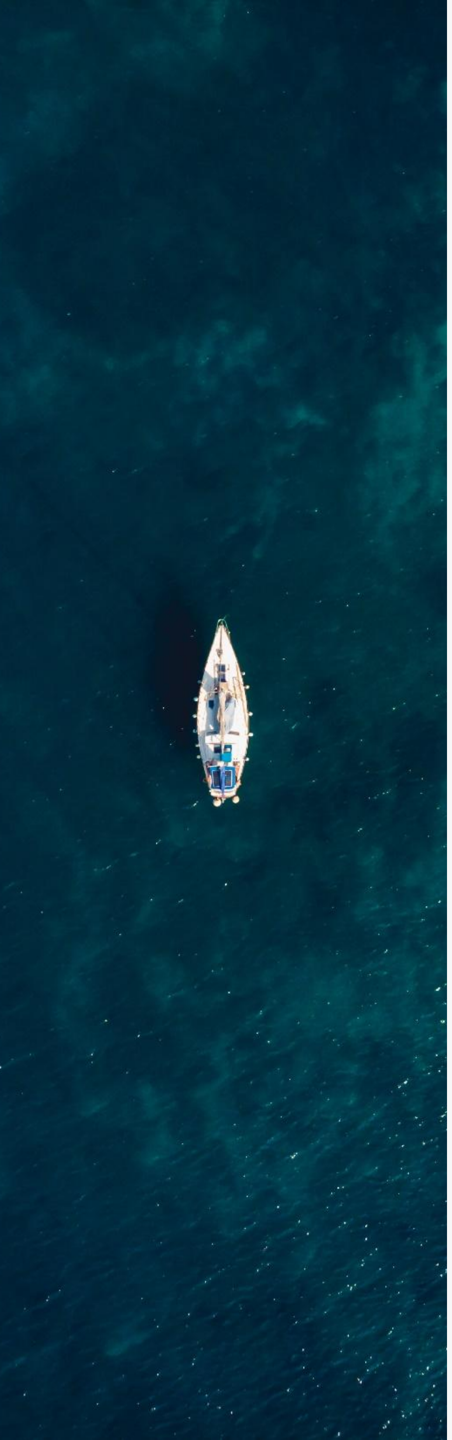


Organic farming

CROP ROTATION

This process is used to either prevent the land from being left fallow or to shorten the time it is left fallow.

The plants most often used in crop rotation are leguminous plants because they naturally fix atmospheric nitrogen.

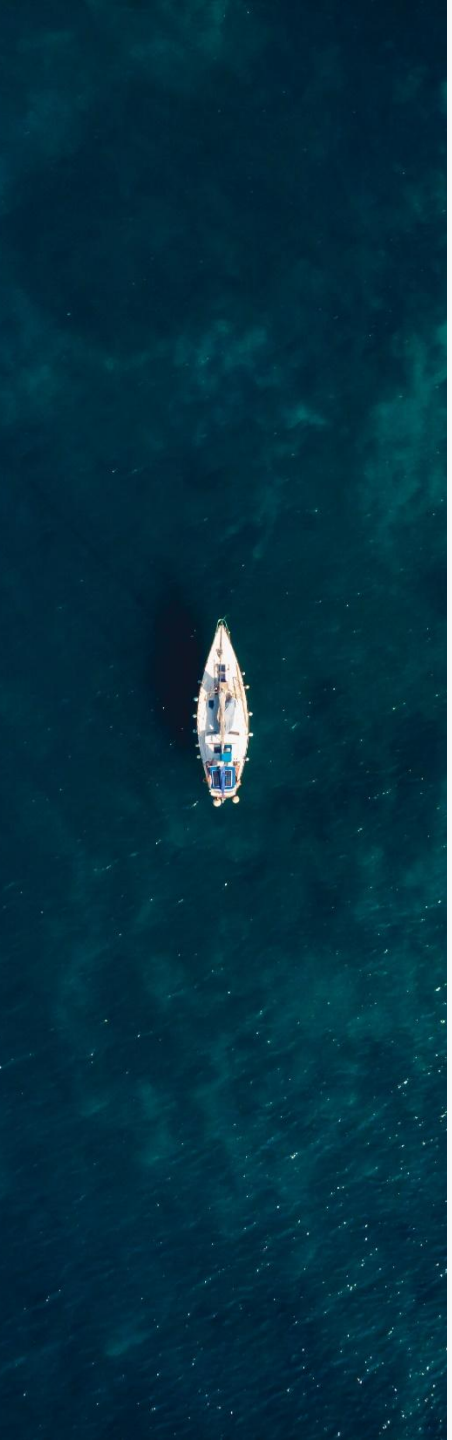


Organic farming

MIXED CROPPING

In this method, two or three crops are grown simultaneously – in doing so, each crop can partially replenish the nutrients used by the other crops.

The percentage of crops that must be combined varies depending on the techniques used and the demands of the region.



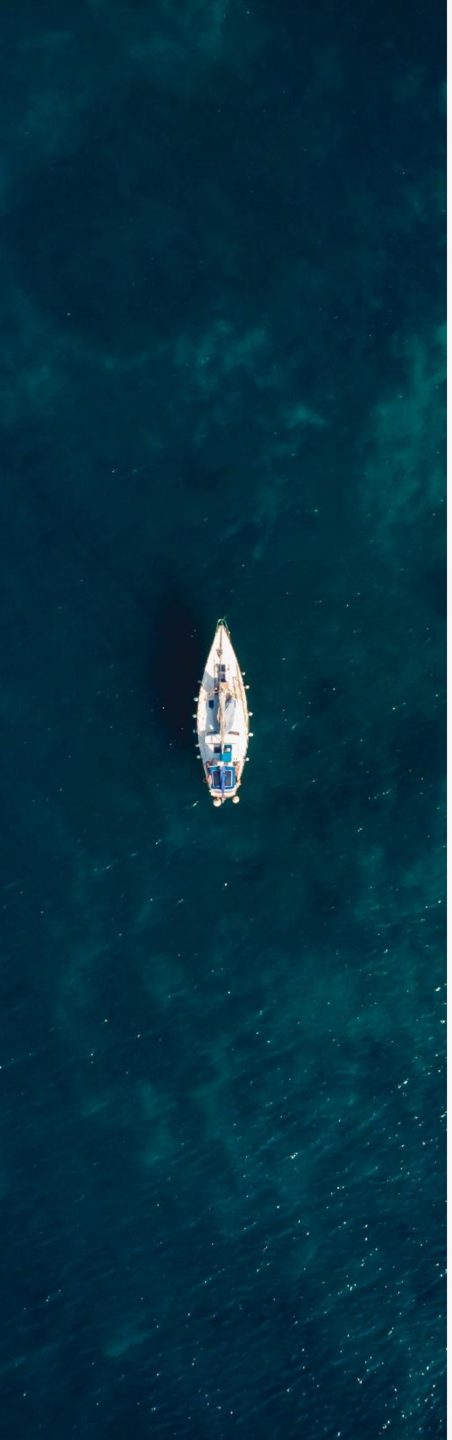
Organic farming

RELAY CROPPING

In this practice, two crops are grown in alternation over the course of a year.

It is common in regions with sufficient rainfall or irrigation infrastructure.

Typically, leguminous crops are the preferred second crop, because of their ability to fix atmospheric nitrogen.

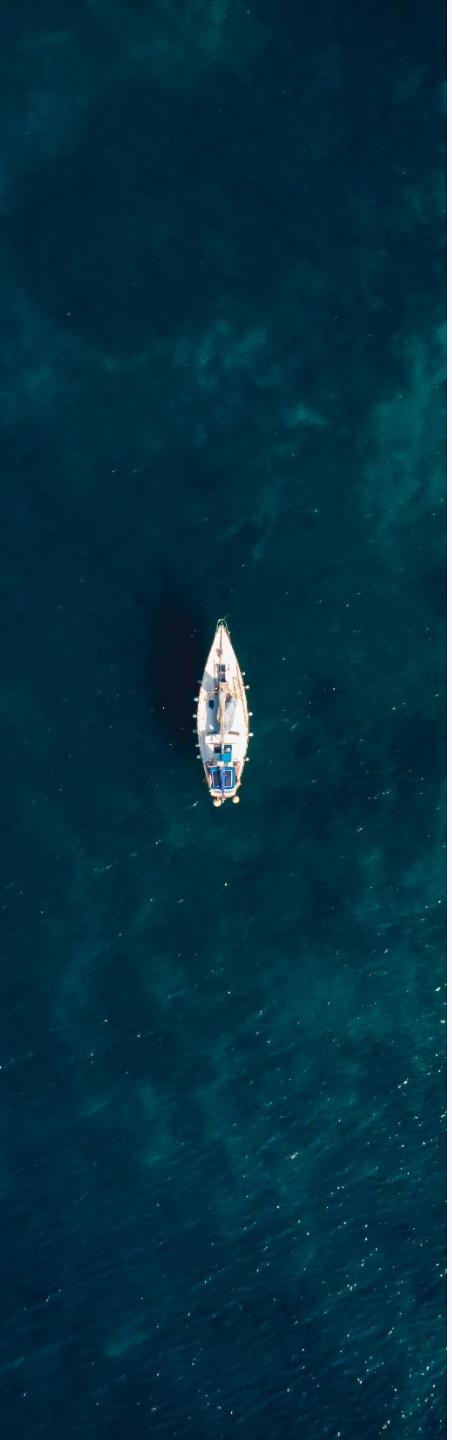


Organic farming

MULTI-CROPPING AGRICULTURE

In this method, three crops are typically grown in a year.

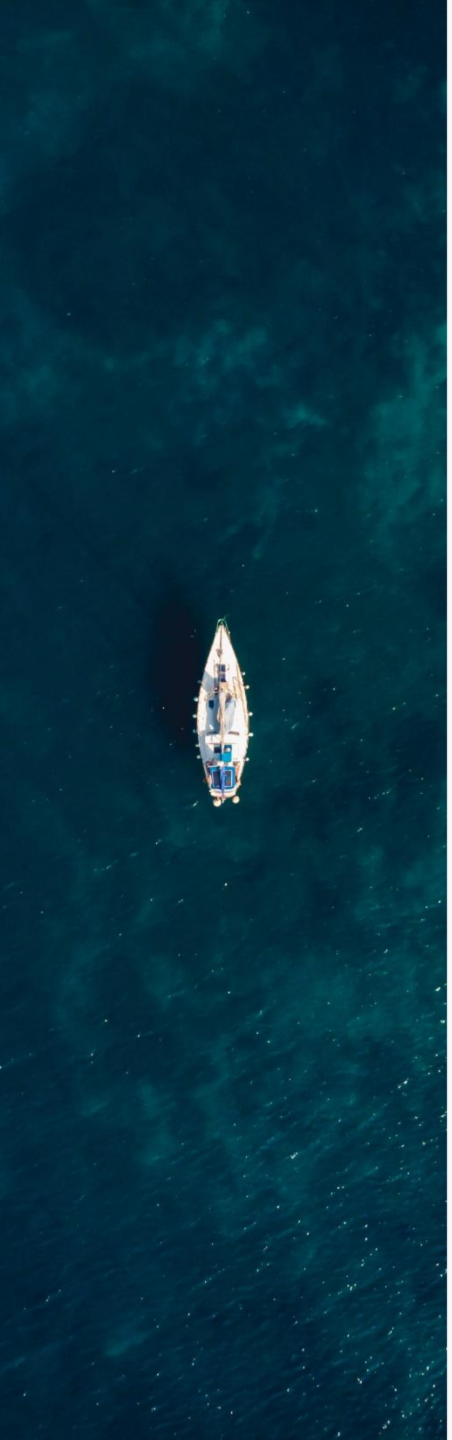
This strategy is popular in areas with access to early-maturing crop types and appropriate water management practices.



Organic farming

RELAY CROPPING

This practice refers to the process of sowing a new crop while an older crop is still present on the field and ripening



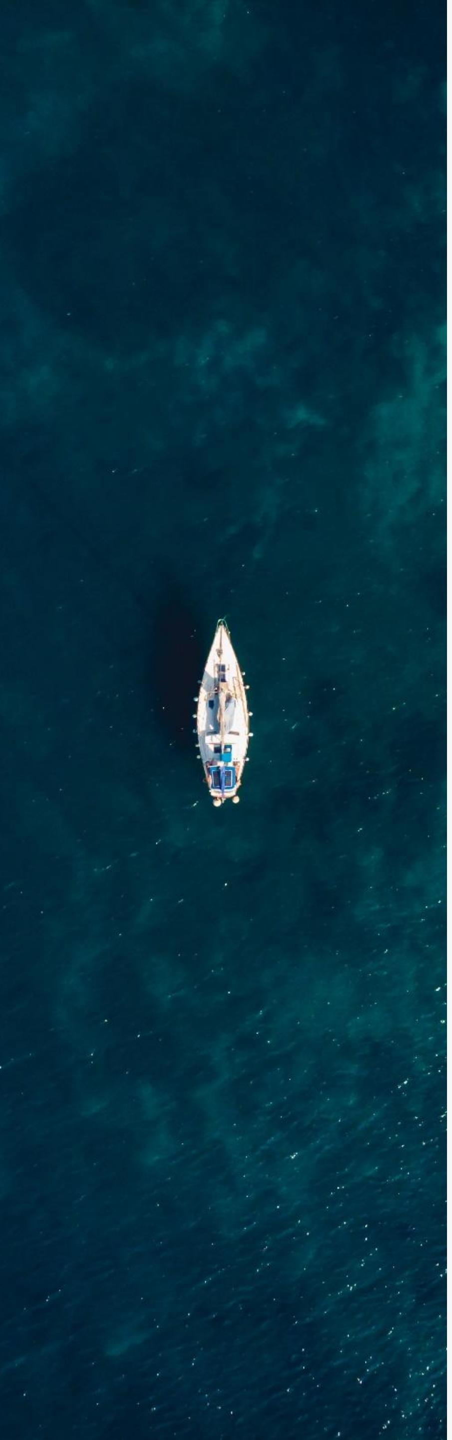
Organic farming

CROP-PRODUCTIVITY

This refers to the amount of production of crop per hectare or per worker.

Per worker productivity is higher in the areas of extensive agriculture.

Per hectare productivity is higher in the areas of intensive agriculture.

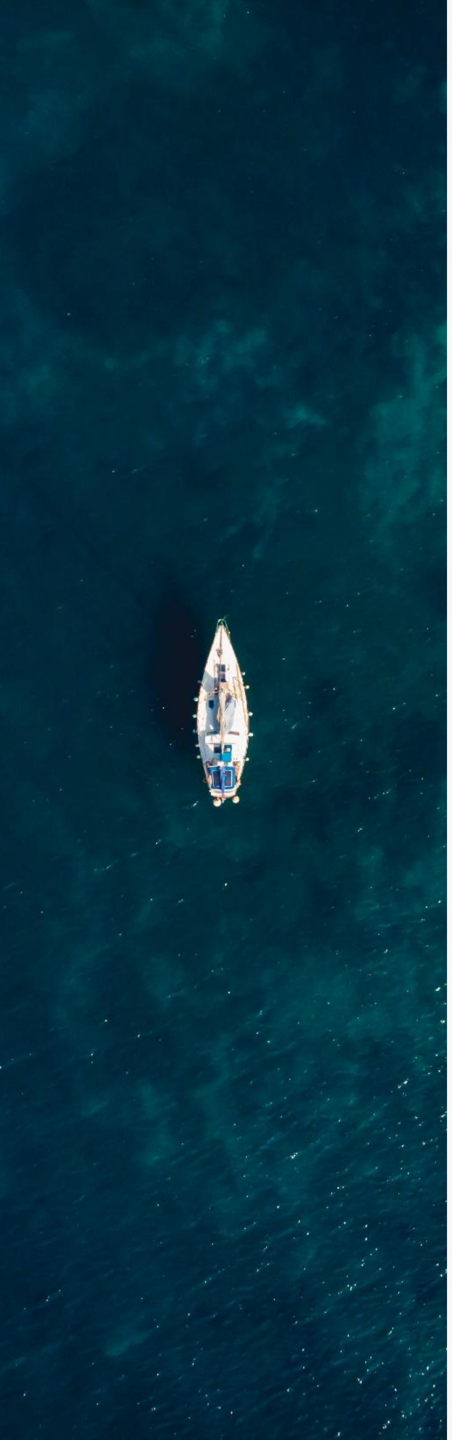


Organic farming

AGRICULTURAL EFFICIENCY

This is about answering the following equation/question:

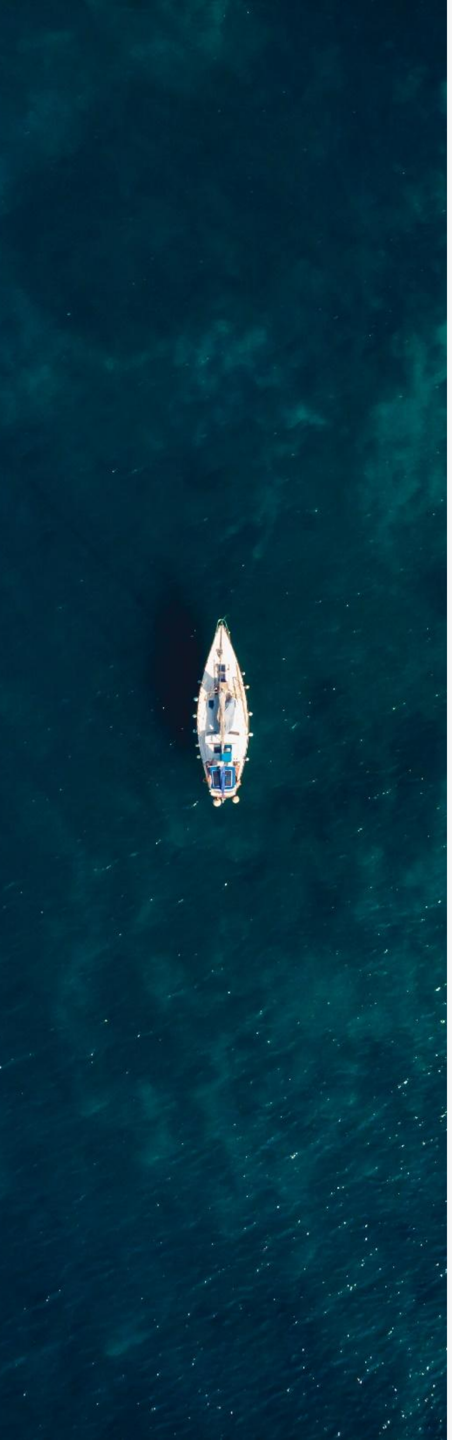
What is the maximum amount of crop produced in a minimum amount of time, and at what price is it sold?



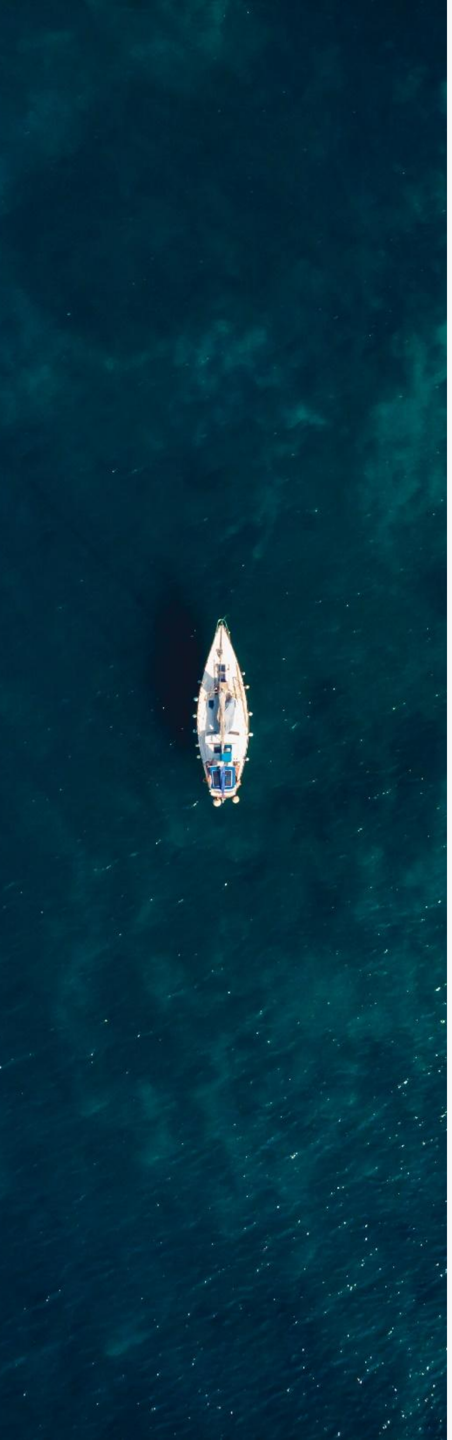
Organic farming

CROP INTENSITY

This refers to the land's optimal agricultural usage i.e., how many crops can be obtained within a year and with what quality.



Gardening Basics



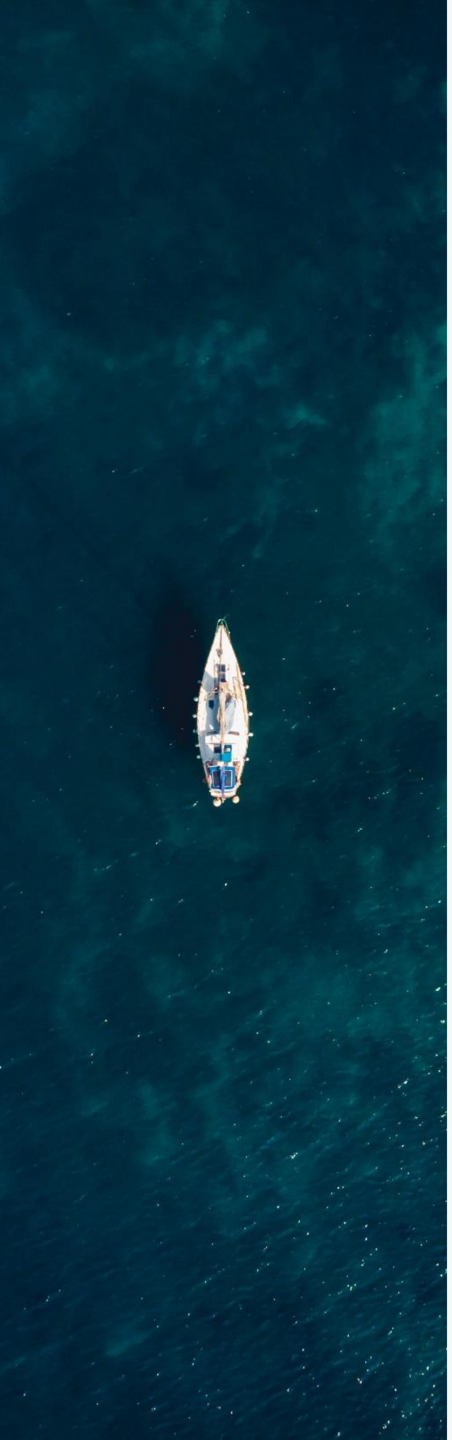
Gardening Basics

START STRONG

Oftentimes we think that the only way to start gardening is with seeds.

In reality, it may be easier to start with small, already sprouted plants.

This may be a great solution if you are completely new to gardening or seeds are in limited supply where you are.



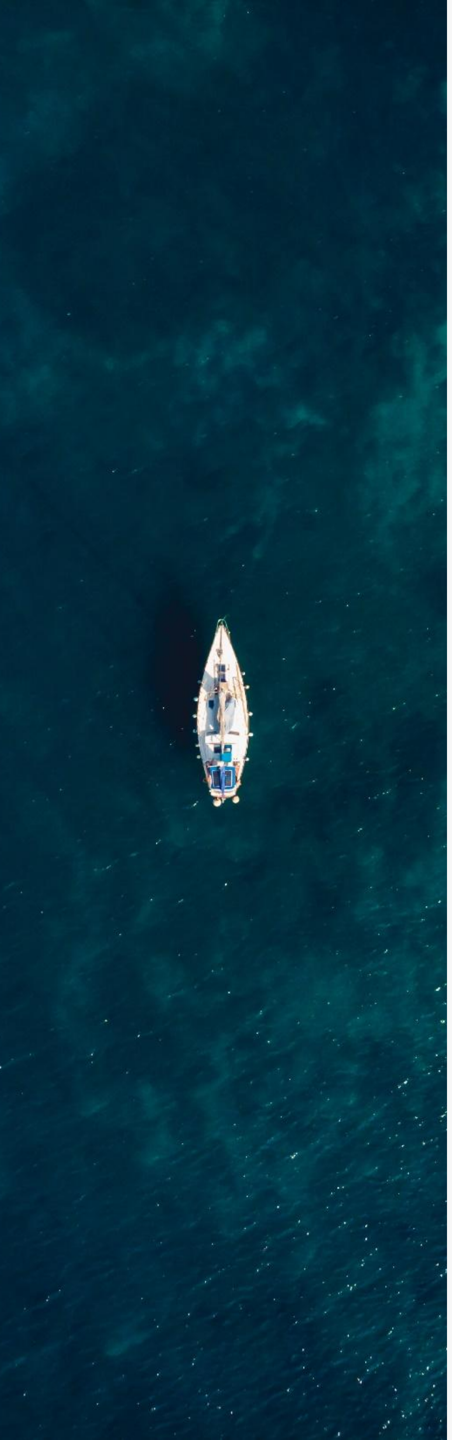
Gardening Basics

LOCATION

Gardening is like real estate – it's all about location.

If you are starting an outside garden, make sure that it is within your regular sight. The same applies if you are starting inside – in doing so you will remember to take care of your plants.

In addition, positioning is crucial as it is inherently related to lighting and moisture, so let's talk about these next.

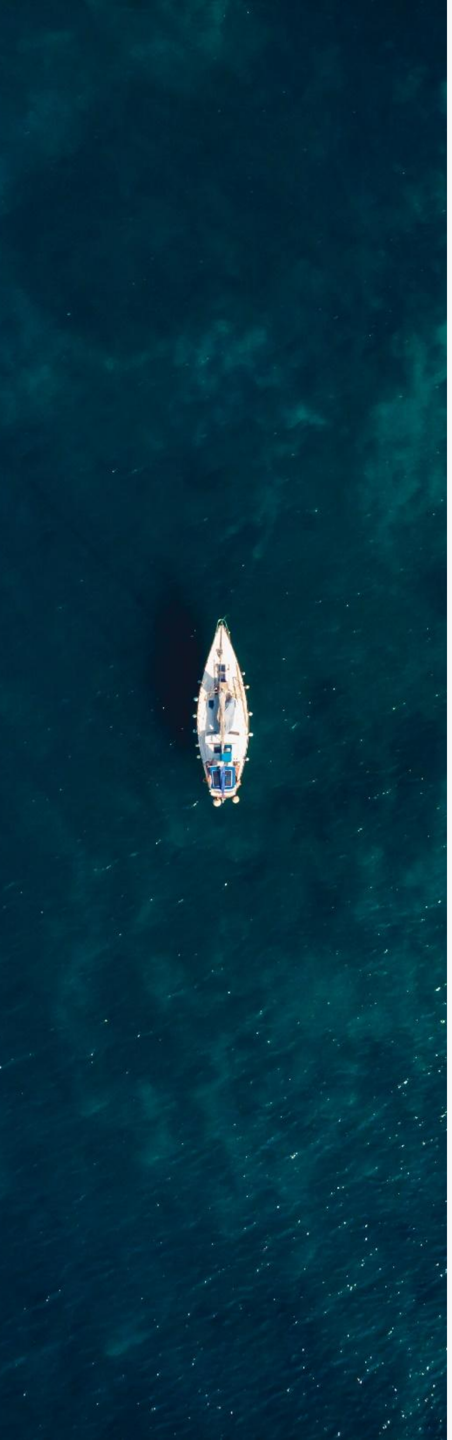


Gardening Basics

LIGHT

Most edible plants, including many vegetables, herbs, and fruits, need at least 6 hours of sun in order to thrive.

Similarly, in-house plants need the sun to keep their water balance checked.



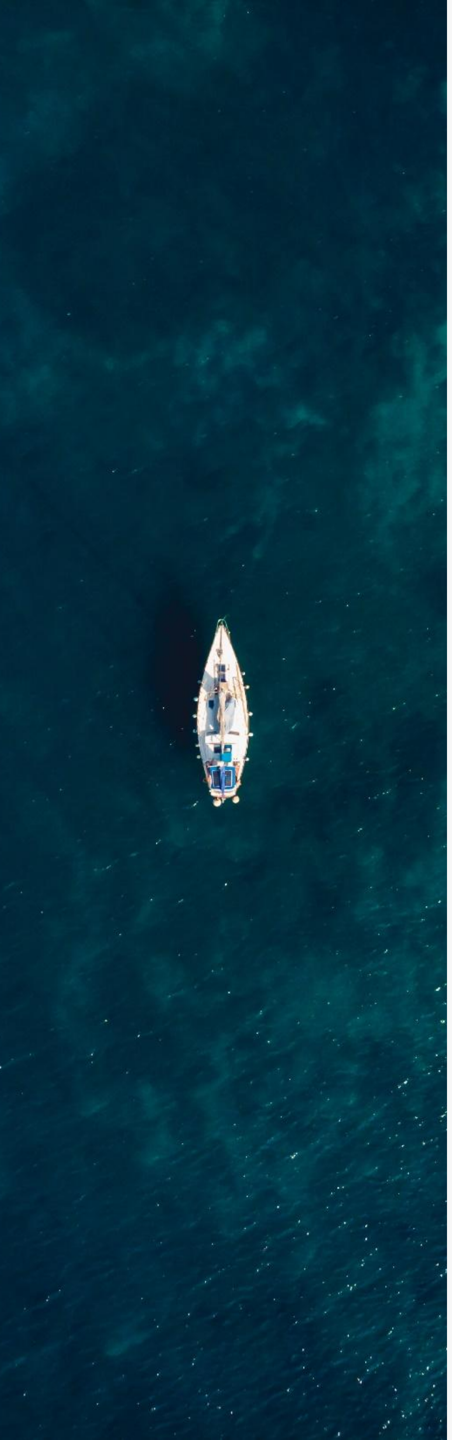
Gardening Basics

WATER

Keeping your plants may be trickier than it seems. This is because you want to keep your plants watered well, but you also don't want to get them drowned.

Too much water can cause water to get stagnant, which may result in your plants getting sick or infected. This is why you want a good balance between water and light.

To make matters easier, consider putting your indoor plants or starting your garden near a water source.



Gardening Basics

SOIL

Starting with the right soil is essential.

Research the best type of soil your plant requires and supplemented with nutrient-rich, well-drained soil.

Also, keep in mind that your soil mix depends on whether or not you are planting directly in the ground or in pots. Certain soil manufacturers provide soil mixes that accommodate plants to better thrive in pots by accommodating for under- or overwatering.

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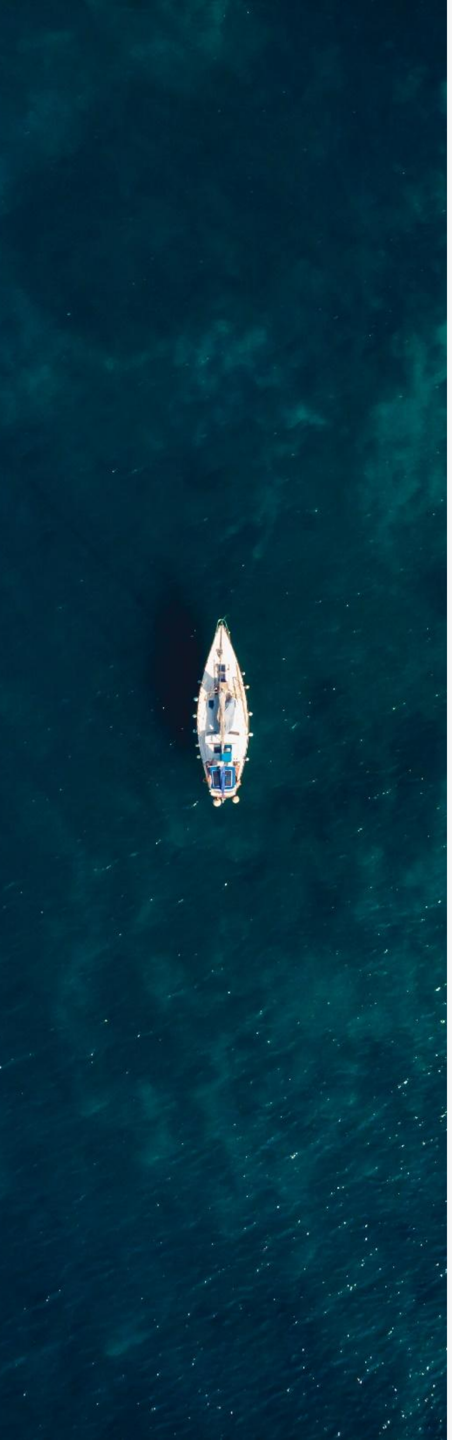
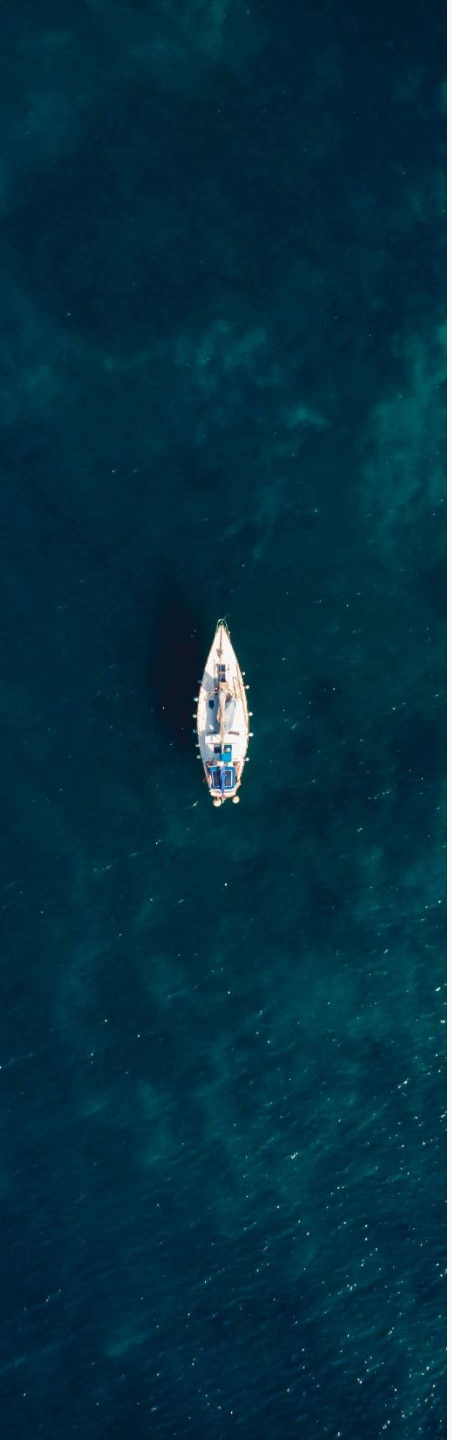


Gardening Basics

CONTAINERS

Whether you're planting inside or outside, space is always important.

Even if you are planting outdoors, you may not have the necessary natural soil conditions to do so – this is when you need to remember that you can plant in pots and containers outside as well.



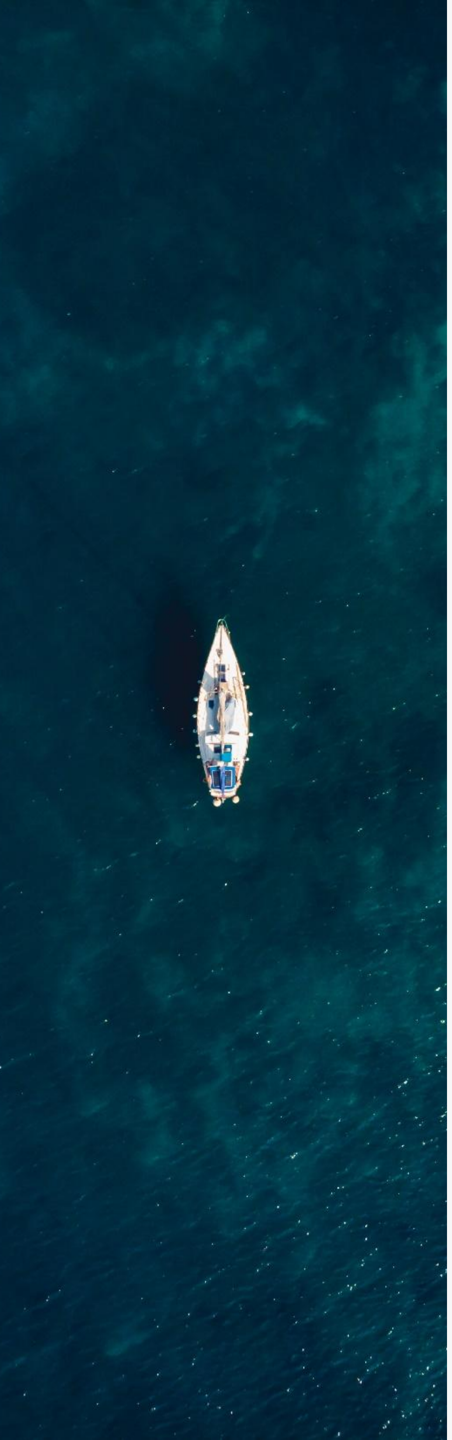
Gardening Basics

PLANTS

As much as you may love certain things, you should only select and grow the ones for which you can match the necessary growing conditions.

This includes sun requirements, heat tolerance, space for their root systems – this means both within the soil, but also outside if the plants are climbers or creepers.

Do your homework and pick the varieties that will grow well where you live and in the space you have.



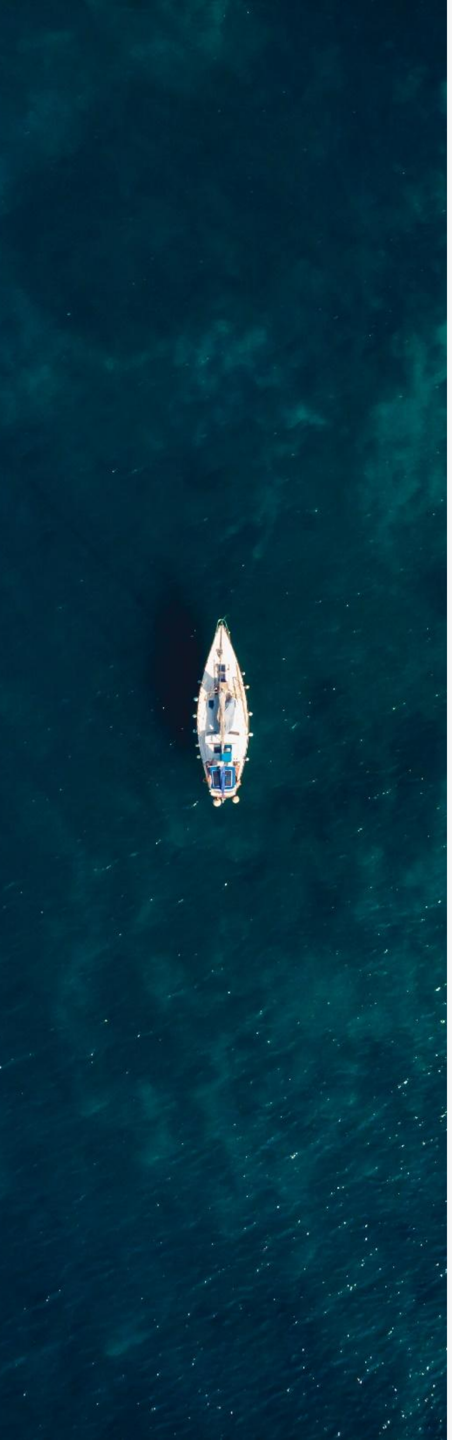
Gardening Basics

Zone hardiness

A “hardiness zone” describes the coldest place a plant can grow.

As you can probably already guess, this can tell you what plants you can grow in your conditions and which you cannot.

A higher zone number means a warmer climate.



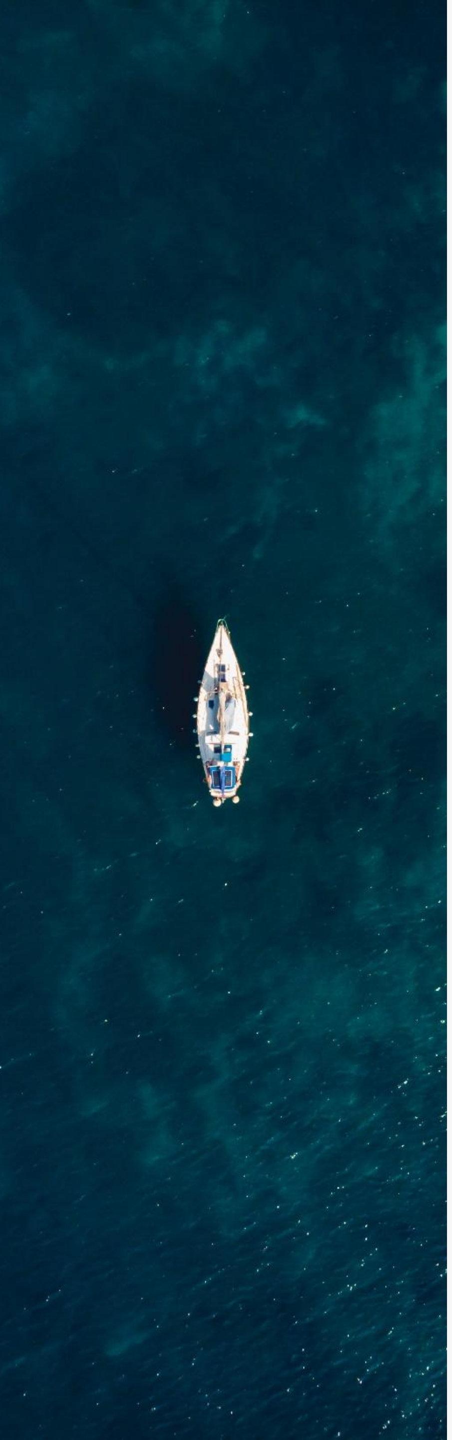
Gardening Basics

FROST DATES

Consider when to plant your flora. Doing so either to early or too late may kill your plants. Therefore, you need to get acquainted with the average frost date for the region where you live.

This also applies for indoor plants, whenever you are deciding to put them out for the spring-summer season or bring them in for the autumn-winter season.

This is why, no matter the seasonal range and accompanying climate change in your region, it is always a good idea to identify the last spring date for your area and plan your planting accordingly.



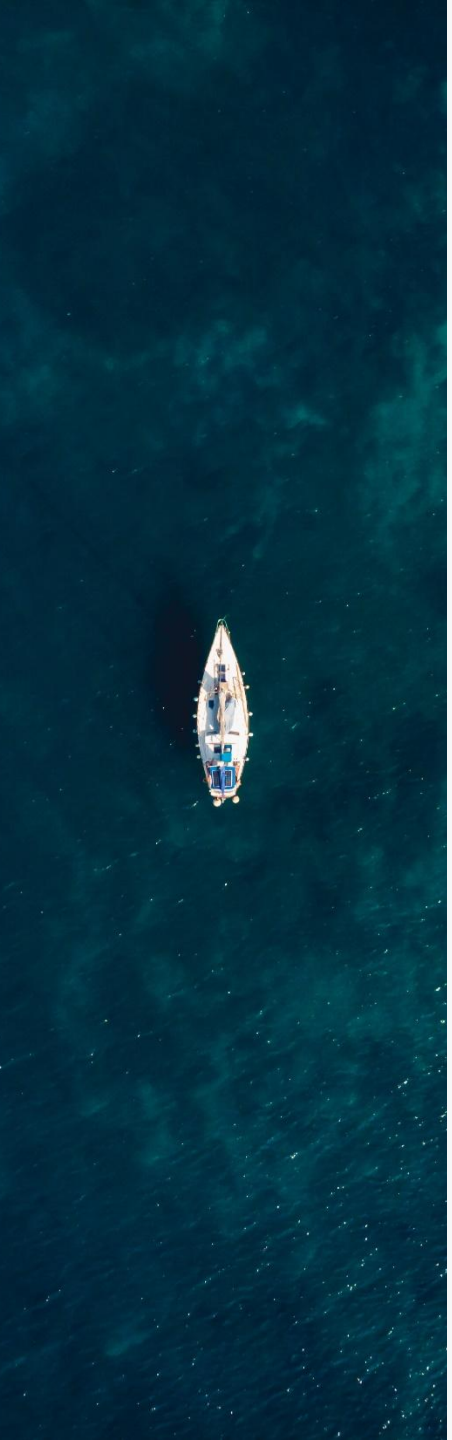
Gardening Basics

ADD MULCH

Mulch is a layer of usually organic material with which you cover the surface around or on top the bases of your plants.

It is used to control weeds, retain moisture and regulate temperature.

Consider applying a layer of mulch that's 2 to 3 inches deep. You can use straw, shredded leaves, pine straw, or some other locally available materials. Alternatively, you can look for ready solutions that you can buy.



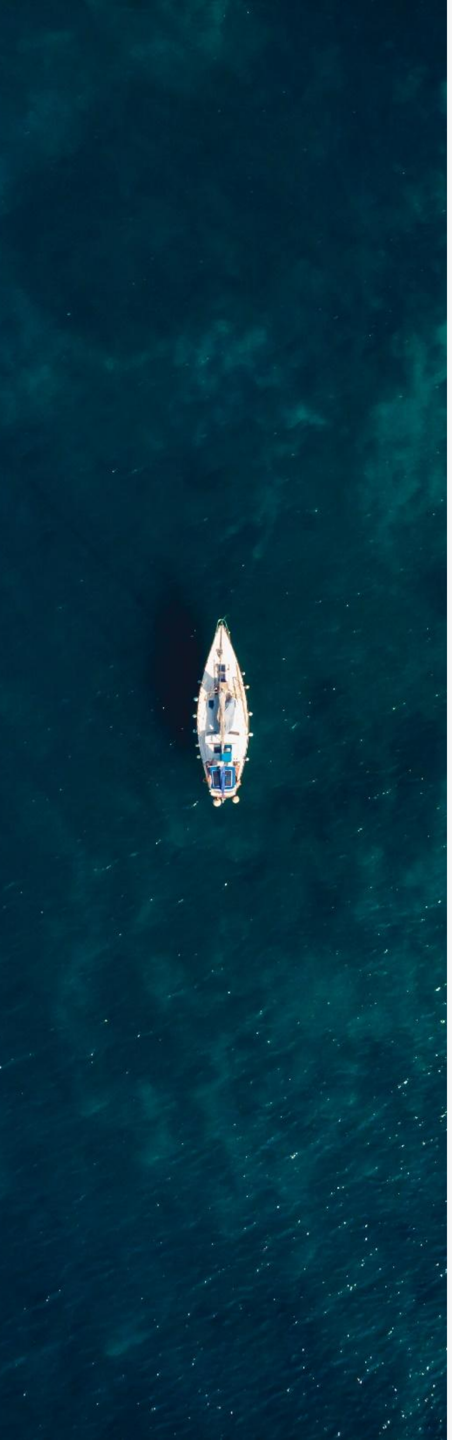
Gardening Basics

FEED REGULARLY

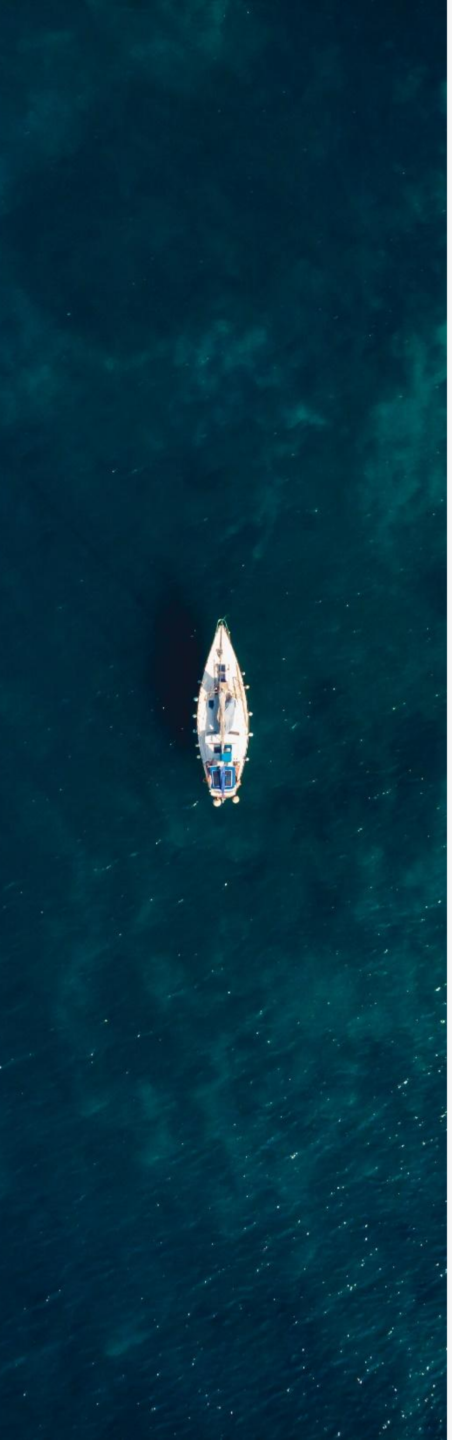
Plant food contains essential elements such as nitrogen, phosphate, and potassium.

Whether your plants are in a small greenhouse or in pots inside your home, these nutrients are essential for renewing the soil and assisting plants in developing strong roots.

A month after planting you can consider adding plant-food-solutions to further enhance your gardening results.



Controlling Plant Diseases



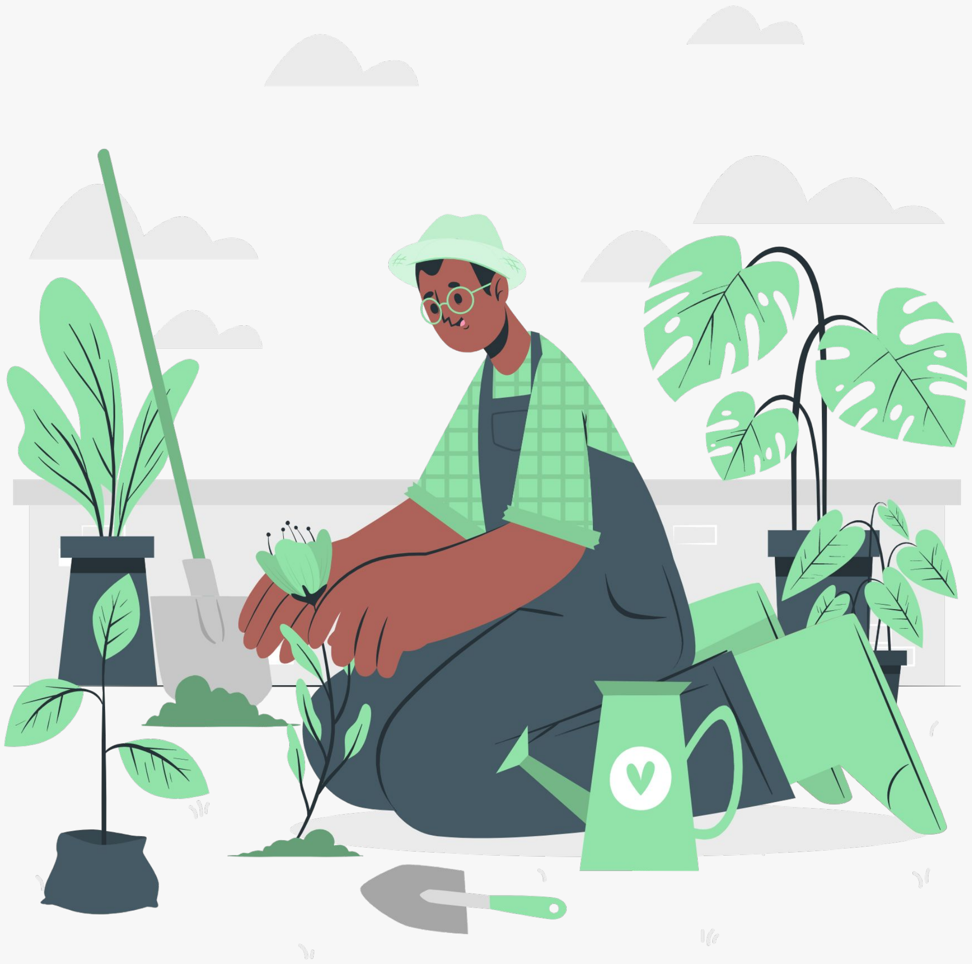
Controlling Plant Diseases

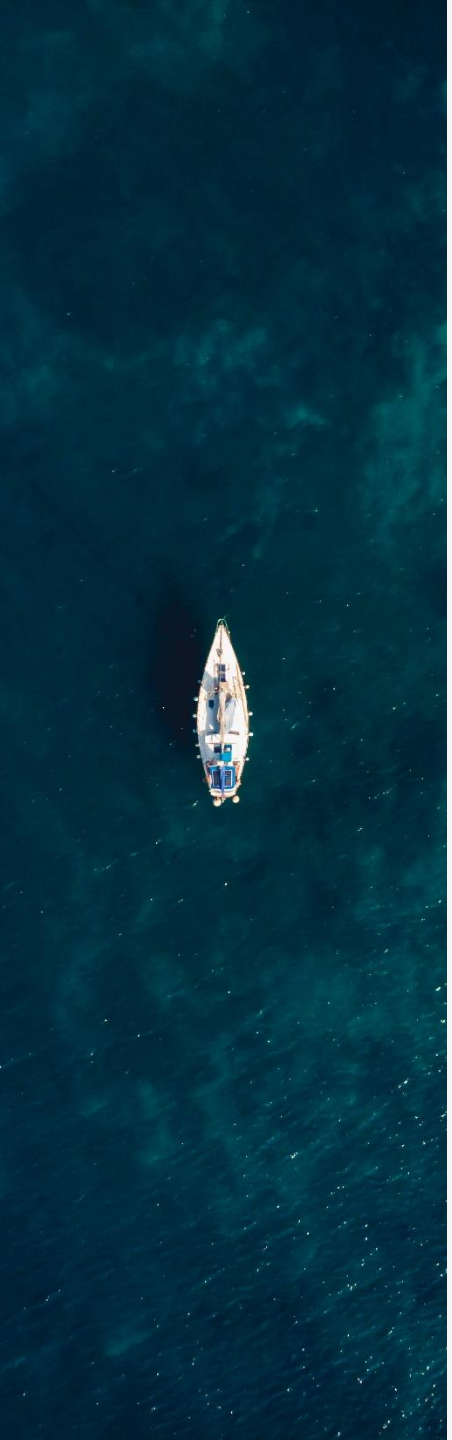
SITE SELECTION

A home garden location has to be well light and have good drainage.

Excessive soil moisture may induce illnesses of the roots and crowns, this is why you want to avoid wet, poorly drained soils.

Direct sunlight is also important – in addition to all other benefits for a plant, it also allows unnecessary water to evaporate from the plant.





Controlling Plant Diseases

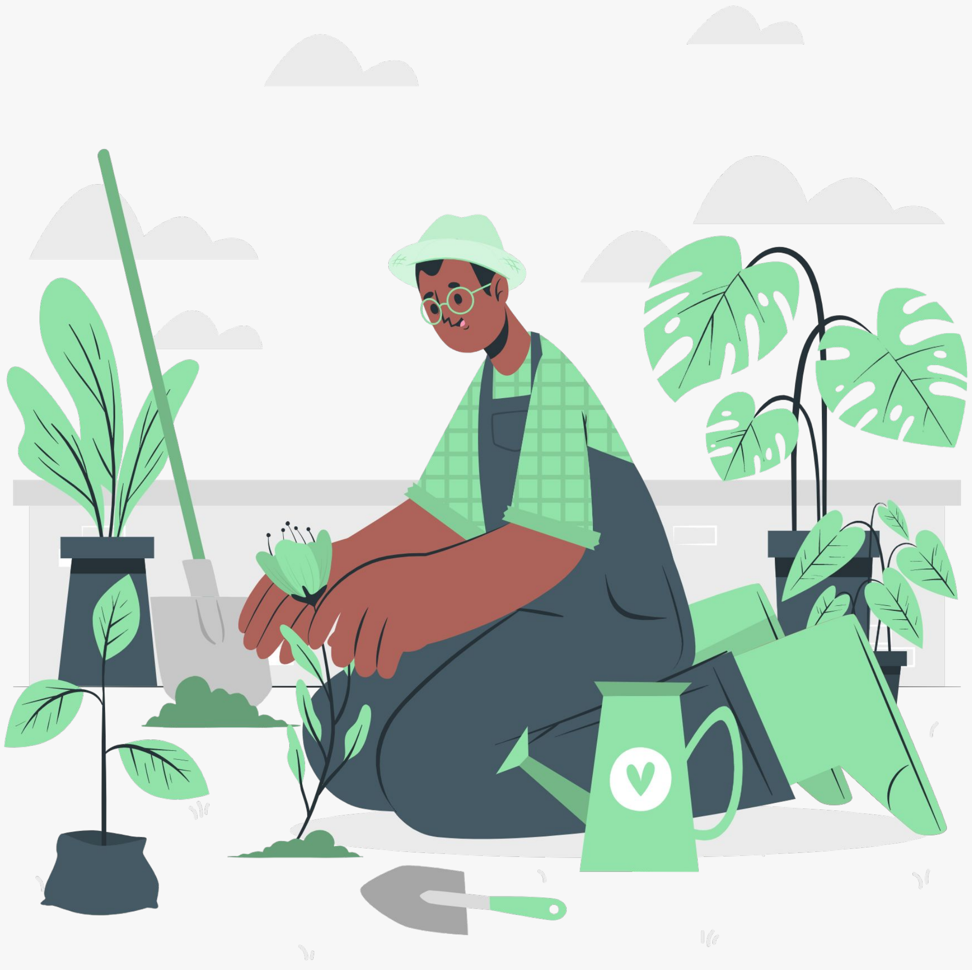
CROP ROTATION

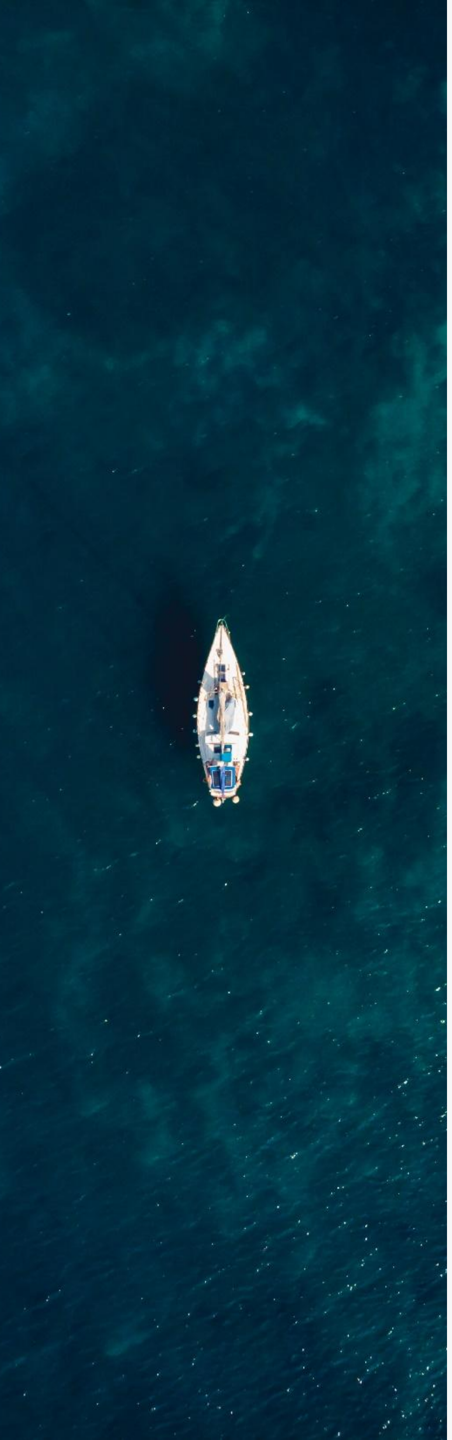
Avoid planting vegetables of the same family in the same area in consecutive years.

Planting vegetables from the same family continuously increases the risk of pathogens.

For optimal results, you can grow the same or closely related plants only once every 3 to 5 years.

In doing so, you are starving out most of the pathogens that cause stem and leaf diseases.



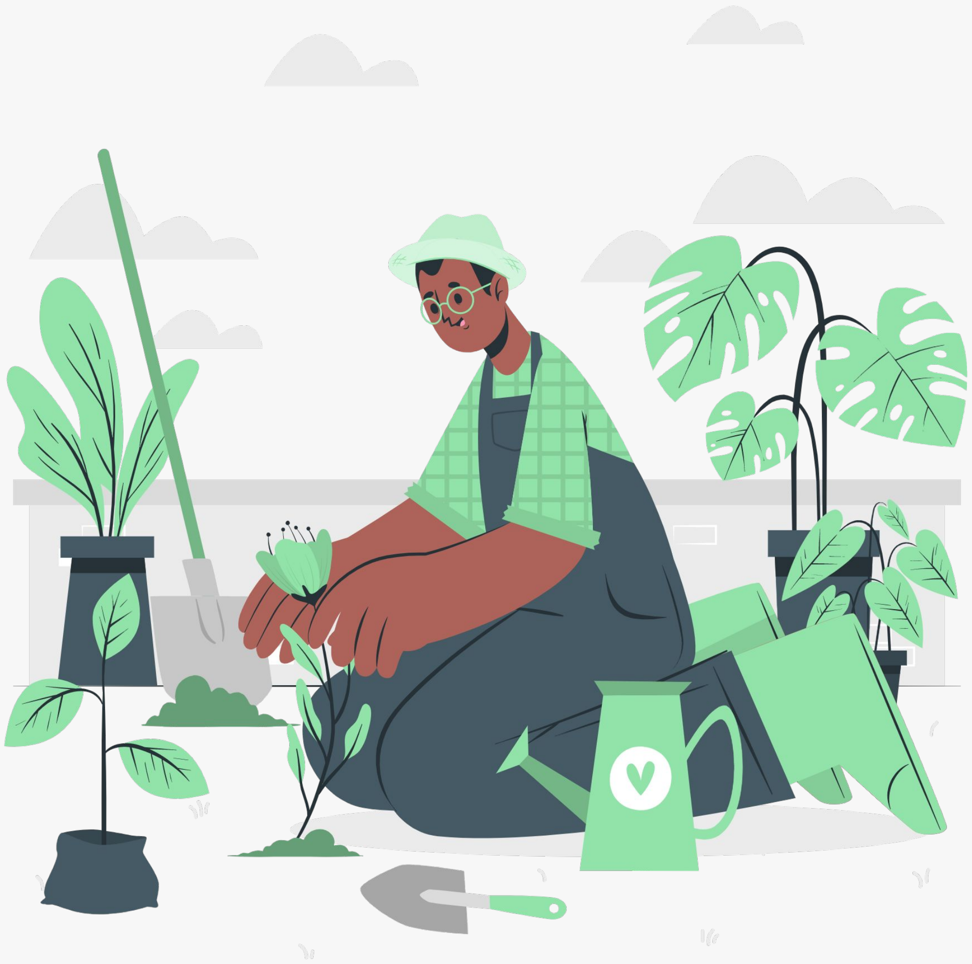


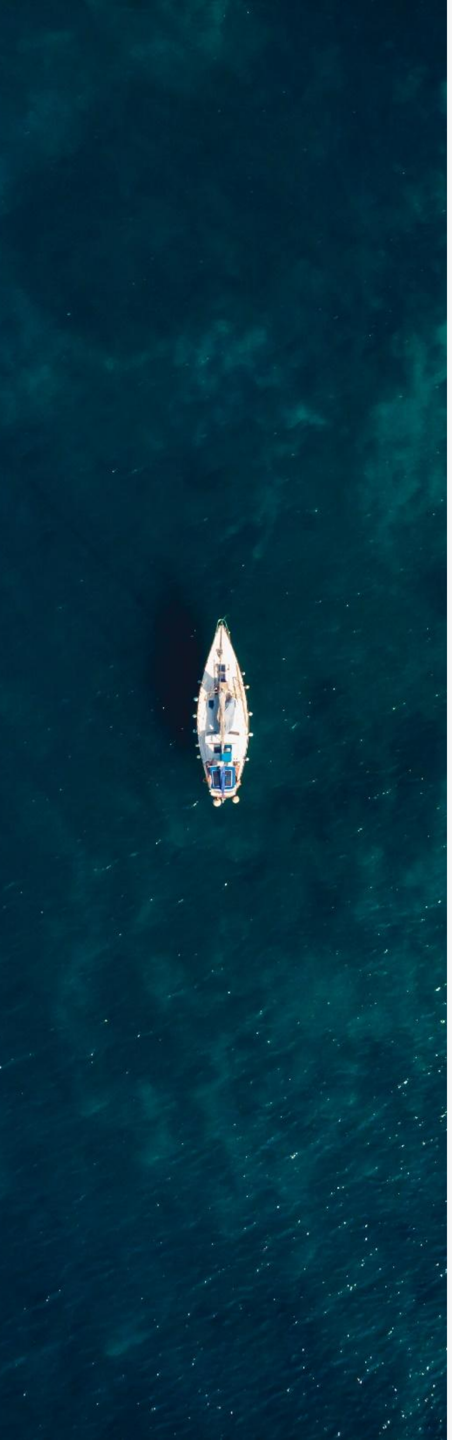
Controlling Plant Diseases

DISEASES FREE SEED AND TRANSPLANTS

You may think that it is a good idea to save seeds from one year to the following – this is not the case.

Many plant diseases are seed-born – that's why it is better to use fresh seeds and always examine the seedlings before purchasing and starting a crop.





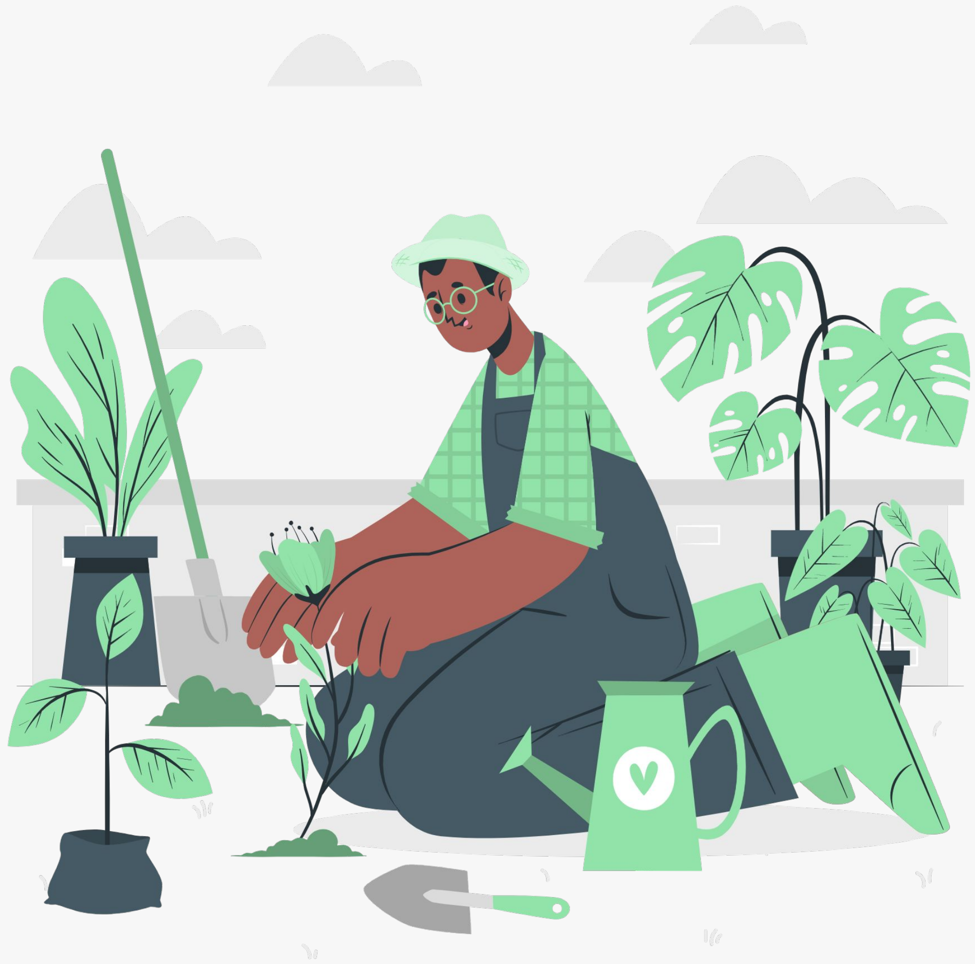
Controlling Plant Diseases

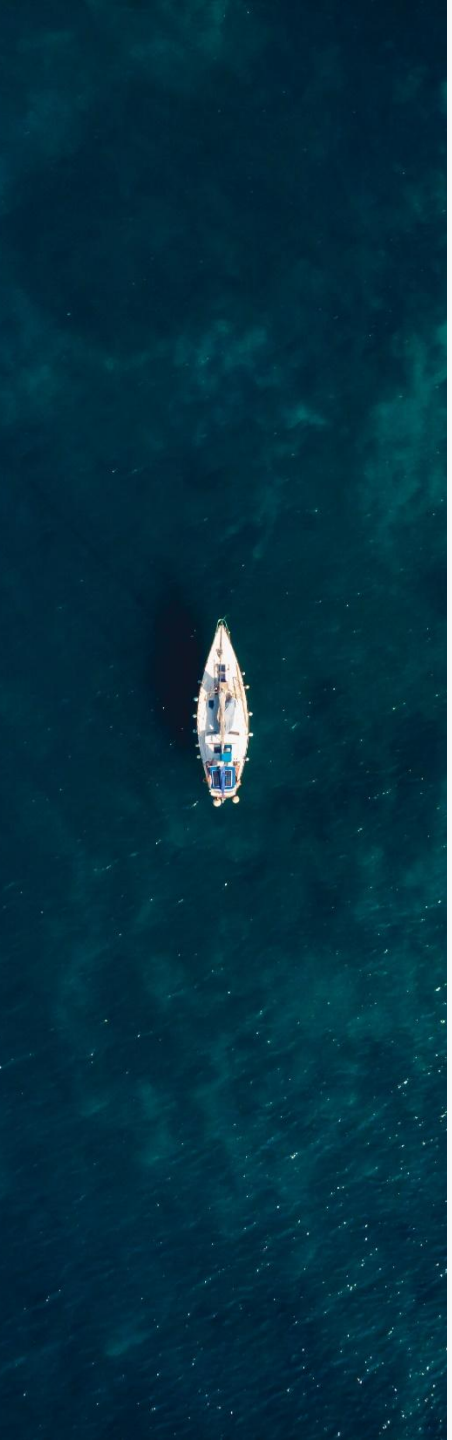
USE RESISTANT VARIETIES

The most efficient way of controlling vegetable diseases is to use resistant varieties.

This is why it is worthwhile to go the extra step and buy resistant varieties when they are available.

Usually, seed catalogs have the resistant traits of the various vegetable varieties listed.

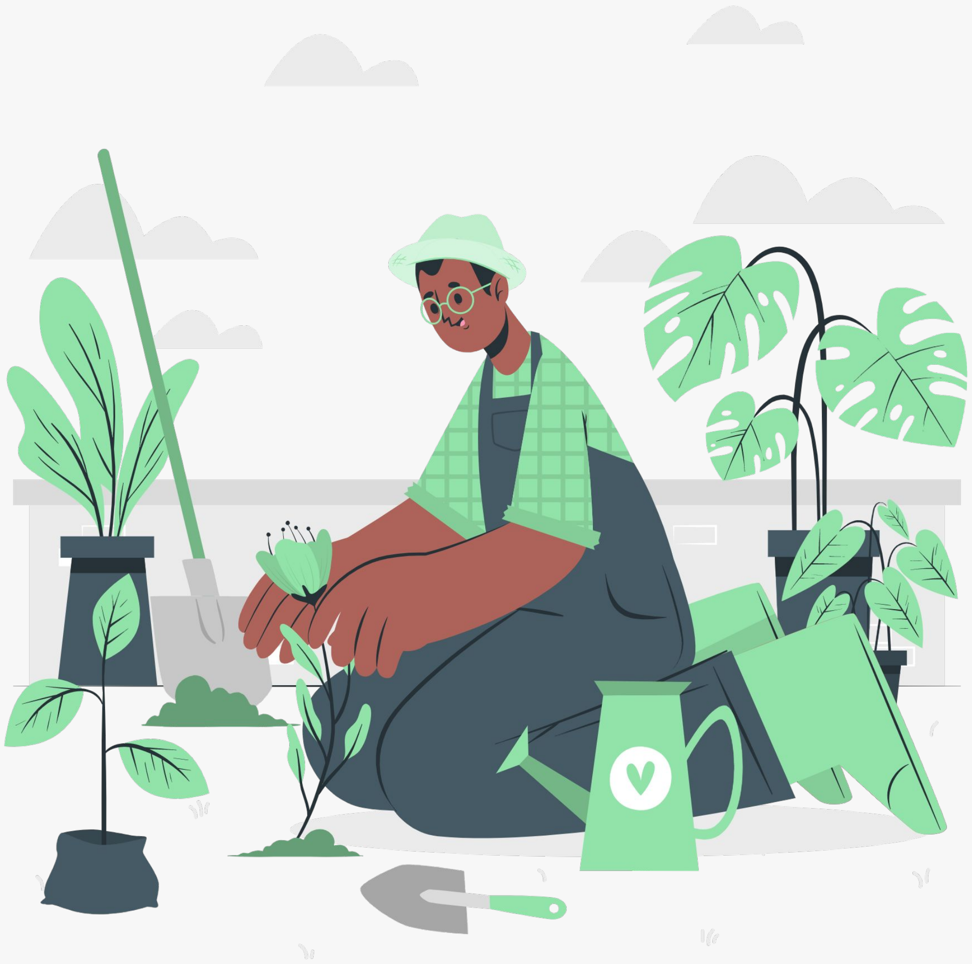


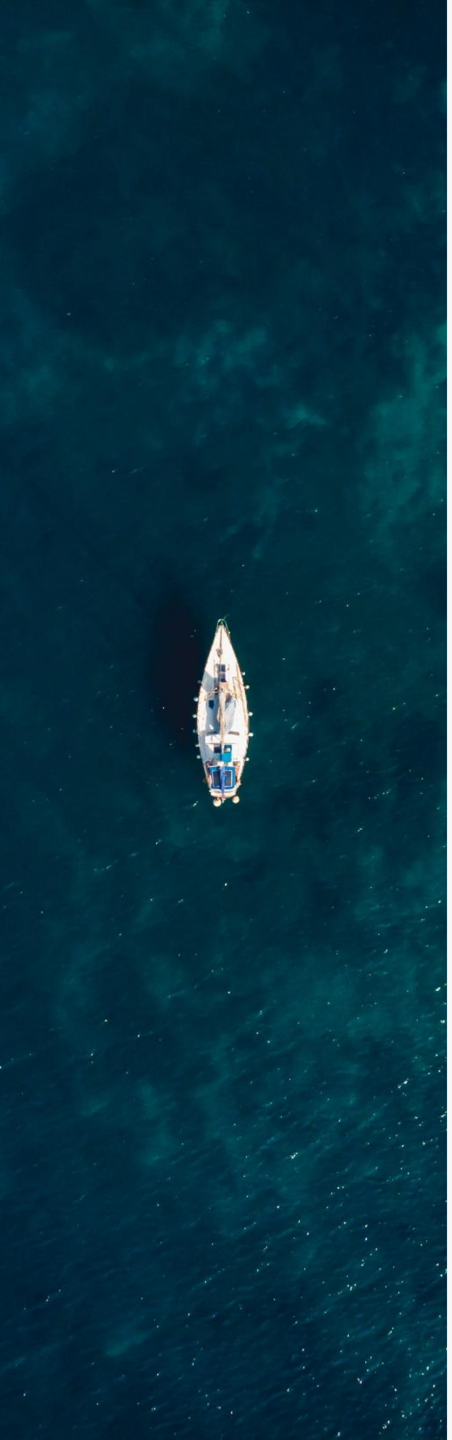


Controlling Plant Diseases

PLANTING DATE MANAGEMENT

Following the recommended planting dates for a particular vegetable can have a strong positive effect against plant diseases.



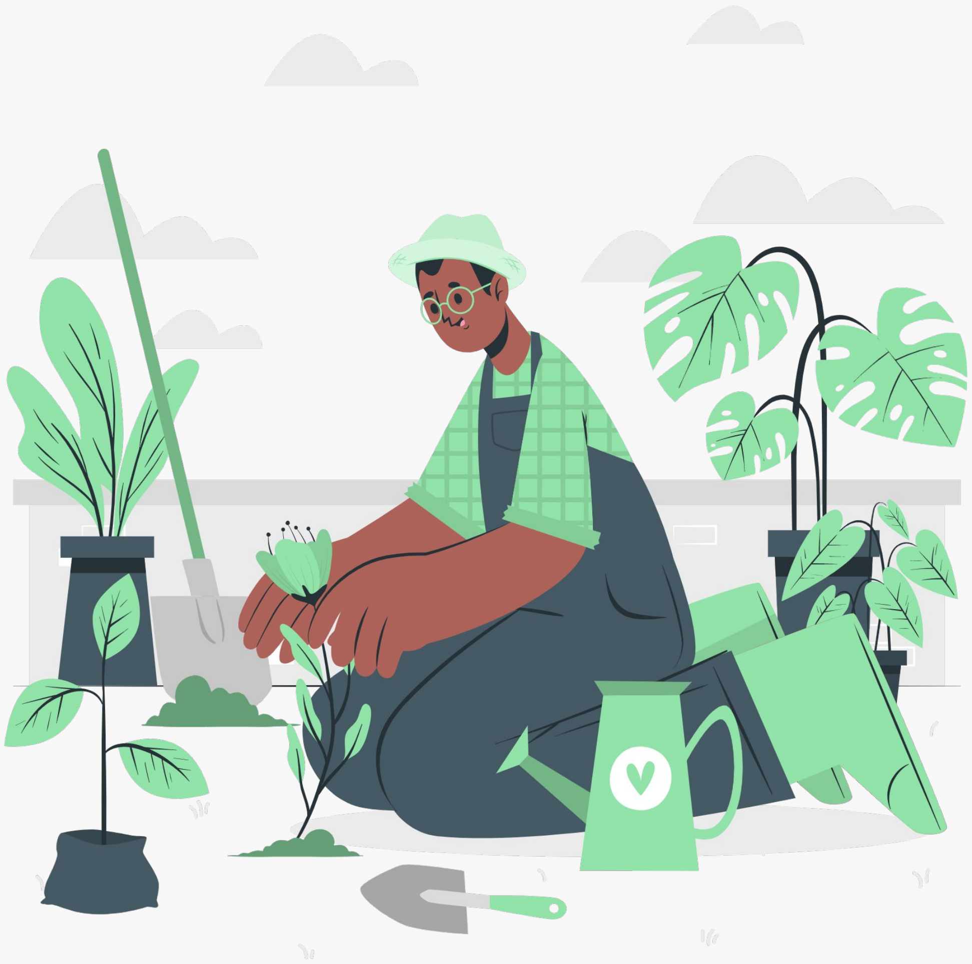


Controlling Plant Diseases

TRAP CROPS

Trap crops can limit aphid damage and help reduce the incidence of virus diseases.

A few rows of a trap crop (e.g., rye or corn) around your vegetable garden will cause aphids to feed there first, and possibly loosen the virus they may carry.



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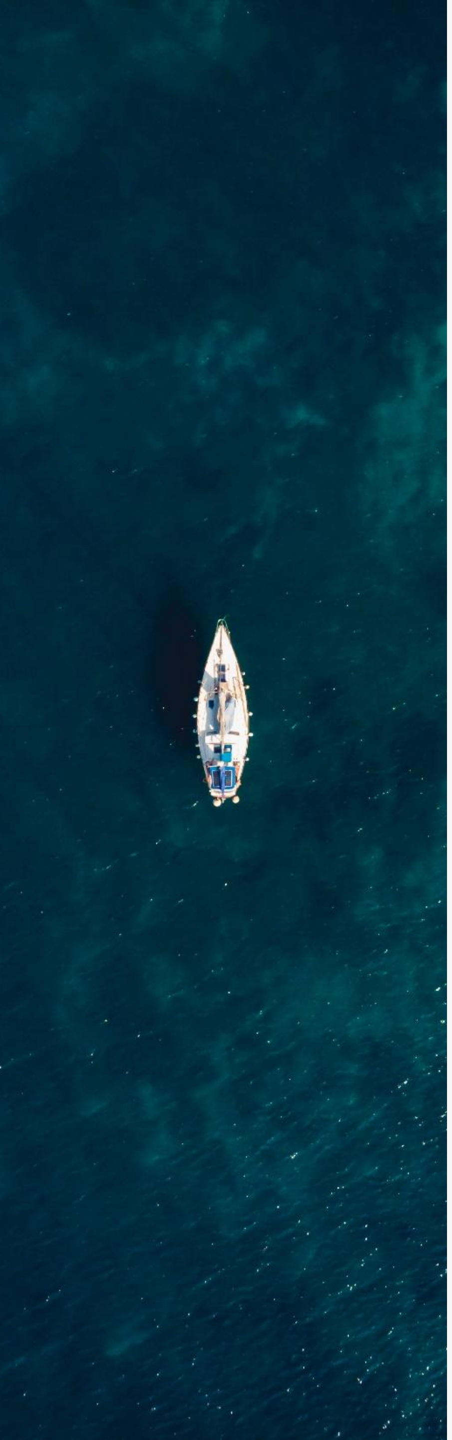


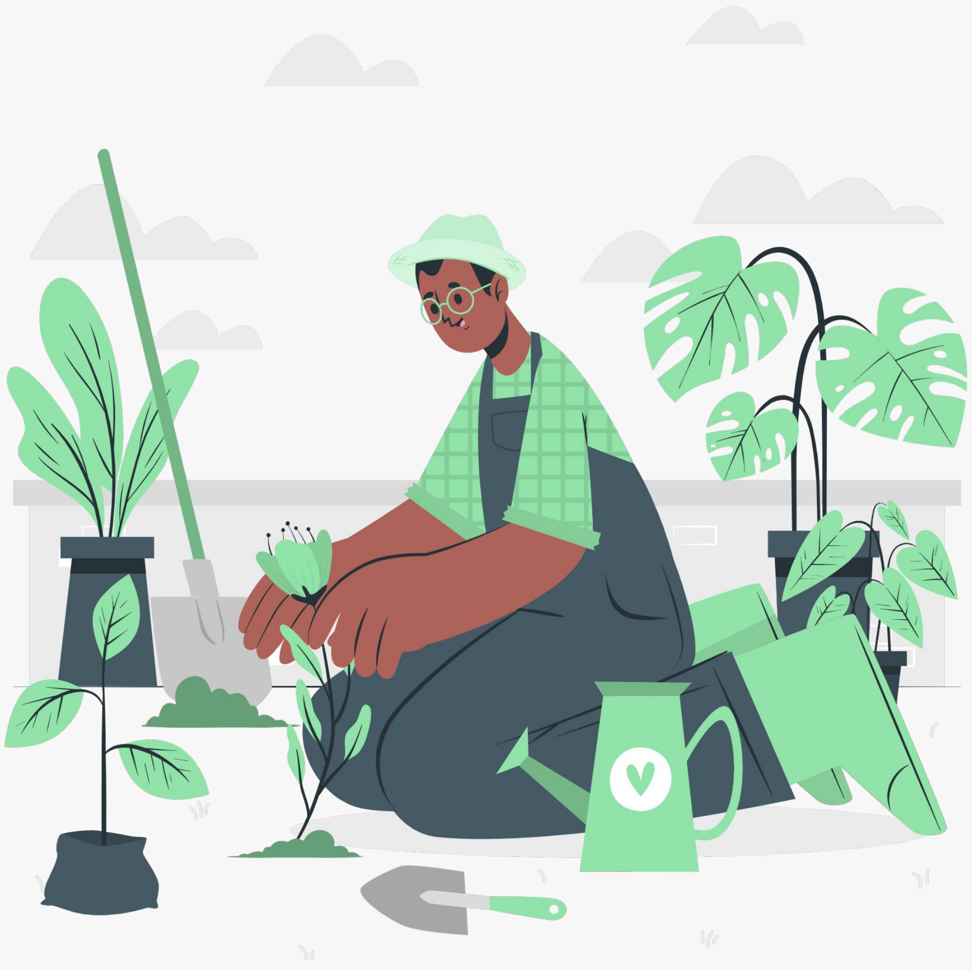
Controlling Plant Diseases

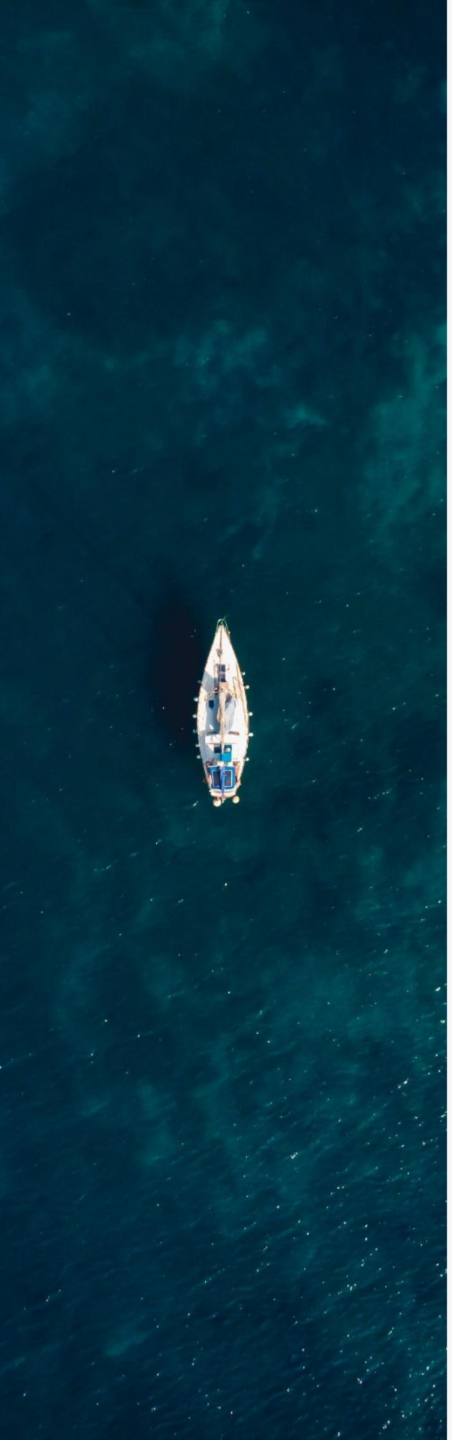
PROPER SPACING & TRELLISING

Staking or trellising prevents soil contact with the foliage and fruit, reducing the incidence of diseases such as fruit rots.

Staking and trellising discourages the growth of pathogens, and promotes foliage drying by preventing soil contact with the foliage and fruit.

This is why you want to space your plants properly, allowing air circulation and growth.



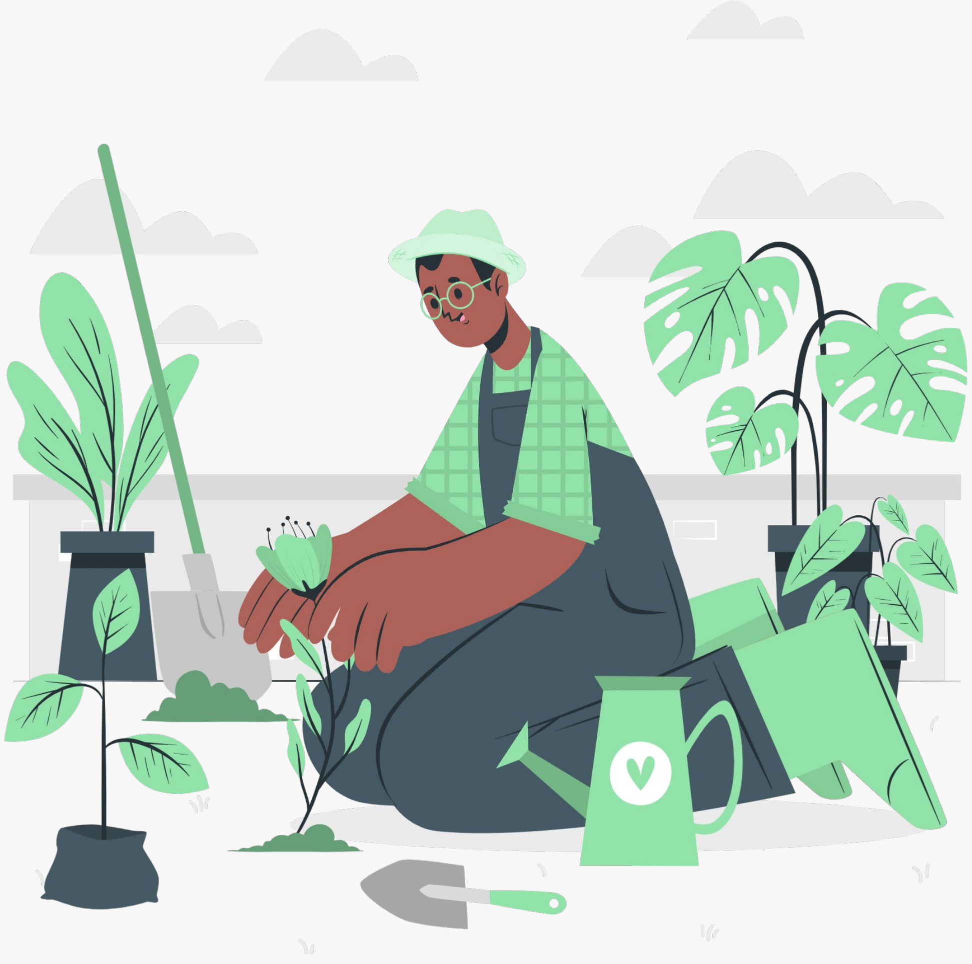


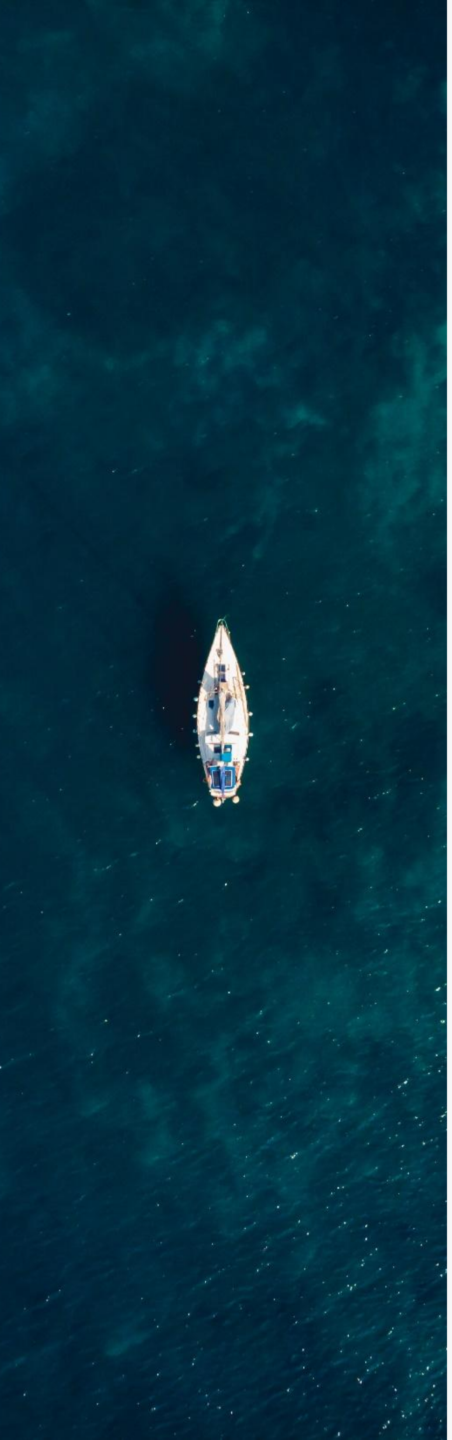
Controlling Plant Diseases

USE A MULCH LAYER

Mulching prevents soil from splashing onto plants and also fruit from touching the bare ground.

This will help to conserve soil moisture, prevent rots on mature fruit and reduce weed infestations.





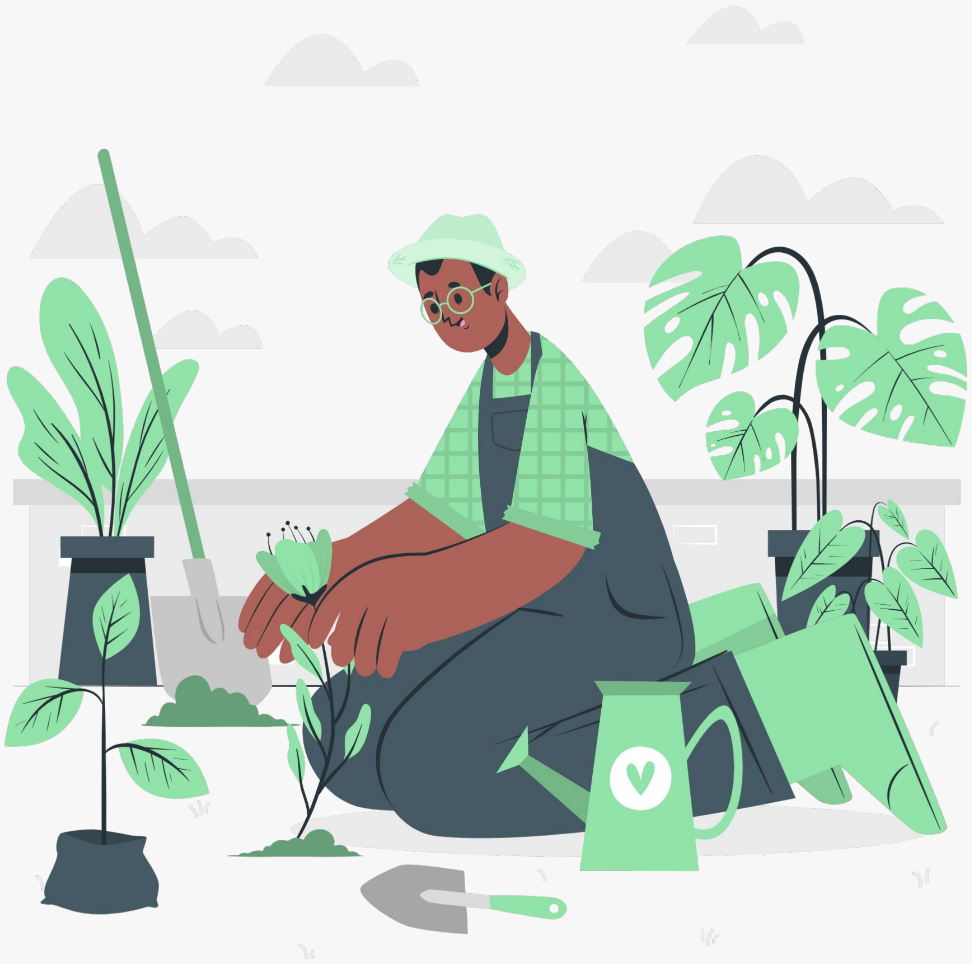
Controlling Plant Diseases

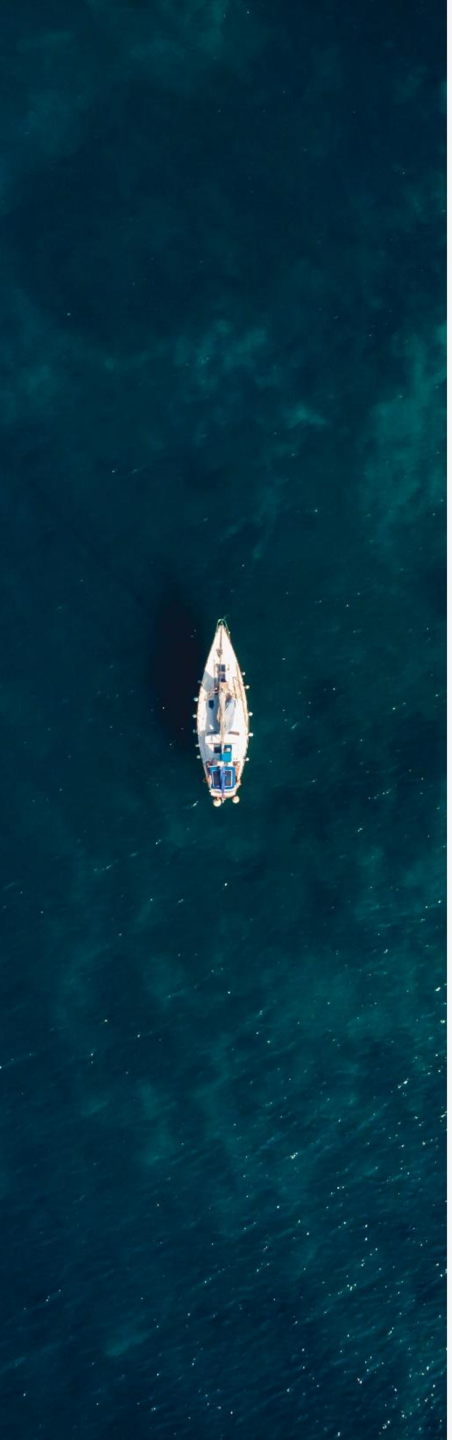
PROPER FERTILIZATION

Proper pH prevents blossom end rot, encourages healthy growth of fruits and vegetables, and prevents vegetables.

For this, make sure to test the soil anywhere from 3 to 6 months before the growing season.

Then, follow the nutrient supply recommendations and adjust the soil pH to the respective requirements.





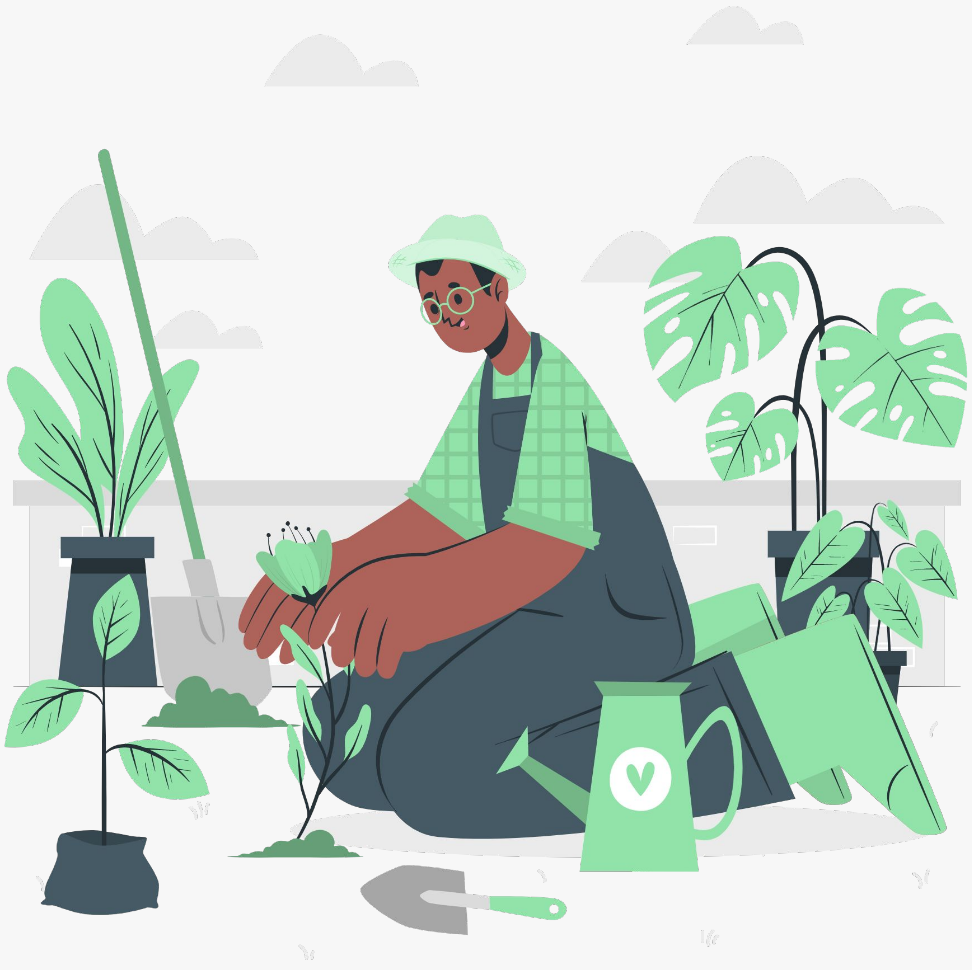
Controlling Plant Diseases

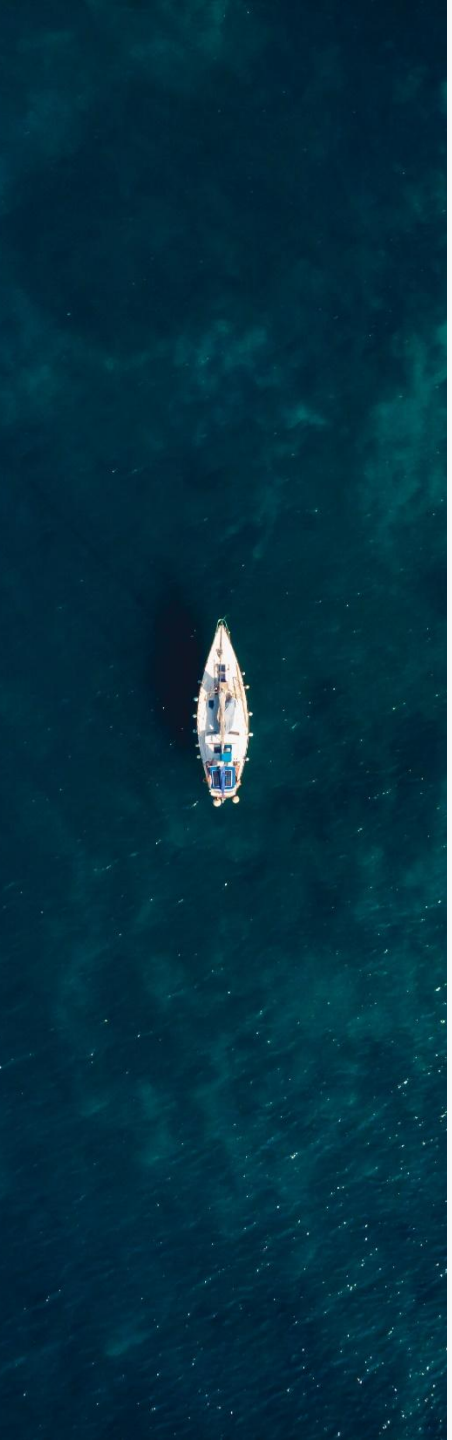
WEED FREE GARDEN

Weed control is essential for preventing numerous insect-transmitted viruses.

Weeds can serve as carriers for these viruses and infect homegrown vegetables.

Good weed control increases air movement and decreases conditions that promote the development of disease (i.e., excessive moisture)



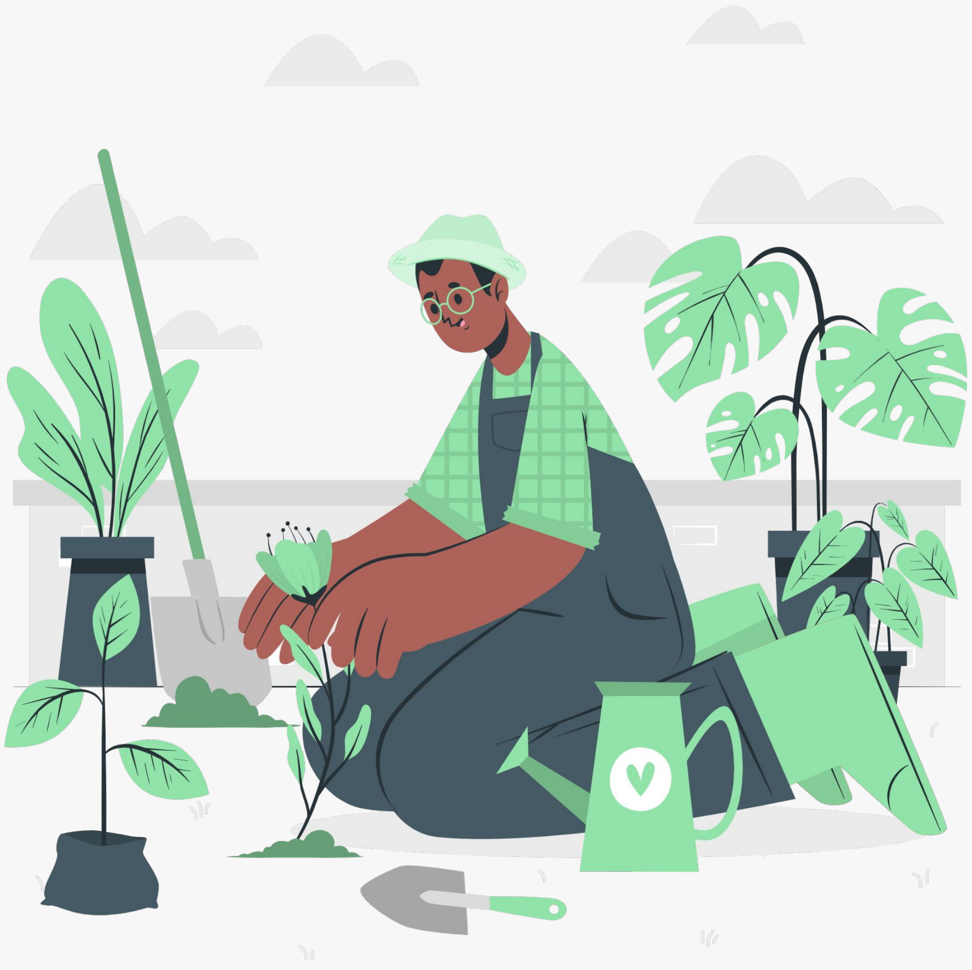


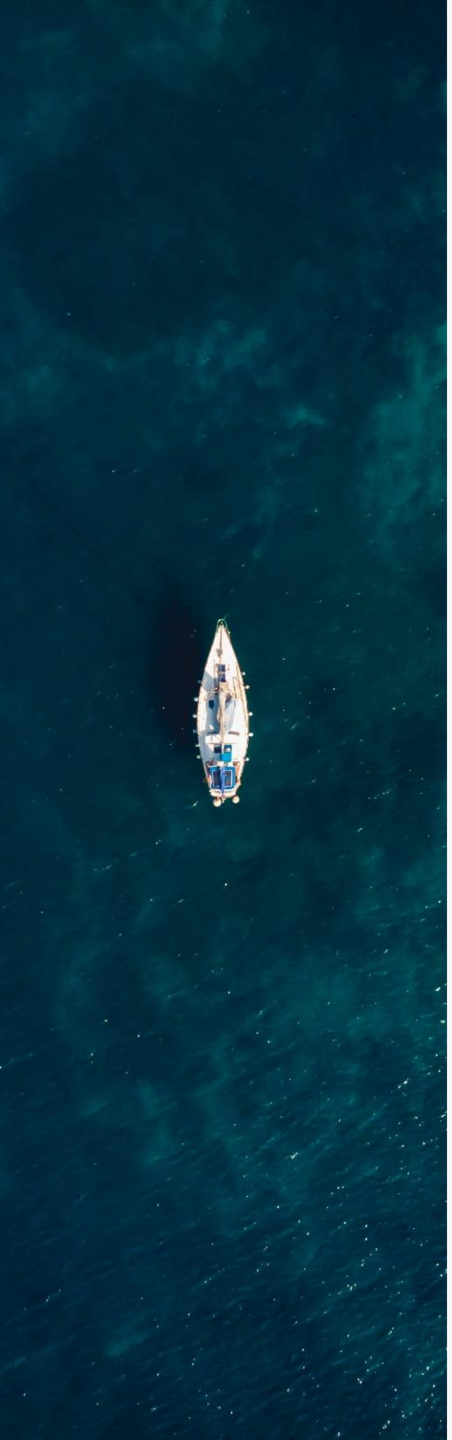
Controlling Plant Diseases

AVOID TOBACCO WHEN WORKING IN THE GARDEN

If you use tobacco, make sure to properly wash your hands before handling any plants.

In doing so, you may prevent the transmission of the tobacco mosaic virus – a disease that may affect many different types of vegetables, especially solanaceous plants (nightshade family plants like tomatoes and peppers).





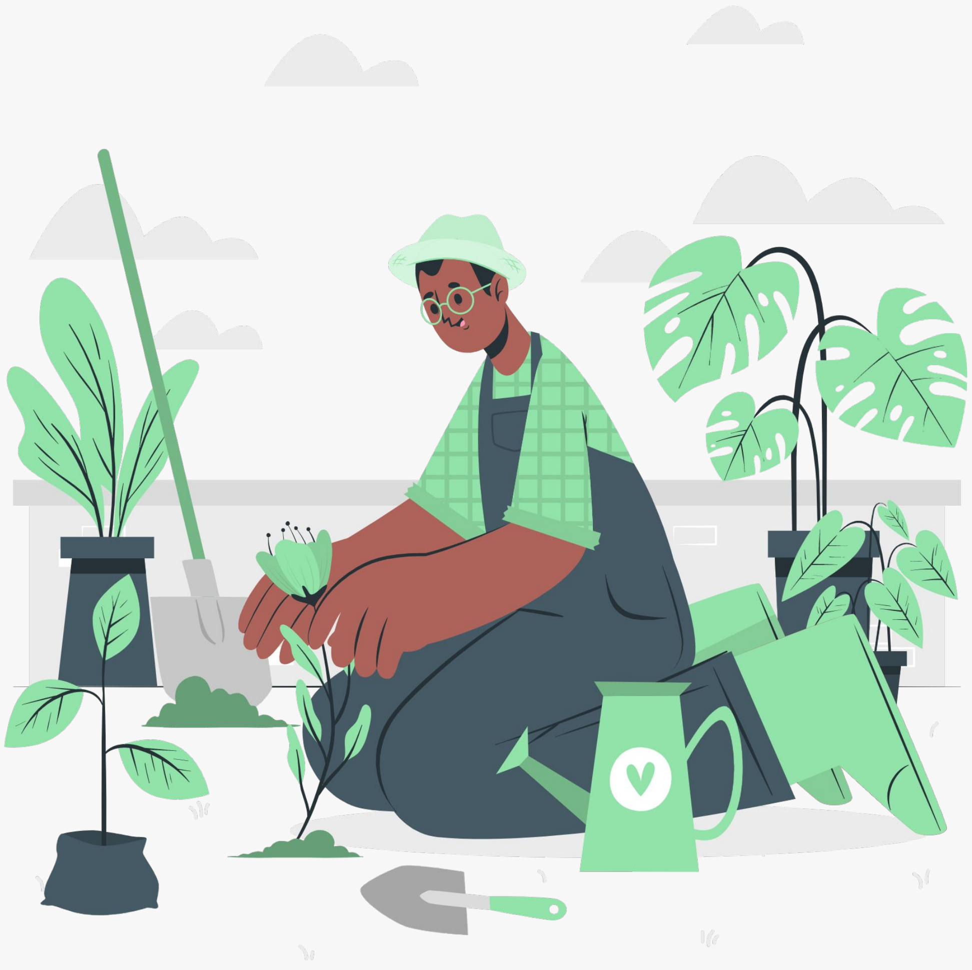
Controlling Plant Diseases

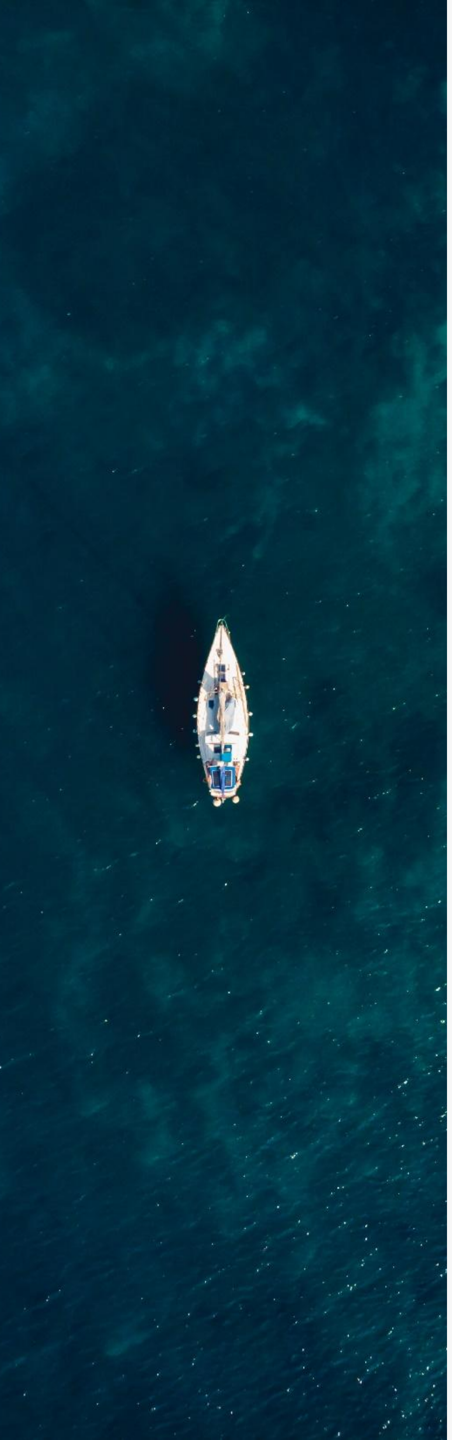
SOIL SOLARIZATION

Soil solarization is a chemical-free way of controlling pathogenic microorganisms (i.e., nematodes, bacteria, fungi).

Soil solarization involves tilling the garden and then covering the areas with a clear plastic tarp for 6 to 8 weeks.

The best time to solarize soil is June through August, when temperatures are at their hottest, as the process requires intense solar heat to be effective.





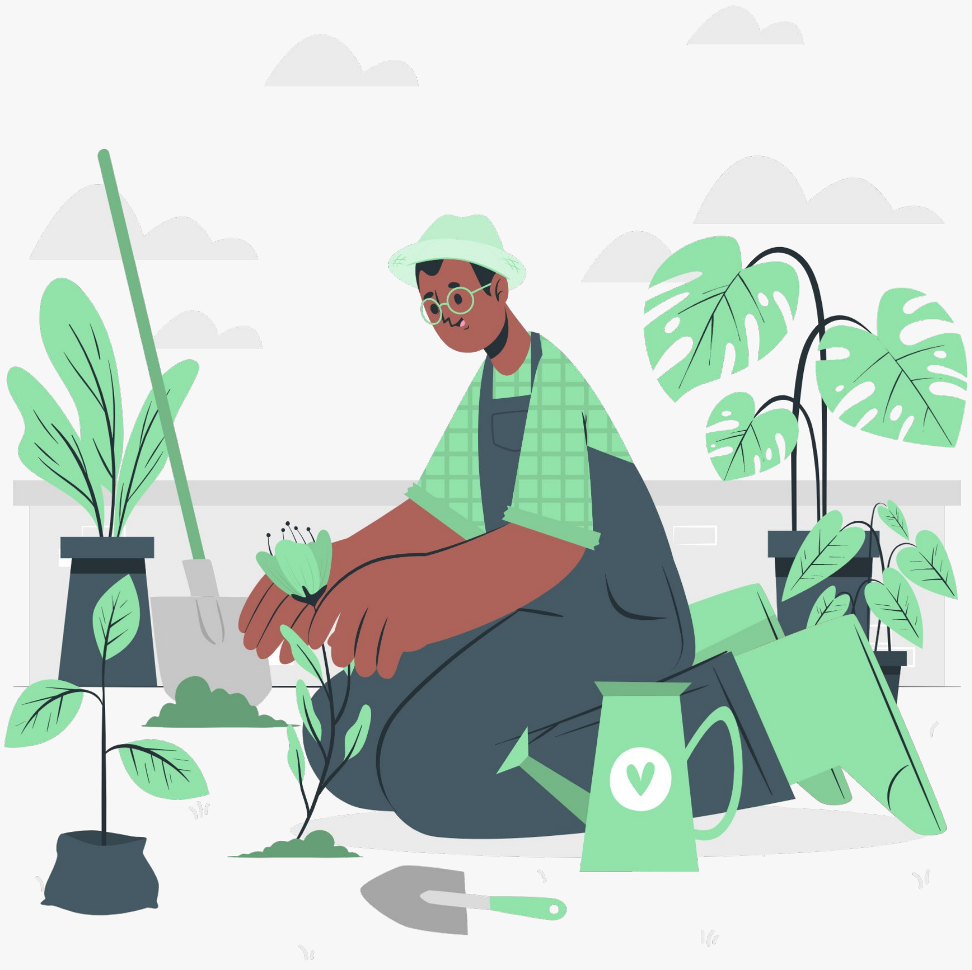
Controlling Plant Diseases

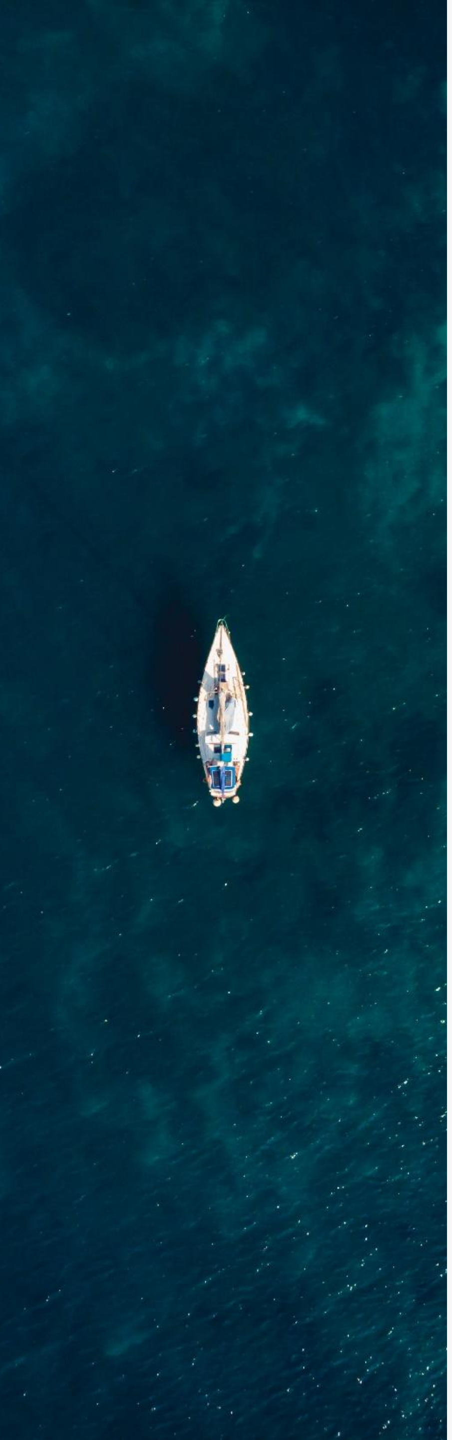
SANITATION

After harvest, remove and destroy plant material.

Remove diseased plants, plant residue, and weeds in and around the vegetable garden to reduce the occurrence of some diseases.

Plow the soil to help break down debris that may harbor nematodes, fungi, and bacteria.



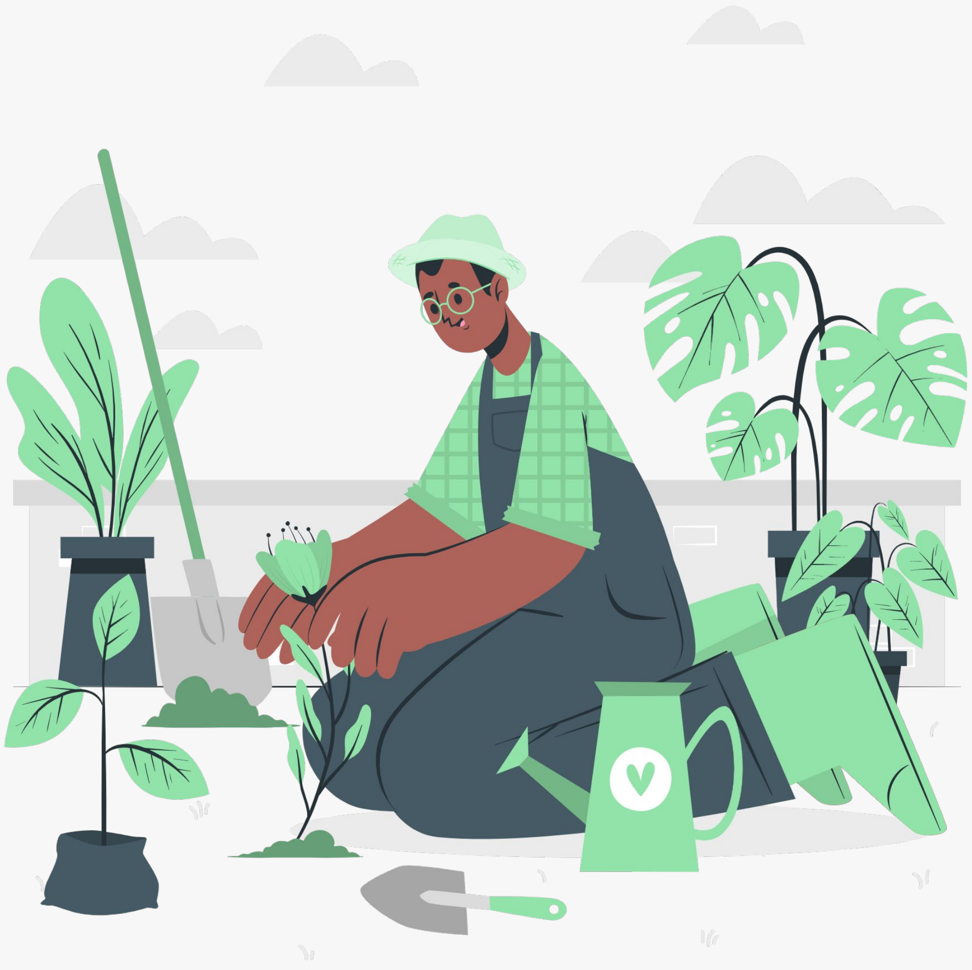


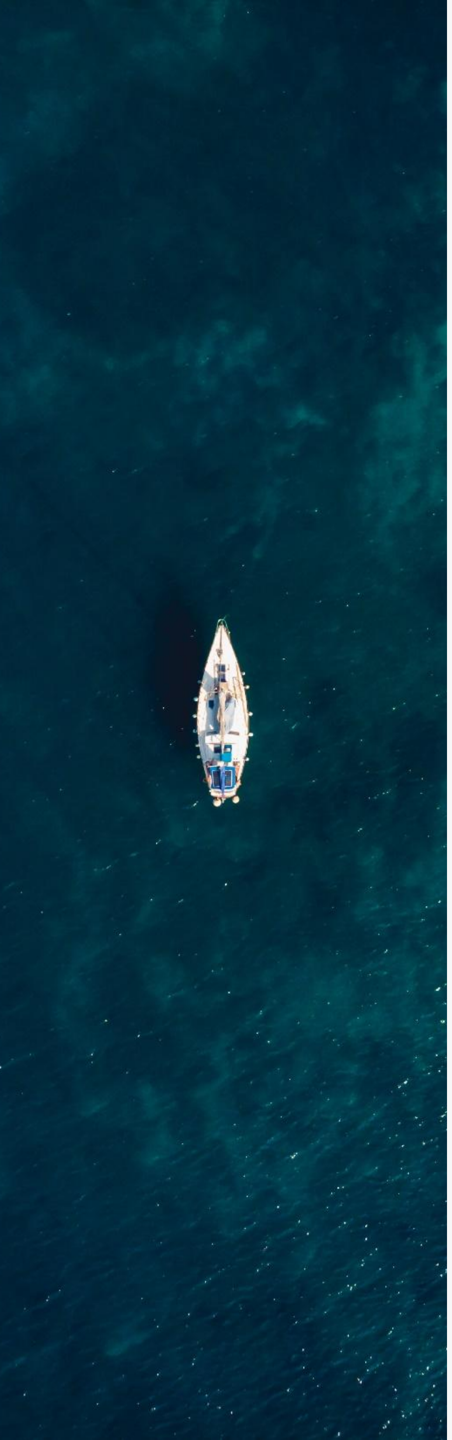
Controlling Plant Diseases

PESTICIDE USE

Pesticides should be the very last form of defense used by home gardeners.

Consider pesticides only once all other disease control options have been exhausted.



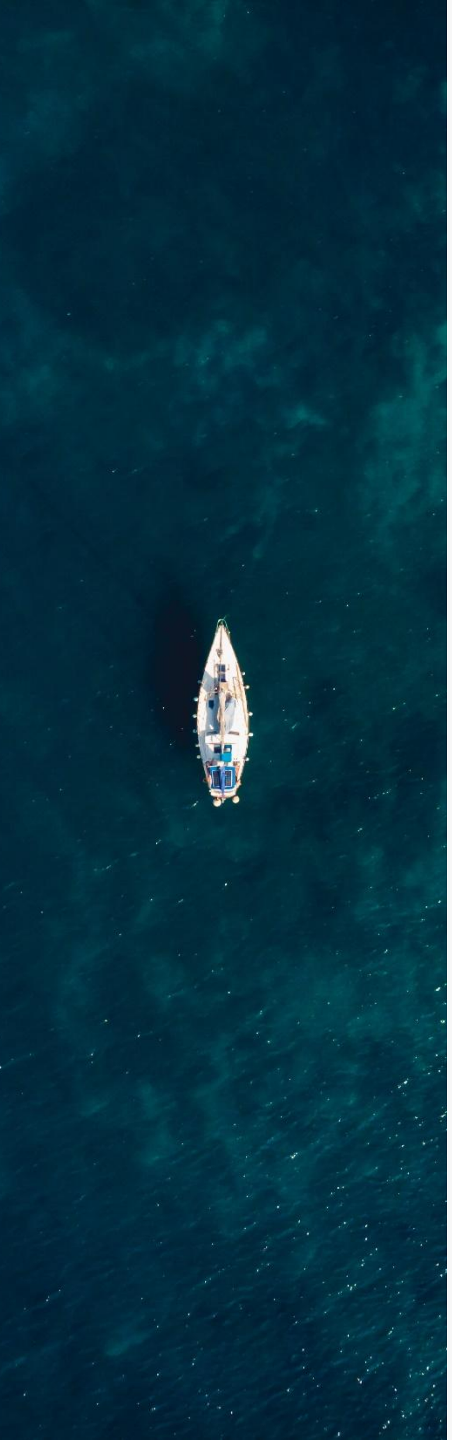


Irrigation (Watering) Strategies

Irrigation is the agricultural process of watering, by applying controlled amounts of water to a land.

It helps to grow agricultural crops, maintain landscapes, and revegetate disturbed soils in dry areas and during periods of less than average rainfall.

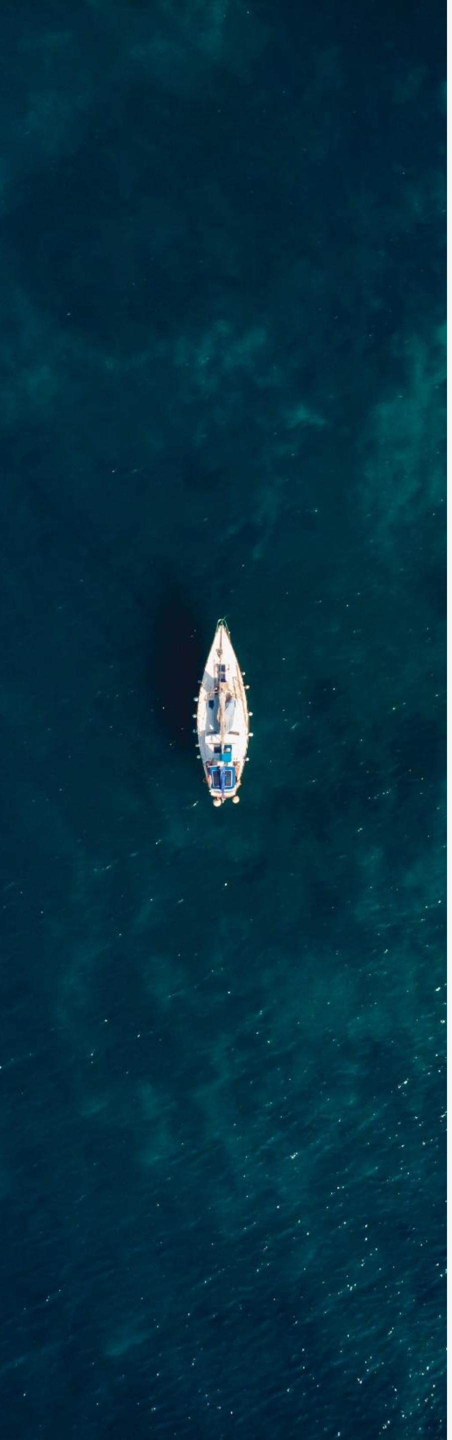
There are many different types of irrigation systems, depending on how the water is distributed throughout the field – here are some common types:



Irrigation (Watering) Strategies

SURFACE IRRIGATION

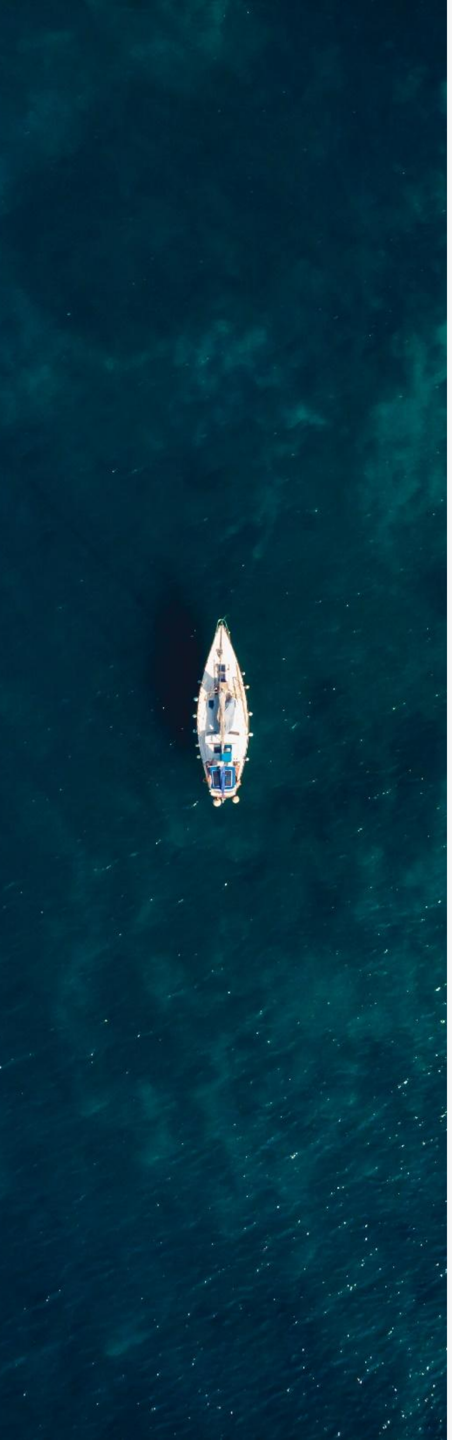
Water is distributed over and across land by gravity rather than a motorized pump.



Irrigation (Watering) Strategies

LOCALIZED

Water is distributed through a low pressure piped network, applied to each plant.

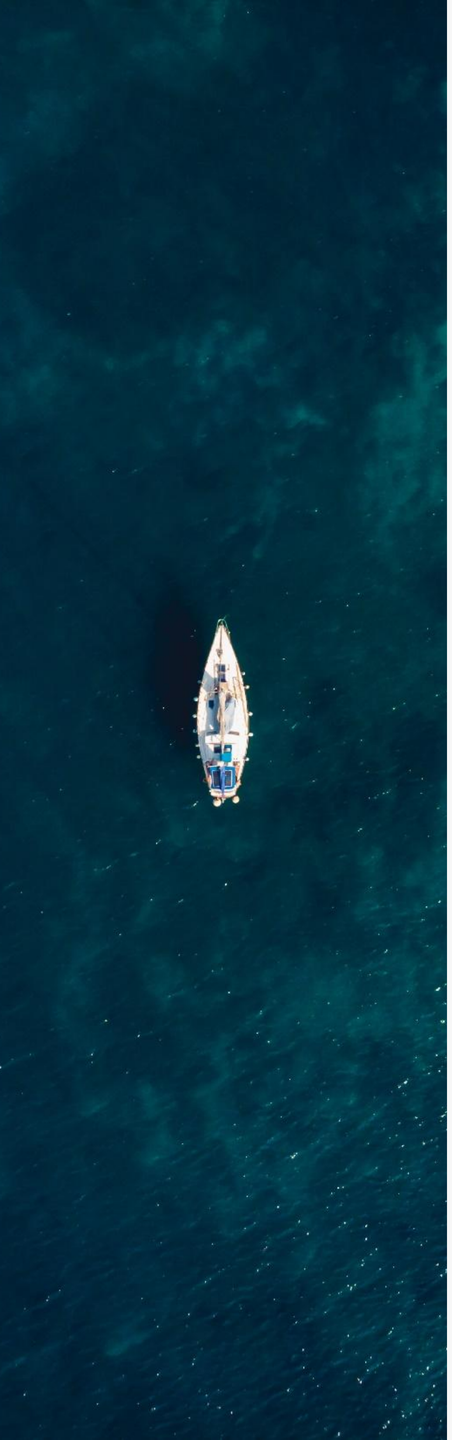


Irrigation (Watering) Strategies

DRIP IRRIGATION

A localized type of watering where the water is delivered near or at the root of plants.

Evaporation and runoff are minimized.

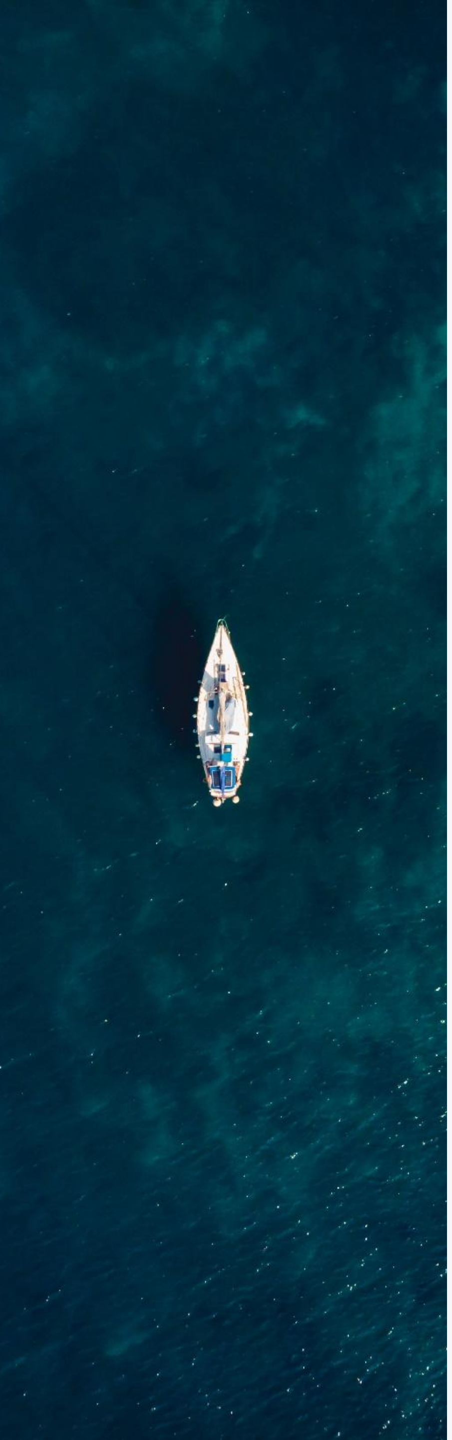


Irrigation (Watering) Strategies

SPRINKLER IRRIGATION

Water is distributed by overhead high-pressure sprinklers or guns.

The sprinklers are placed in a central location in the field or put on moving platforms.

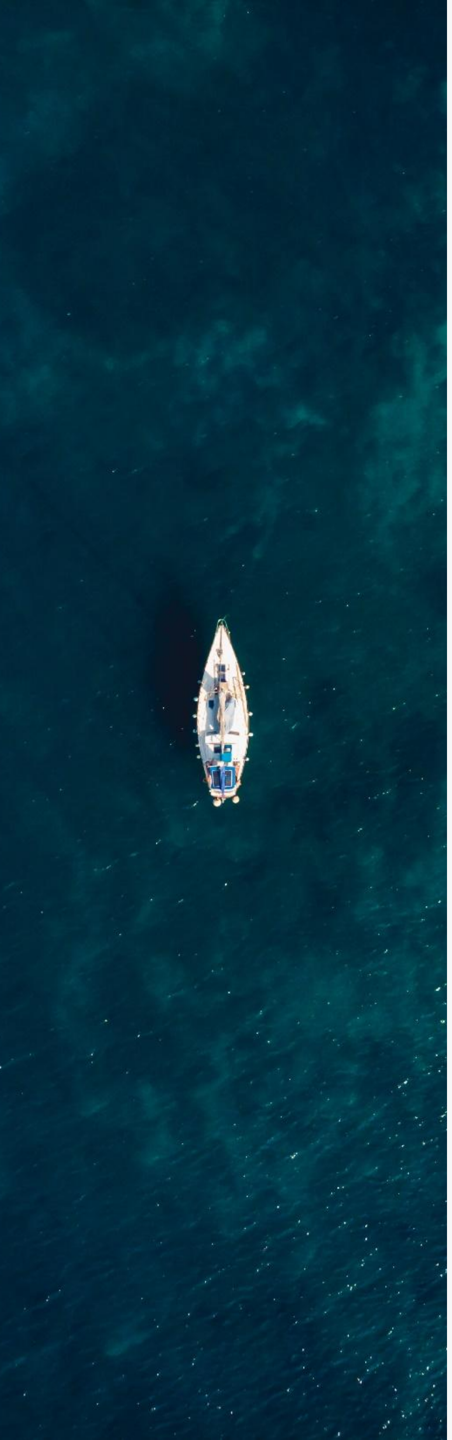


Irrigation (Watering) Strategies

CENTER PIVOT IRRIGATION

A system of sprinklers move on wheeled towers and move in a circular pattern to distribute the water.

This system is common in flat areas.



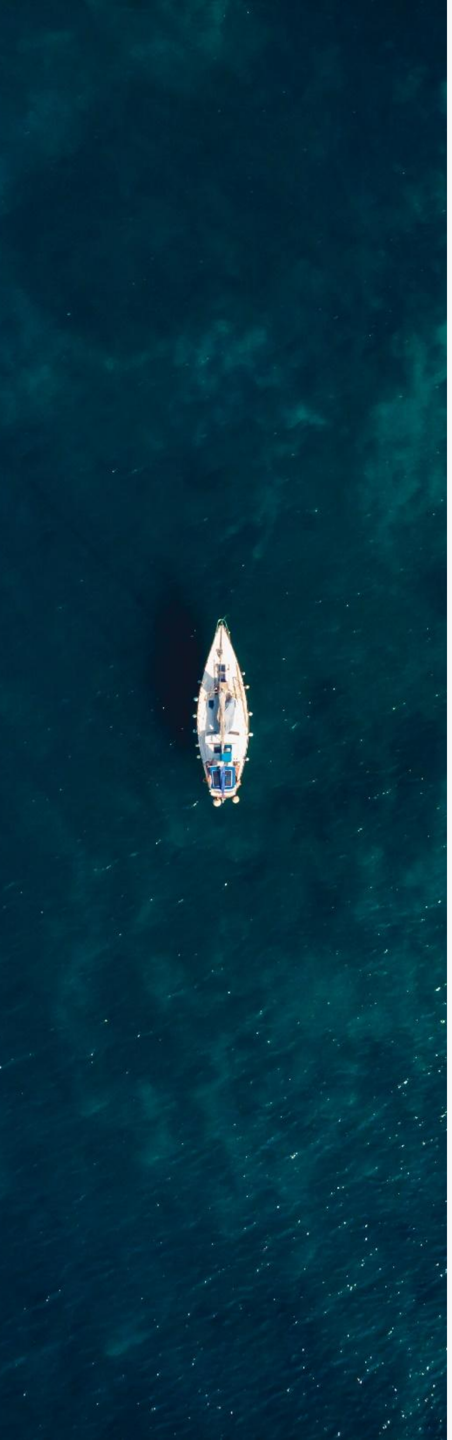
Irrigation (Watering) Strategies

LATERAL MOVE IRRIGATION

Water is distributed through a series of pipes, each with a wheel and a set of sprinklers.

The sprinklers are rotated either by hand or with a purpose-built mechanism.

The sprinklers move a certain distance across the field and then need to have the water hose reconnected for the next distance. This system tends to be less expensive but requires more labor than others.

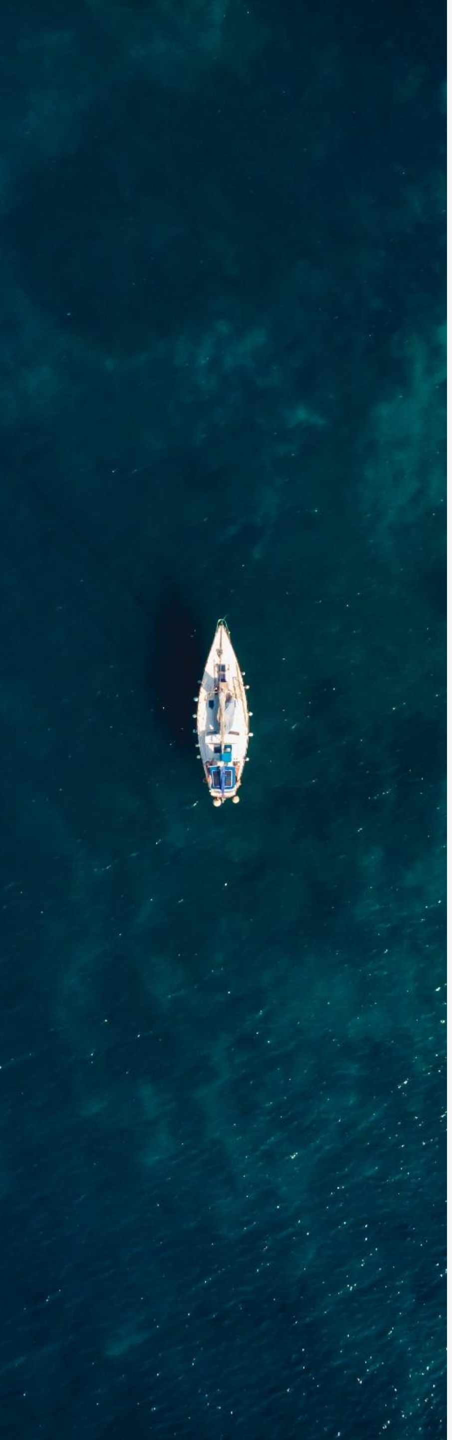


Irrigation (Watering) Strategies

SUB-IRRIGATION

Water is distributed across land by raising the water table, through a system of pumping stations, canals, gates, and ditches.

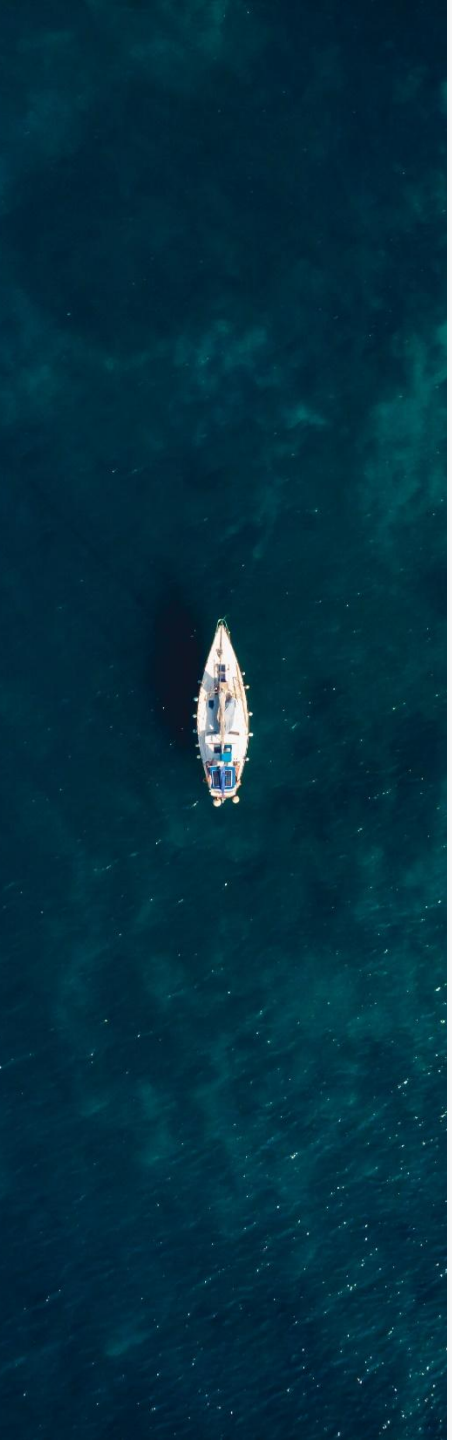
This type of irrigation is most effective in areas with high water tables.



Irrigation (Watering) Strategies

MANUAL IRRIGATION

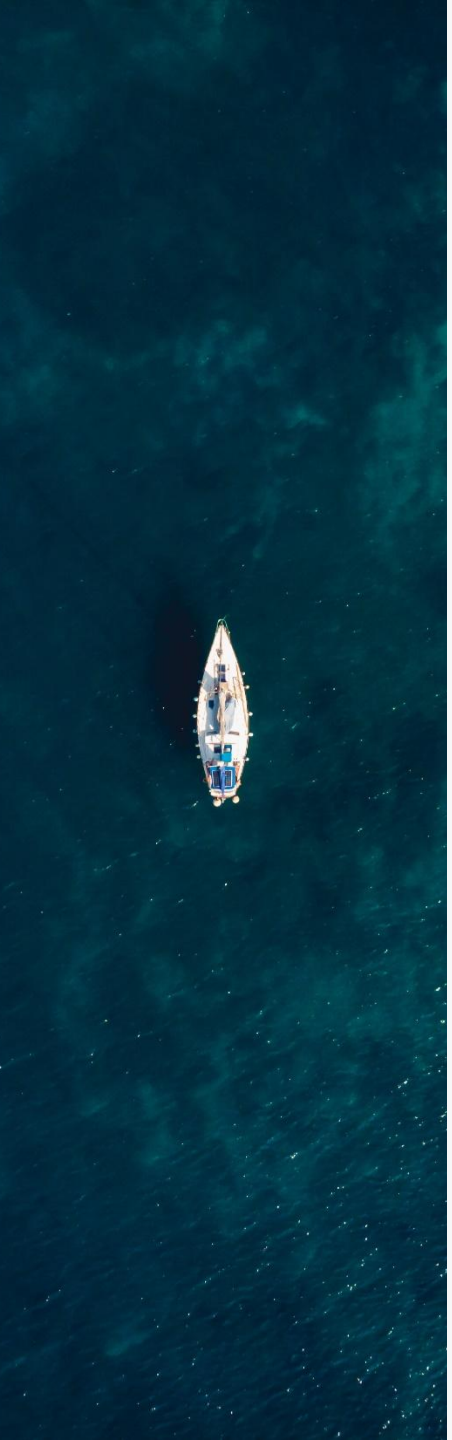
Water is distributed across land through manual labor and watering cans. This system is very labor intensive.



Composting

Compost, also known as composted soil, is the result of the bio-oxidation and humification of a mixture of organic matter (such as pruning residues, kitchen waste, manure, slurry or garden waste such as leaves and mown grass) by macro- and micro-organisms under special conditions: the presence of oxygen and the balance of the chemical elements of the matter involved in the transformation.

Once produced, compost can be used as a soil conditioner, which is then destined for agronomic or floricultural uses. Its use, with the addition of organic matter, improves soil structure and the availability of nutrients (phosphorus and nitrogen compounds). As a biological activator, it also increases the biodiversity of microflora.

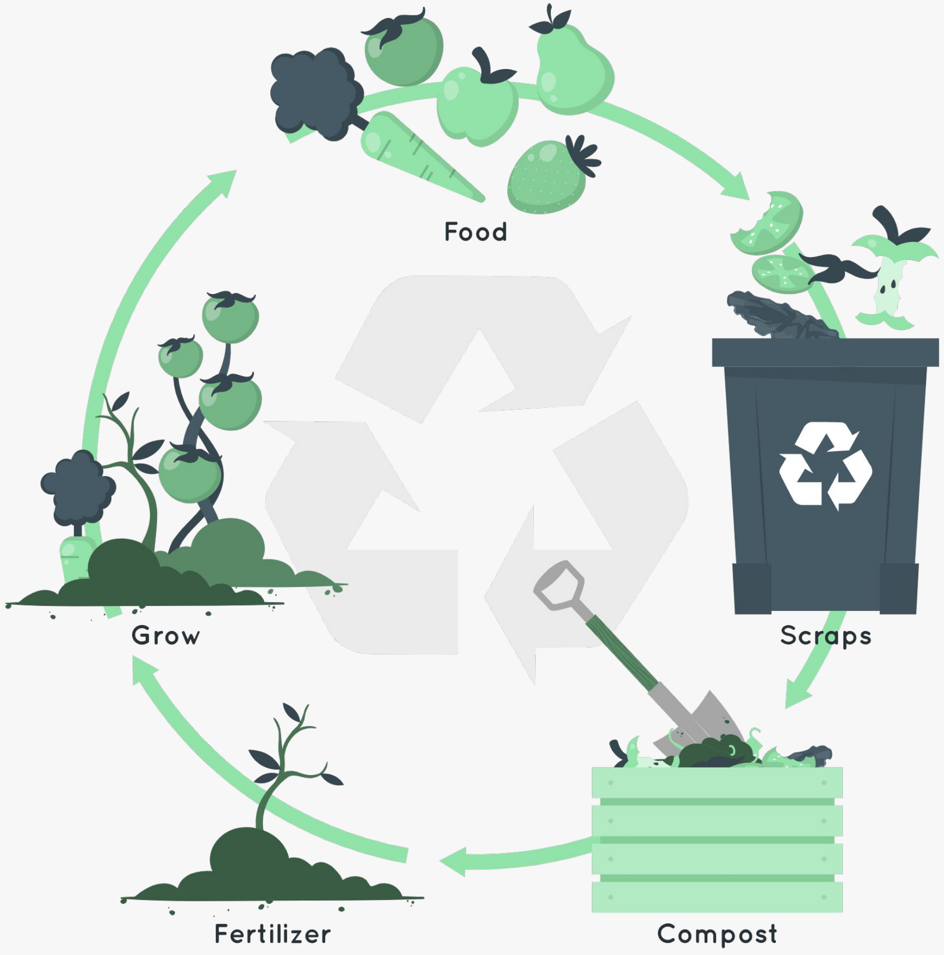


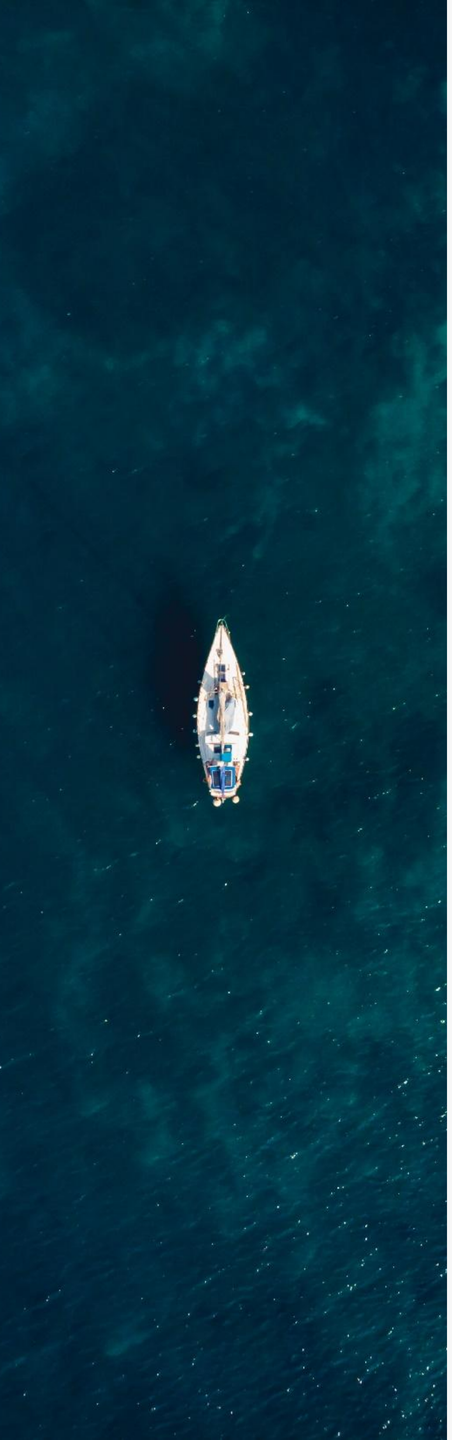
Composting

BASIC PRINCIPLES OF COMPOSTING

It is the decomposing organisms in the soil that produce compost and the optimal conditions are:

- **Nutrients**: a mixture of carbonaceous matter (brown-hard-dry) and nitrogenous matter (green-soft-wet)
- **Moisture**: a nitrogenous (wet) matter and possibly rainwater or water brought in by hand
- **Air**: infiltrating through the porosity produced by the presence of the (hard) carbonaceous structuring substances

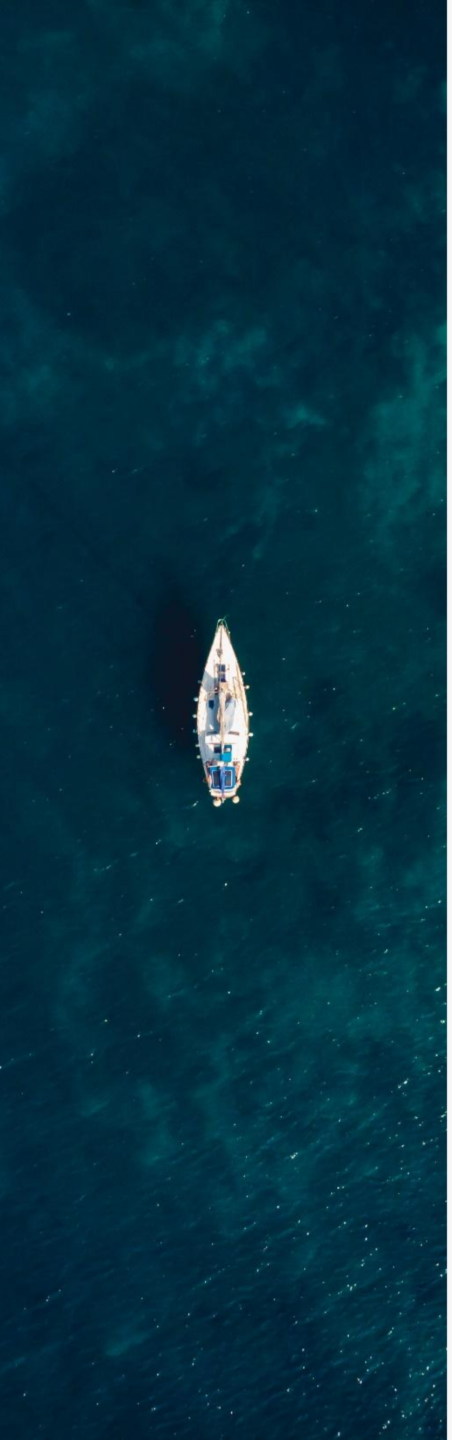




Compostable Organic Residues

NITROGENOUS WASTE

- Vegetable waste
- Garden waste
- Hedge clippings
- Lawn grass, etc.
- Green leaves
- Household waste (wet fraction)
- Limiting residues of animal origin and mixing them well with those of vegetable origin

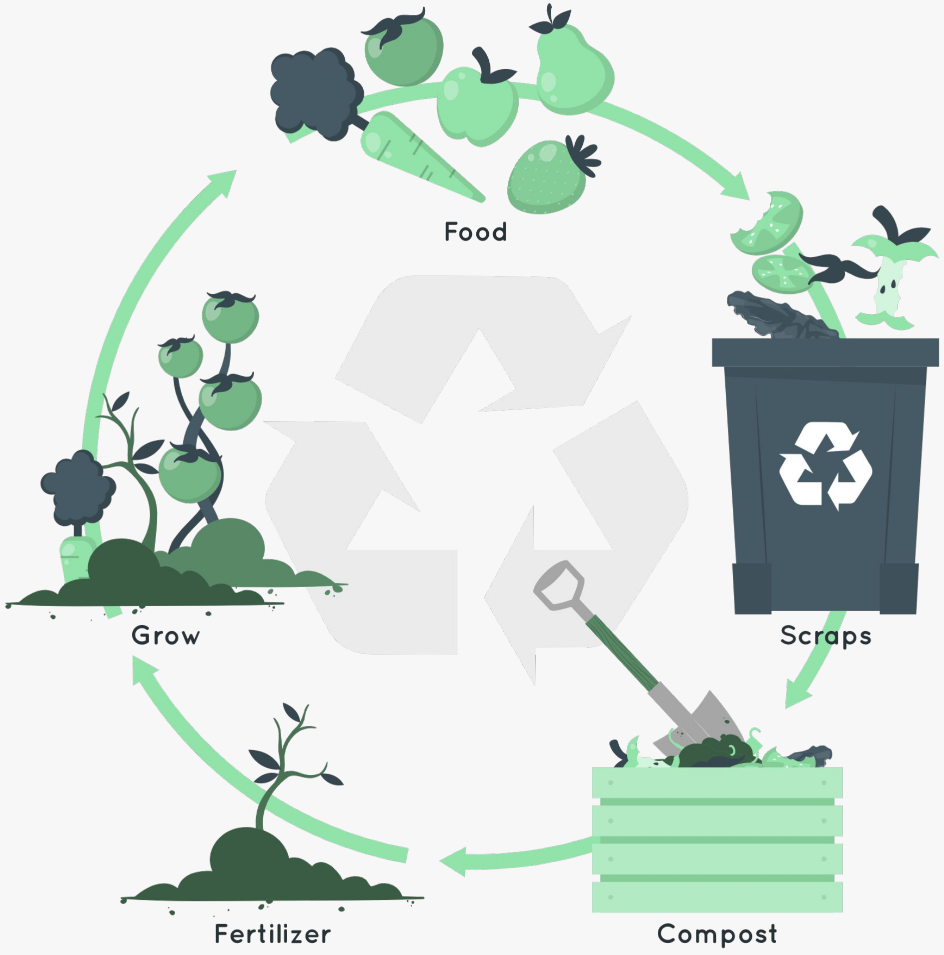


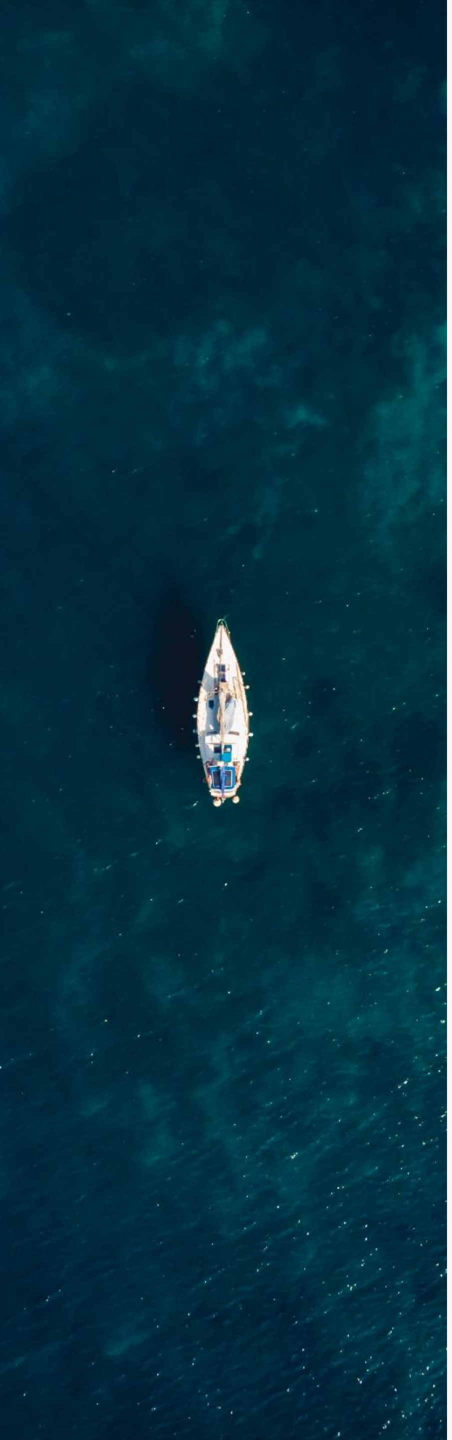
Compostable Organic Residues

CARBONACEOUS WASTE

Branches from pruning
Better if they are shredded with a bio-shredder, otherwise they will be poorly attackable by the microorganisms - increasing the 'attackable' surface area increases the speed of composting

Dry leaves, and straws
Carefully keep these materials aside and mix them in with the nitrogenous waste that is produced from day to day



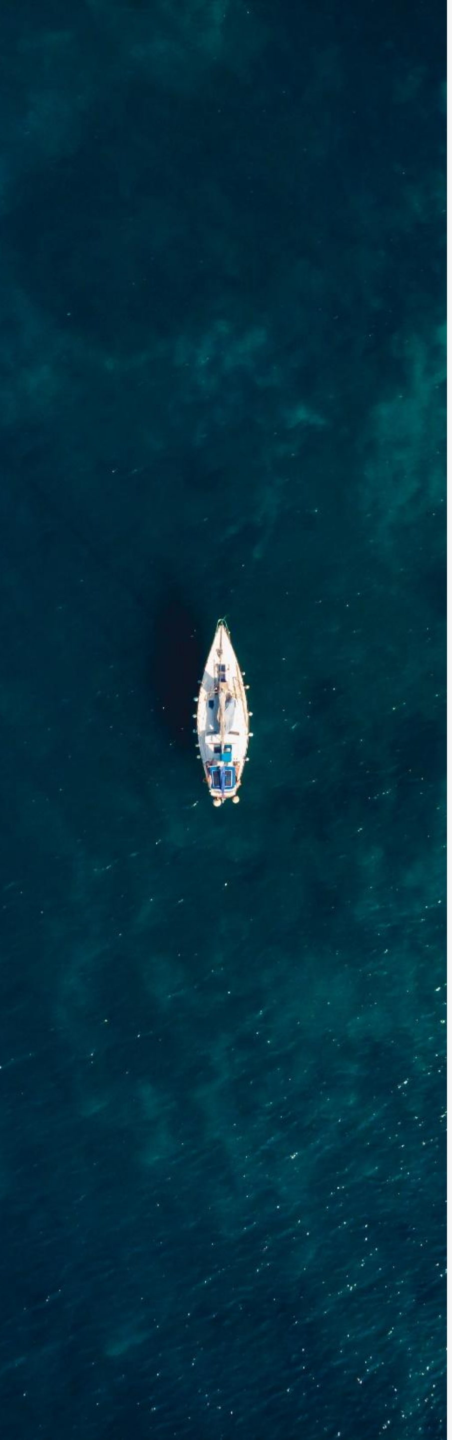


Compostable Organic Residues

PAPER

Avoid printed paper (even though newspapers today no longer contain toxic substances)

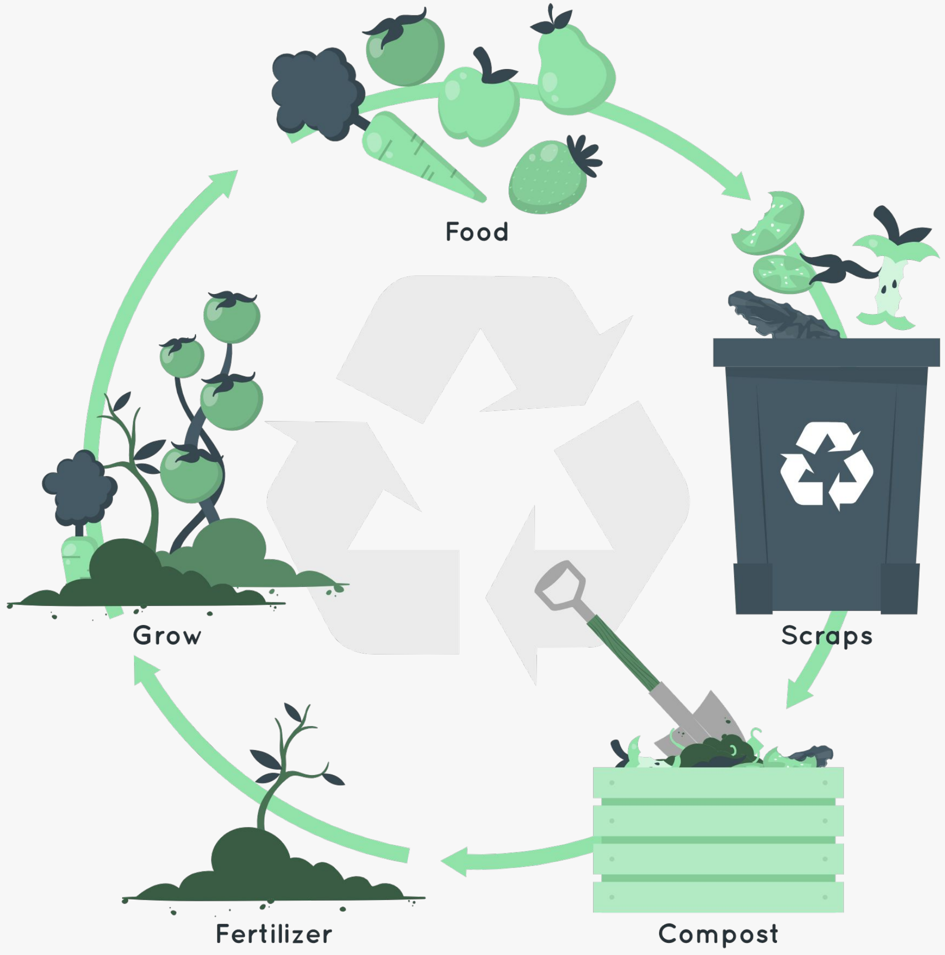
Above all, avoid glossy paper!

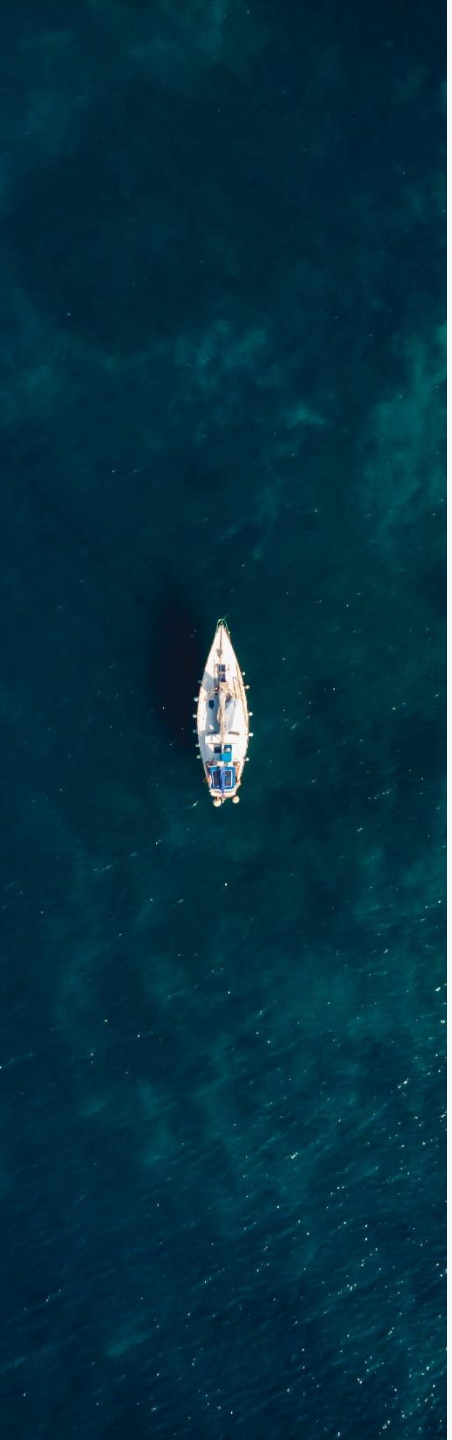


Compostable Organic Residues

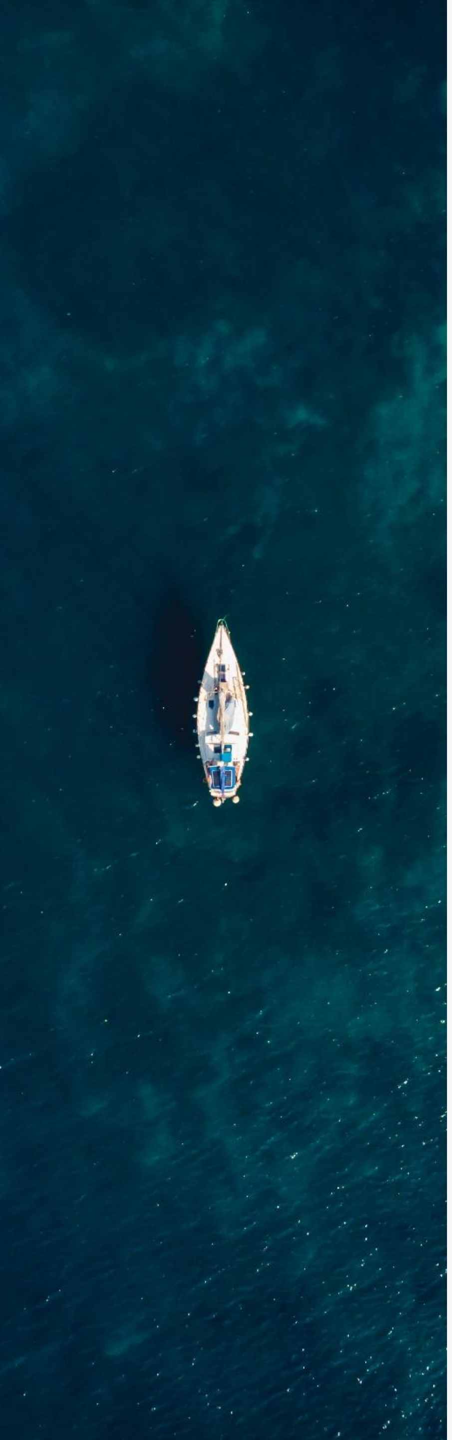
100% NATURAL FABRICS AND OTHERS

- Pieces of wool
- Cotton
- Coffee grounds
- Tea filters
- Egg shells
- Dried fruit shells
- Biodegradable bedding of herbivorous animals





Types of composting



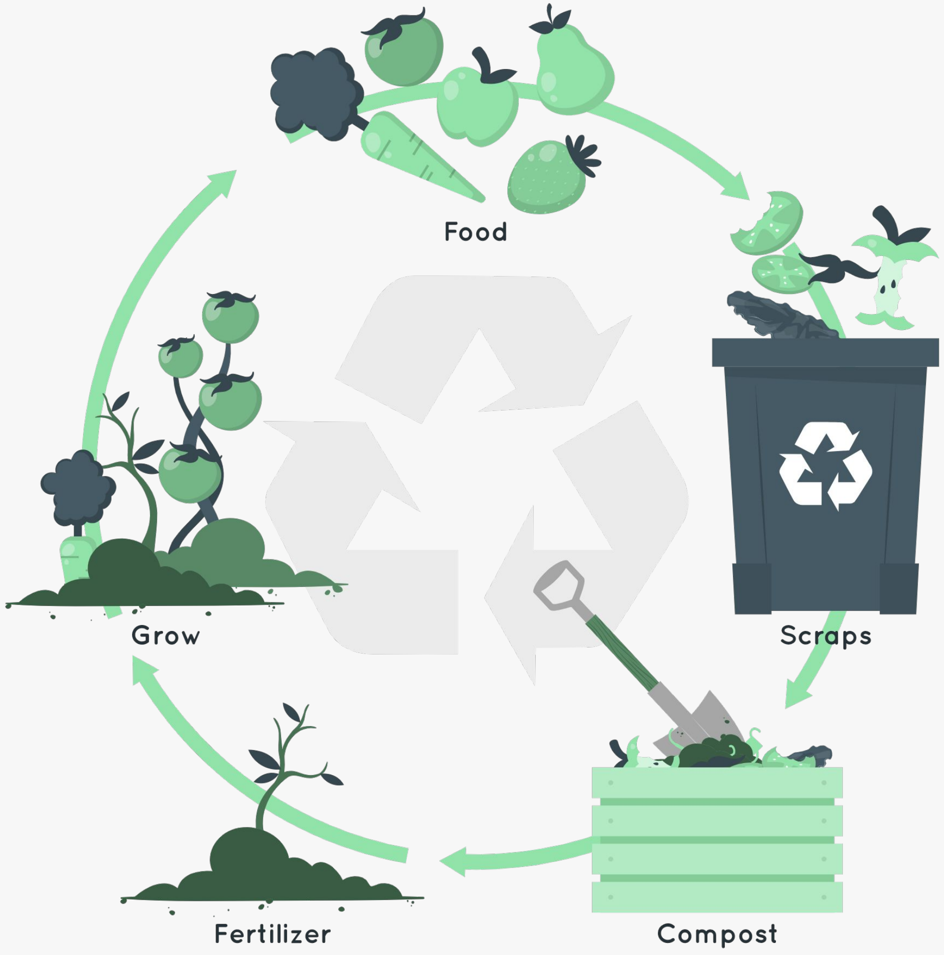
Types of composting

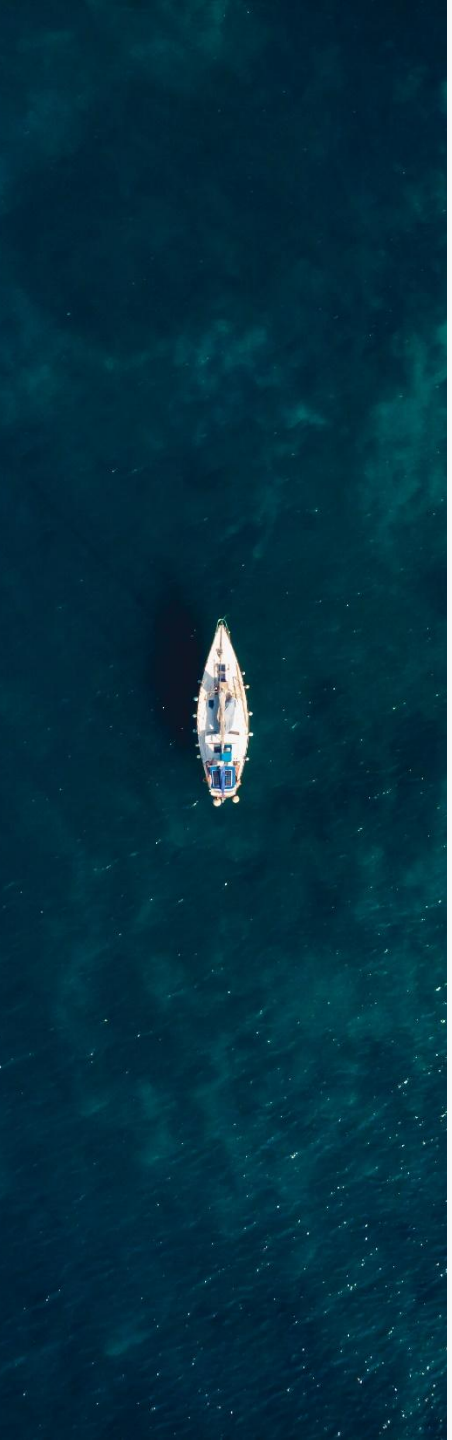
INDUSTRIAL COMPOSTING

Industrial composting allows optimal control of the process conditions (humidity, oxygenation, temperature, etc.) and the presence of any pollutants in the raw material (e.g. heavy metal residues and various aggregates) or pathogenic microorganisms for agriculture is eliminated through further mechanical separation and biological treatments respectively.

Other commonly exploited compostable biomasses are sewage sludge and waste from the care and maintenance of green areas (green compost).

The **quality compost** obtained from the separate collection of organic waste through an industrial process can thus be conveniently exploited in agriculture.





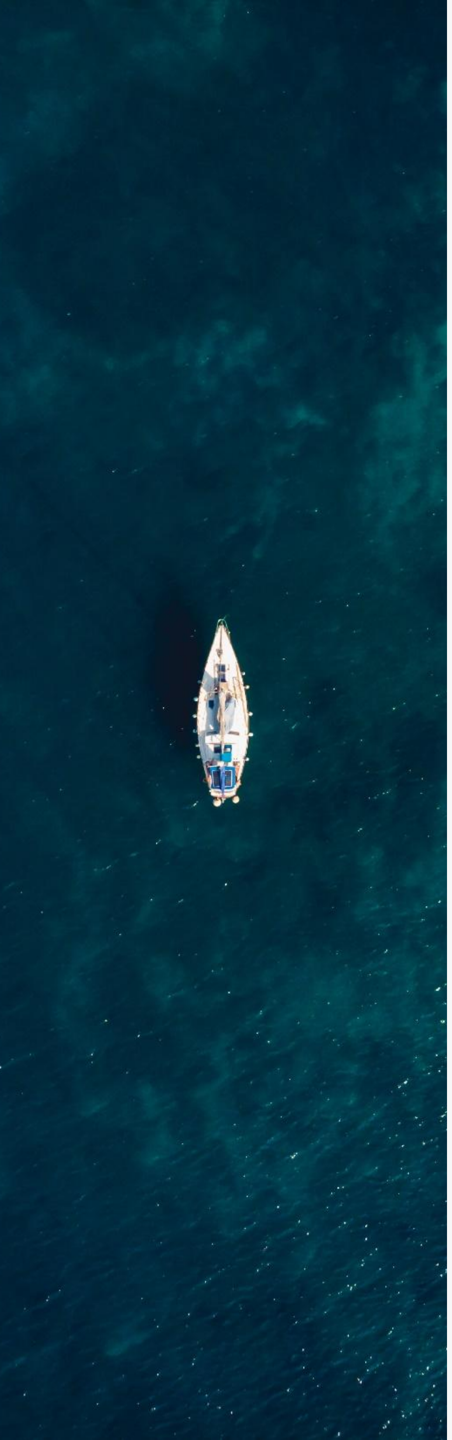
Types of composting

COMMUNITY COMPOSTING

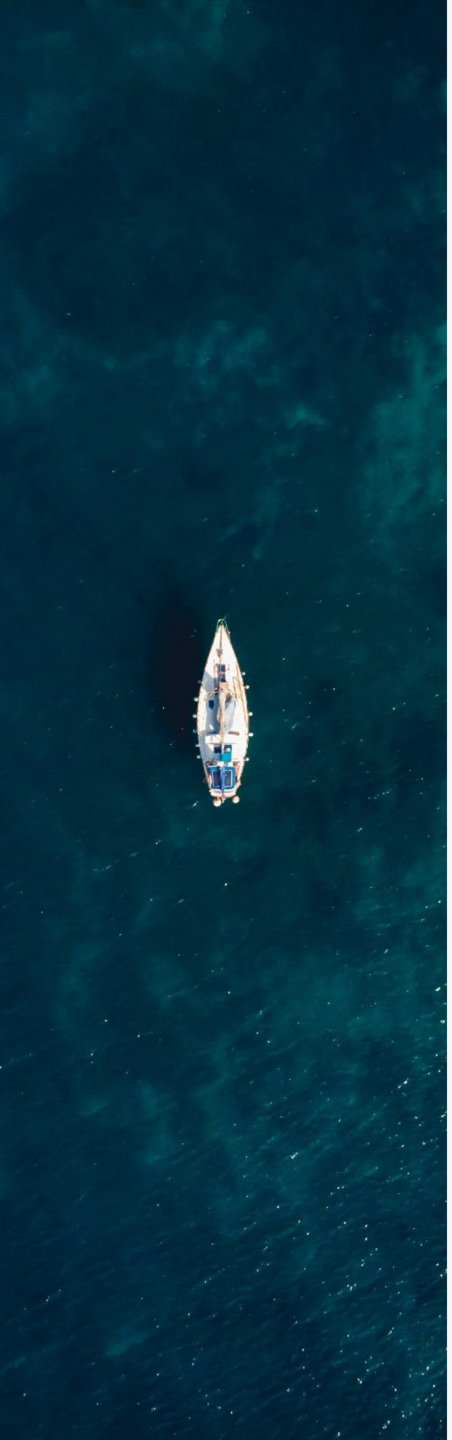
In terms of size, community composting is somewhere between industrial and household composting. It is carried out through small plants used to accelerate the natural composting process of organic waste.

These plants are used to serve a few dozen to a few hundred households or the needs of a canteen, hotel or other producer of organic waste.

In home and community composting, at least two or three times a year, the material must be turned over to reactivate the composting process. The maturation time of the compost varies depending on the climatic conditions and the type of product to be obtained.



The composting process takes place in two stages:



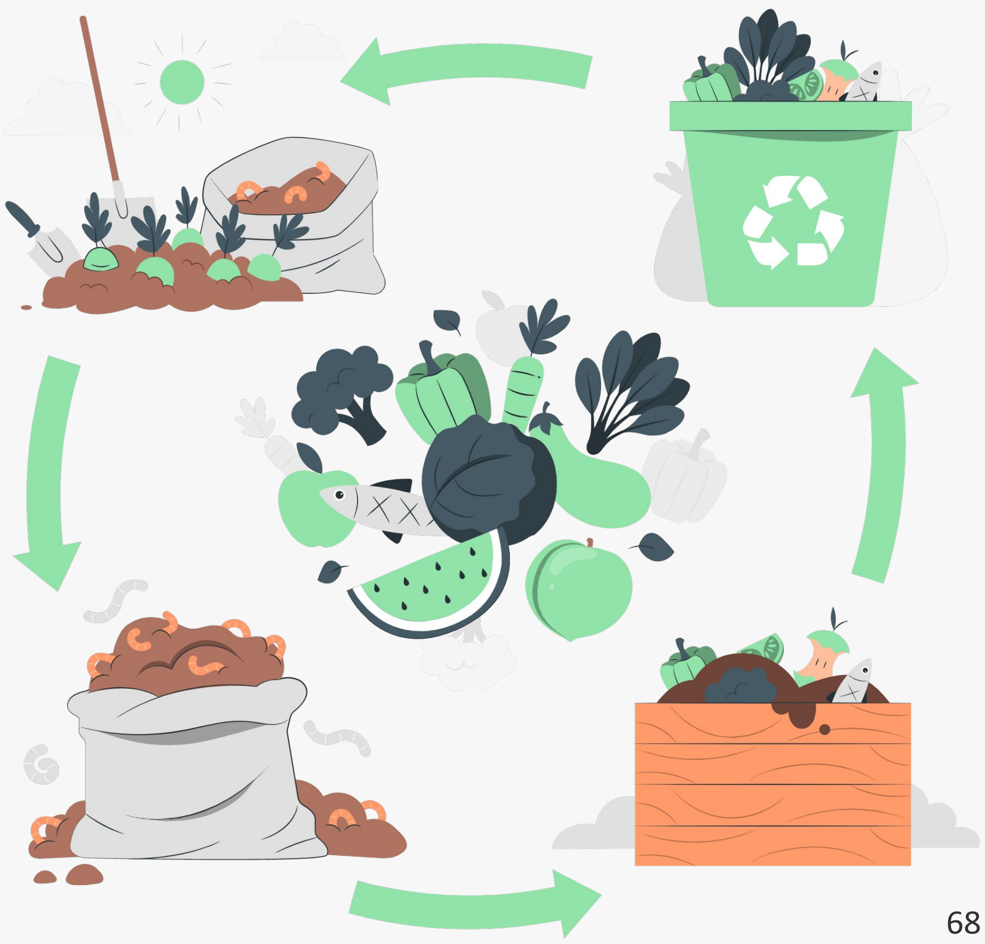
The composting process takes place in two stages

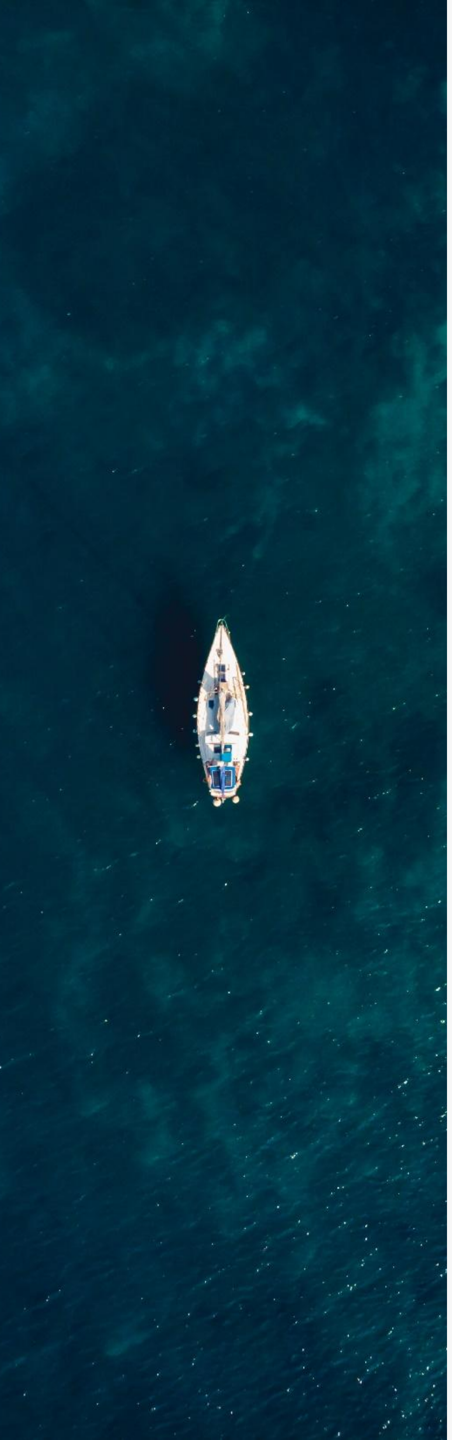
Active phase
This first phase is characterized by a high level of activity of the microorganisms, which, by means of hydrolysis, degrade the most easily degradable organic fractions.

The duration of this phase is a few weeks

Ripening phase
This second phase is where the more recalcitrant (i.e. less degradable) fraction is concentrated and subsequently humidified.

The duration of this phase is longer than the first and lasts more than 2-3 months.





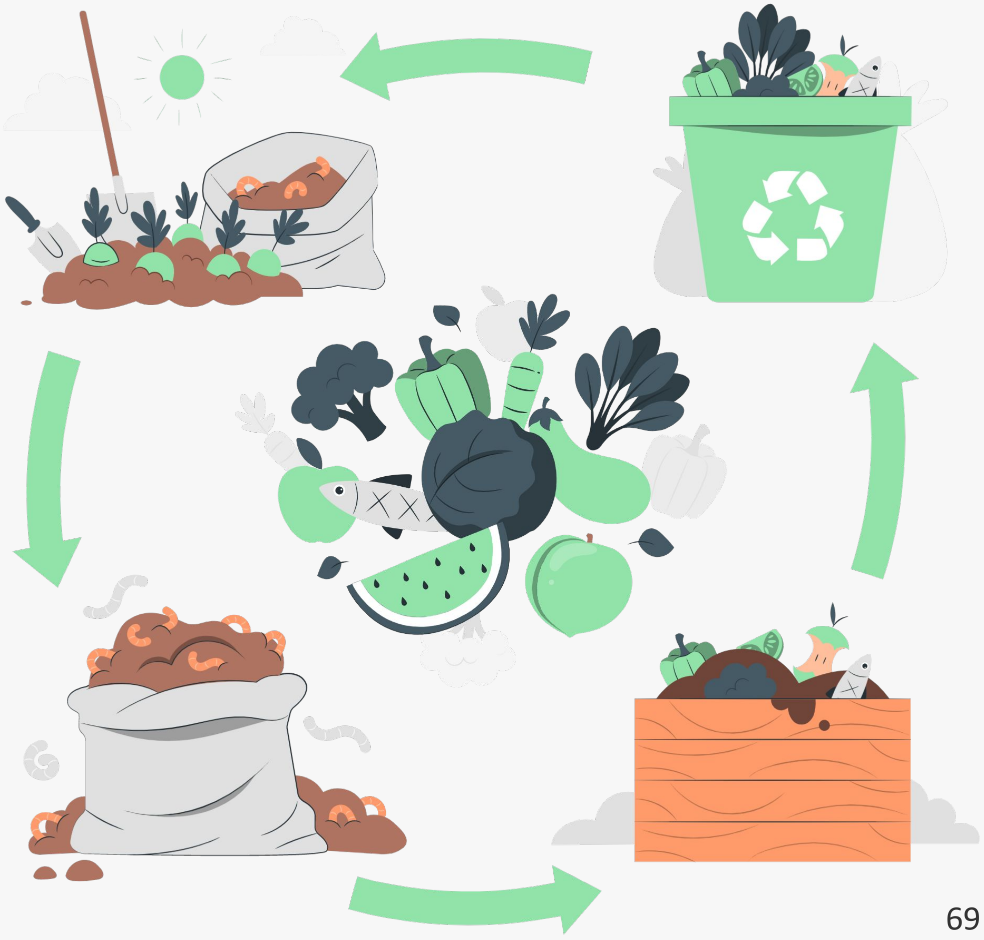
Types of composting

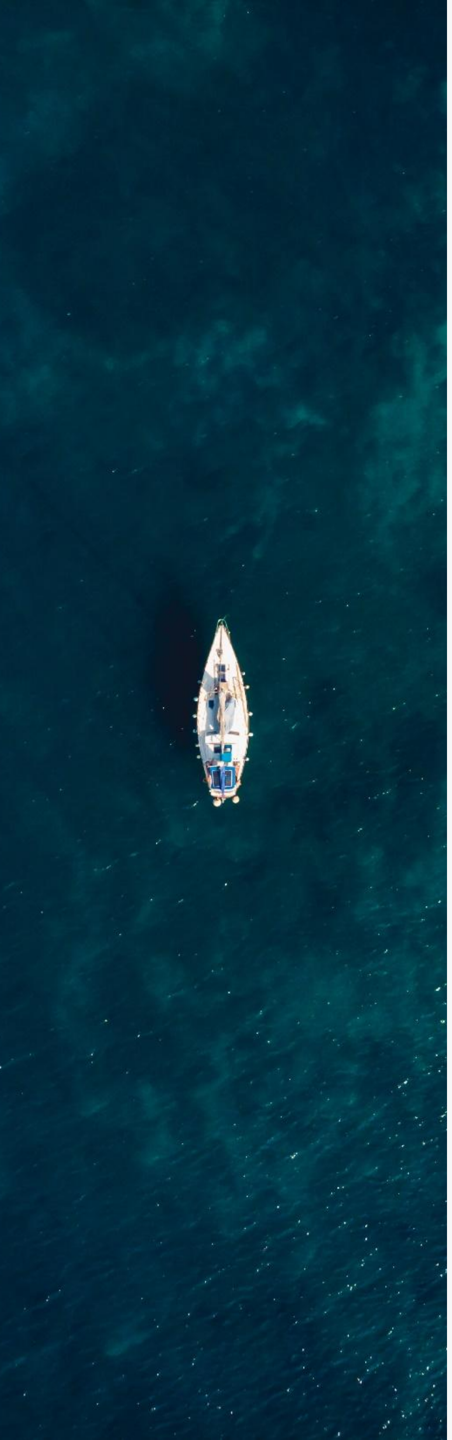
HOME COMPOSTING

Home composting is a procedure used to manage the organic fraction present in municipal solid waste produced in the home (mainly of food origin).

To practise it, it is sufficient to have a patch of garden, preferably sunny, in which to accumulate food waste from the kitchen and those from the vegetable garden/garden.

In some cases, a compost bin is used, a container that promotes oxygenation and conserves heat during the winter.

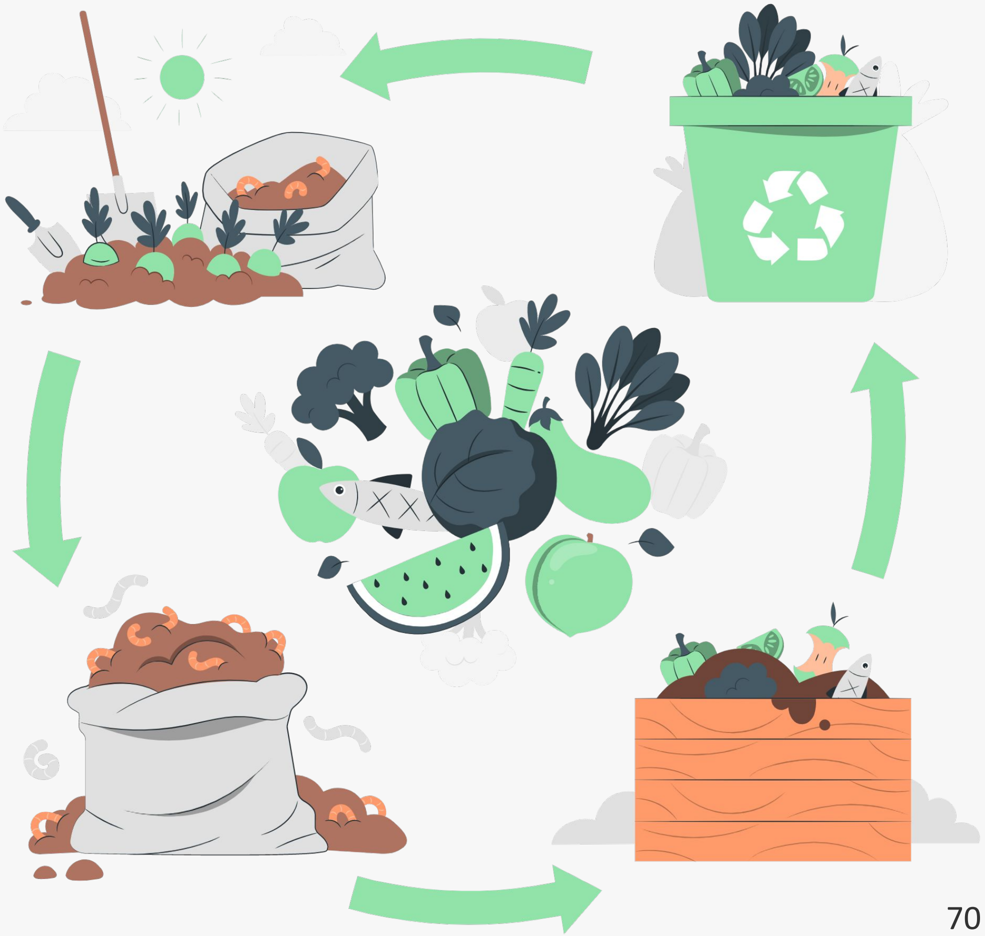


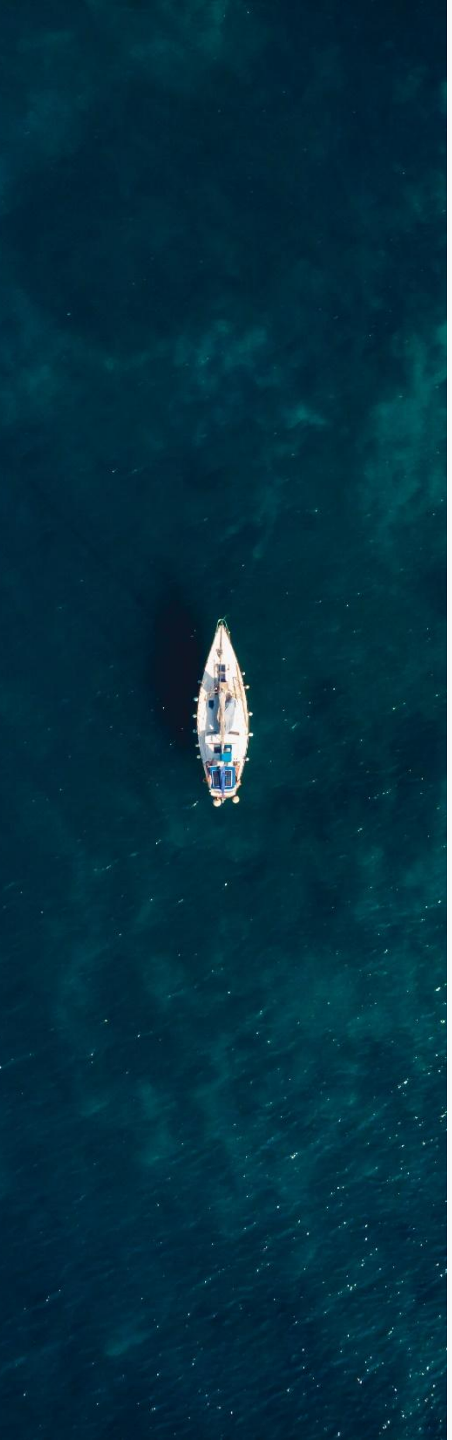


Home Composting

PROCESS

- You will need at least two pits - one in use, and the other at rest, each rotating for 6 months
- When the first one is full, you put it to rest, empty the second one and make it the active one
- A 50 x 50 cm hole, 40 cm deep, can suffice for 6 months at the rate of one 10-liter bucket per week of kitchen waste, plus the mowing of a small lawn



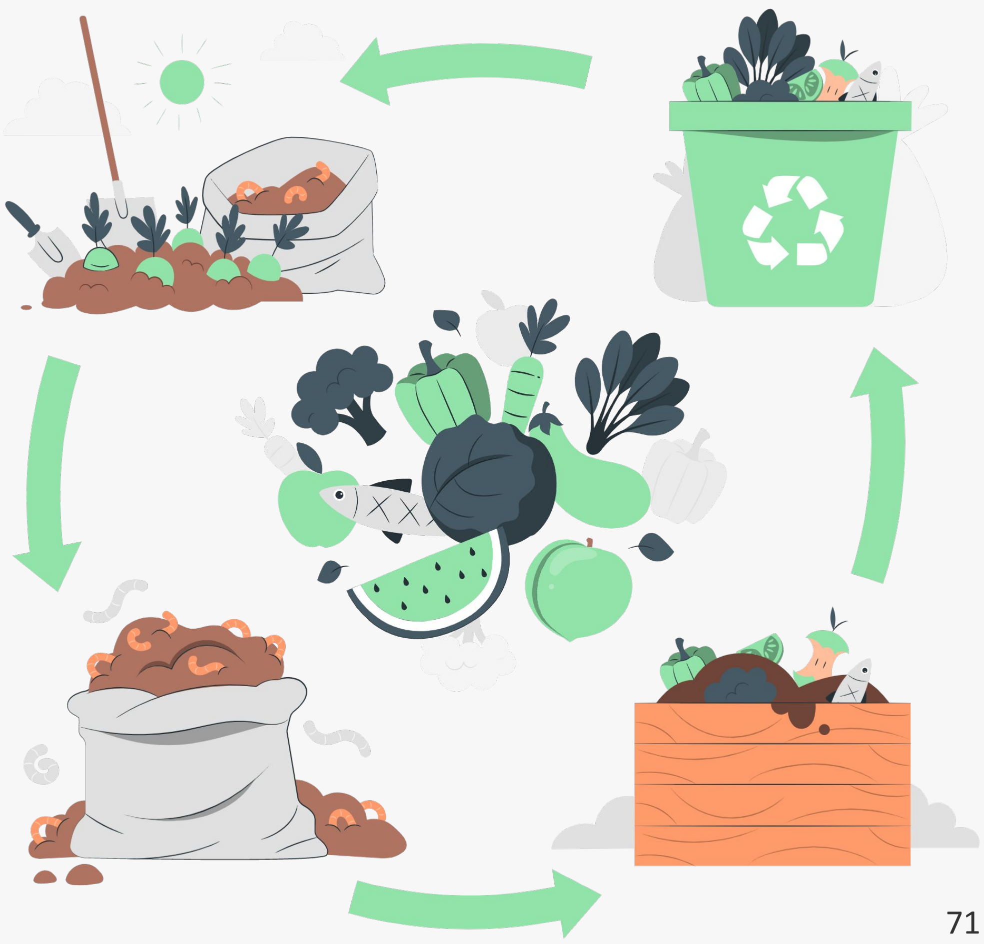


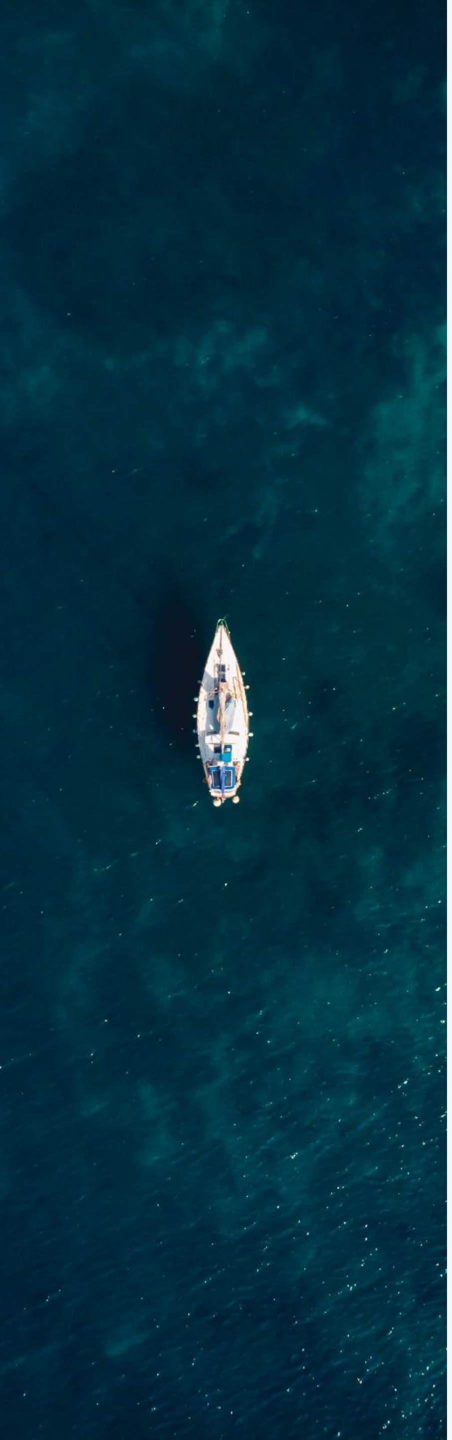
Home Composting

PROCESS

- In order to live and reproduce, the microorganisms also need a favorable temperature, so the composter, or pit, must be closed and sufficiently insulated from the outside environment.
- Rain and cold weather lower the temperature of the material, and thus slow down the process.

  In this sense the pit works better than the heap, as it is insulated on 5 sides (as well as having a more discreet visual impact).

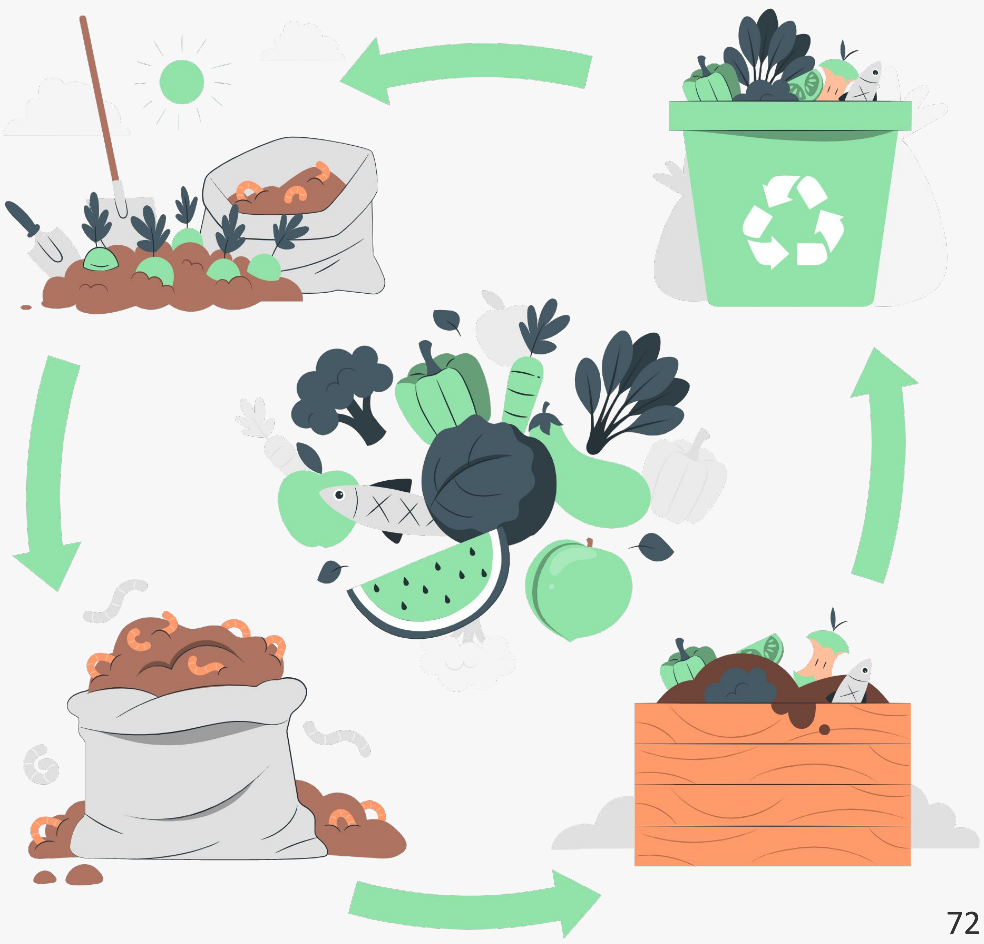


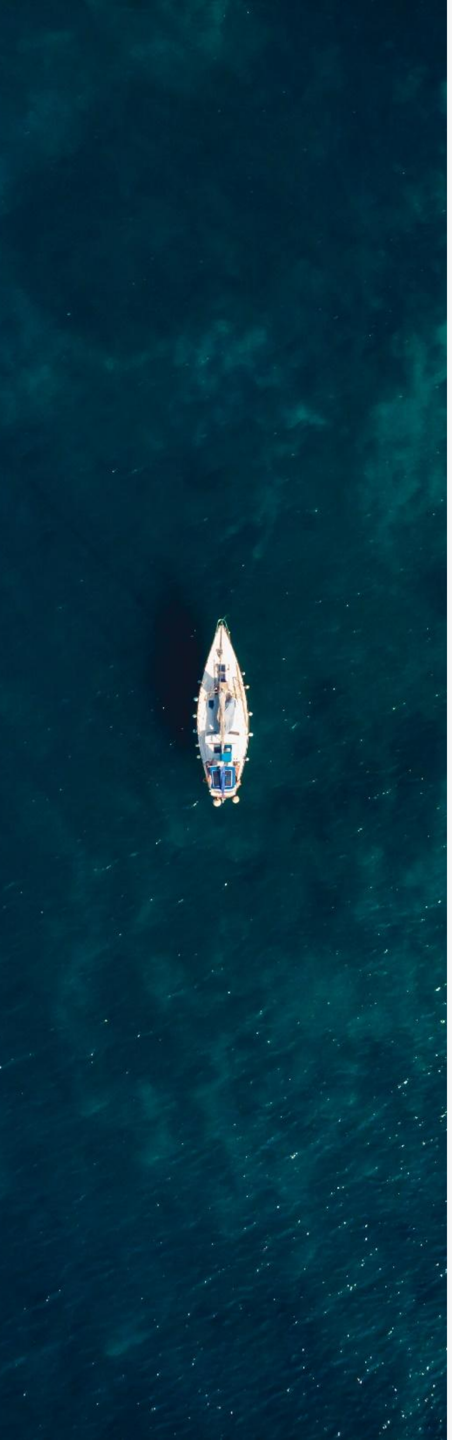


Home Composting

PROCESS

- Although it is possible to introduce meat and fish waste, excess is generally discouraged as decomposing animal proteins release an unpleasant smell and may attract rats or other unwanted animals.



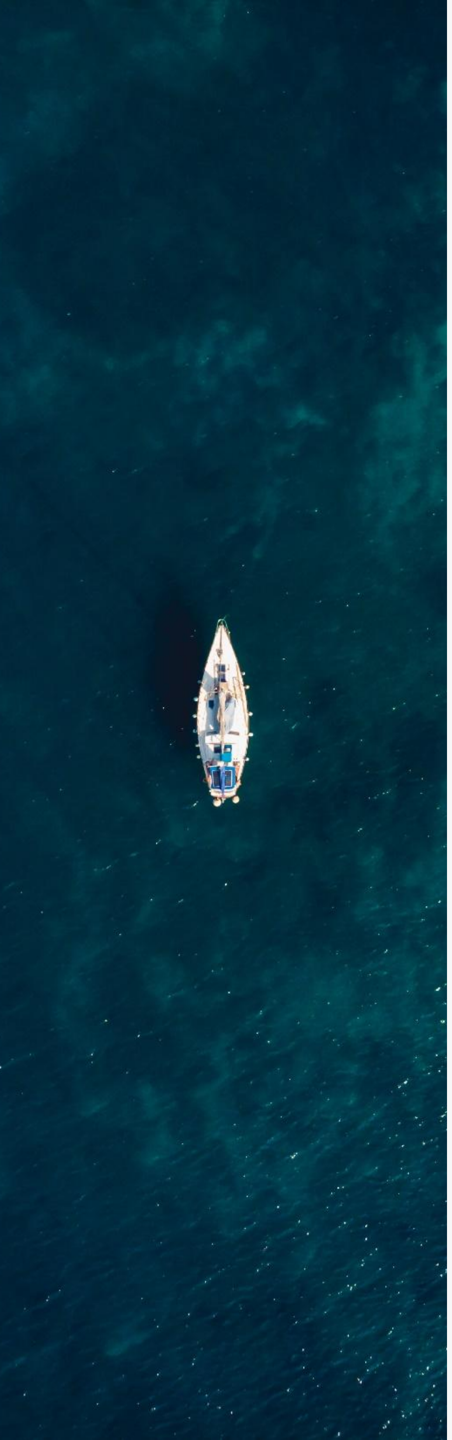


Soilless and Hydroponic Crops

Even the common potted plants that we keep on our balcony at home are an above-ground crop.

It must therefore be made clear that soilless crops can be subdivided into crops on substrate and crops without substrate or on liquid medium.

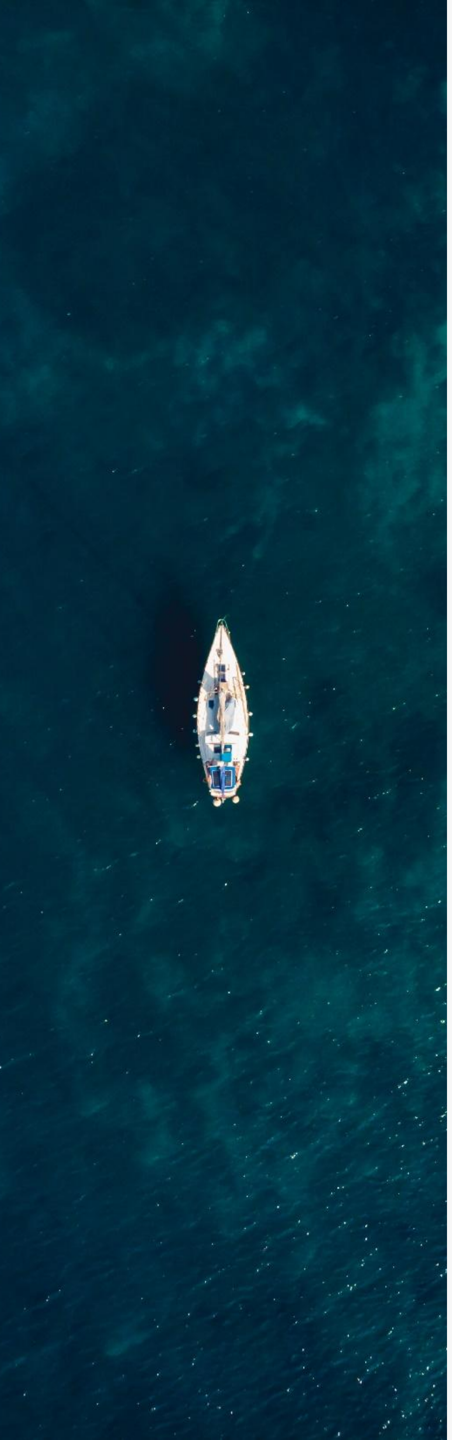
In the former, the roots sink into a substrate of a different type (organic, inorganic or artificial) that is constantly moistened with nutrient solution, in the latter the root system is immersed directly into the nutrient solution.



Soilless and Hydroponic Crops

Hydroponic cultivation falls into the latter category.

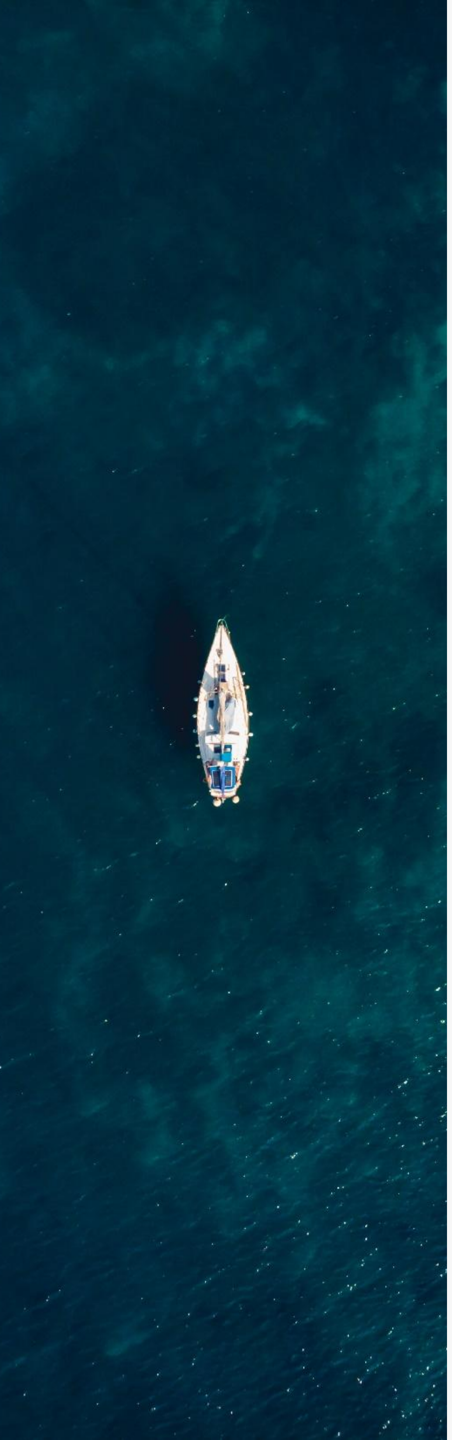
Hydroponic agriculture (from the Greek ὕδωρ hýdor, water + πόνος pónos, work), or hydroponics refers to one of the techniques of above-ground cultivation: the soil is replaced by an inert substrate (expanded clay, perlite, vermiculite, coconut fiber, rockwool, zeolite, etc.) and the plant is irrigated with a nutrient solution composed of water and the (mostly inorganic) compounds required to provide all the elements necessary for normal mineral nutrition.



Soilless and Hydroponic Crops

In this particular type of cultivation, the growth of the plant and its root system takes place outside the soil, which is replaced by an inert substrate, usually composed of expanded clay, perlite, vermiculite, rockwool, zeolite, coconut fiber, and other natural fibers.

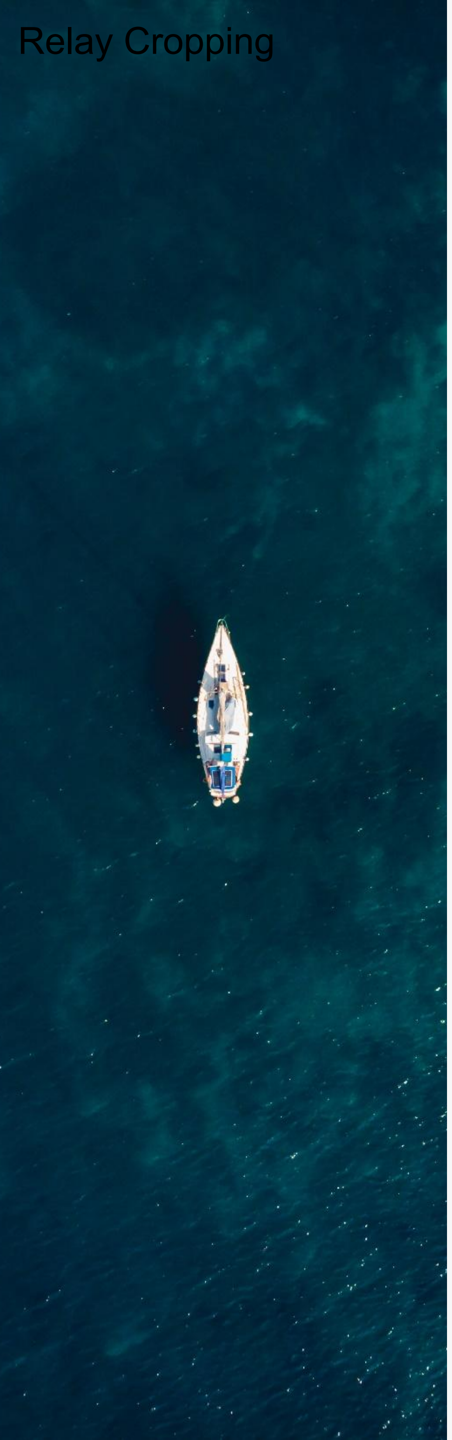
At the same time, the irrigation and growth of the plant is entrusted to a nutritive solution composed of water and inorganic compounds, necessary to supply all the substances required for plant growth.



The role of soil

PHYSICAL-MECHANICAL

The soil enables the anchoring of plants by protecting the root system from atmospheric agents that may interfere with its vitality (atmospheric humidity, lighting, insolation).

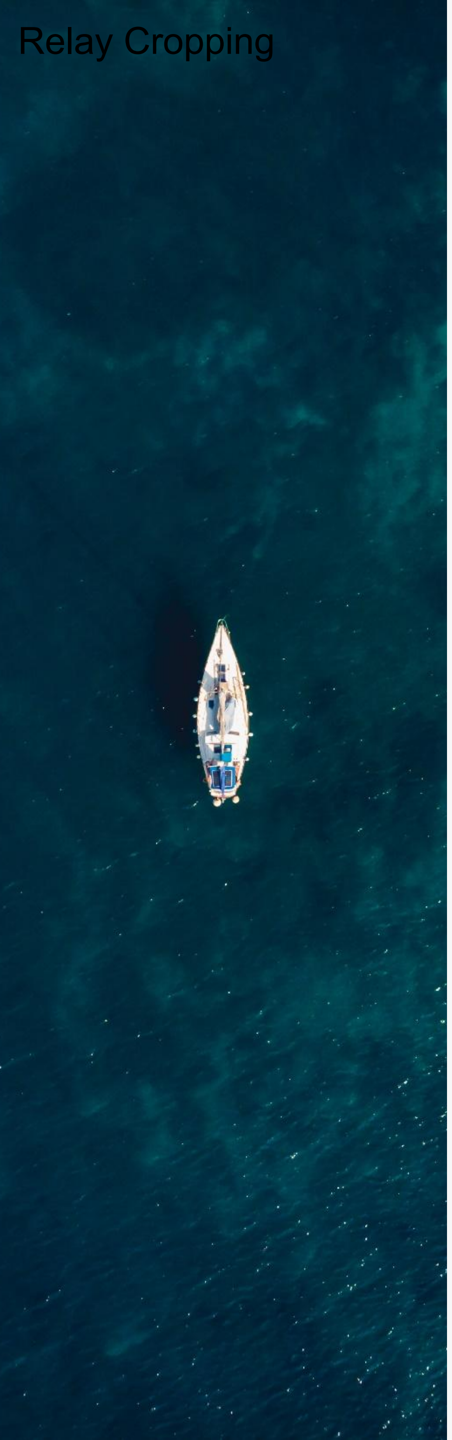


The role of soil

TROPHIC

The soil is the physical environment that under natural conditions provides the plant with almost all the mineral elements it needs through root uptake.

Only carbon and oxygen are taken up by carbonic nutrition, taking carbon dioxide from the air through the stomatal openings in the leaves.



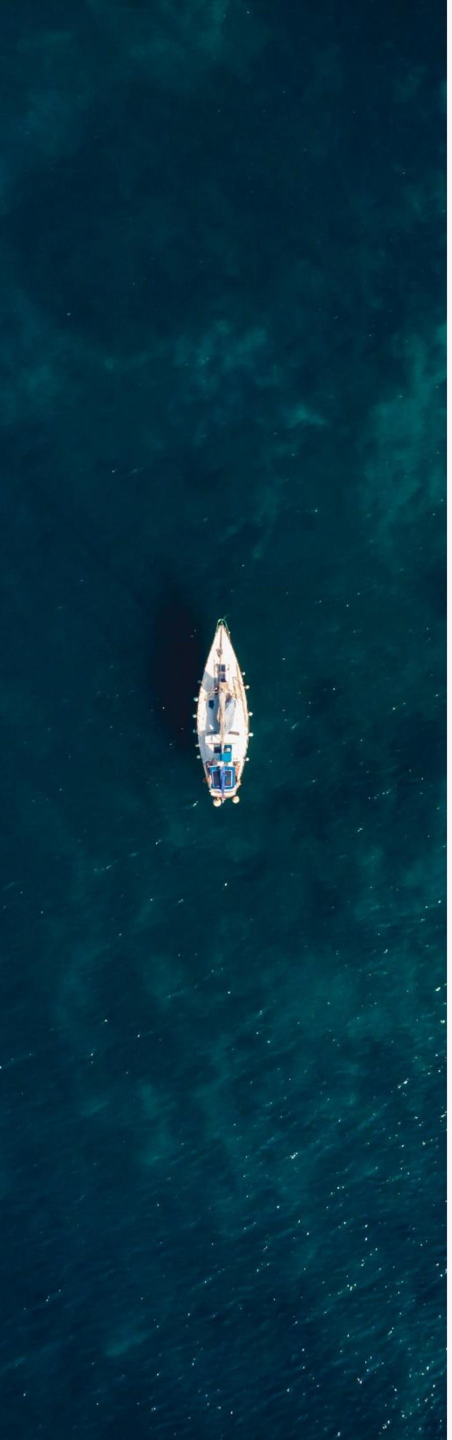
The role of soil

ECOLOGICAL

The rhizosphere is the part of the soil biocenosis that has more or less direct relationships with the plant root system.

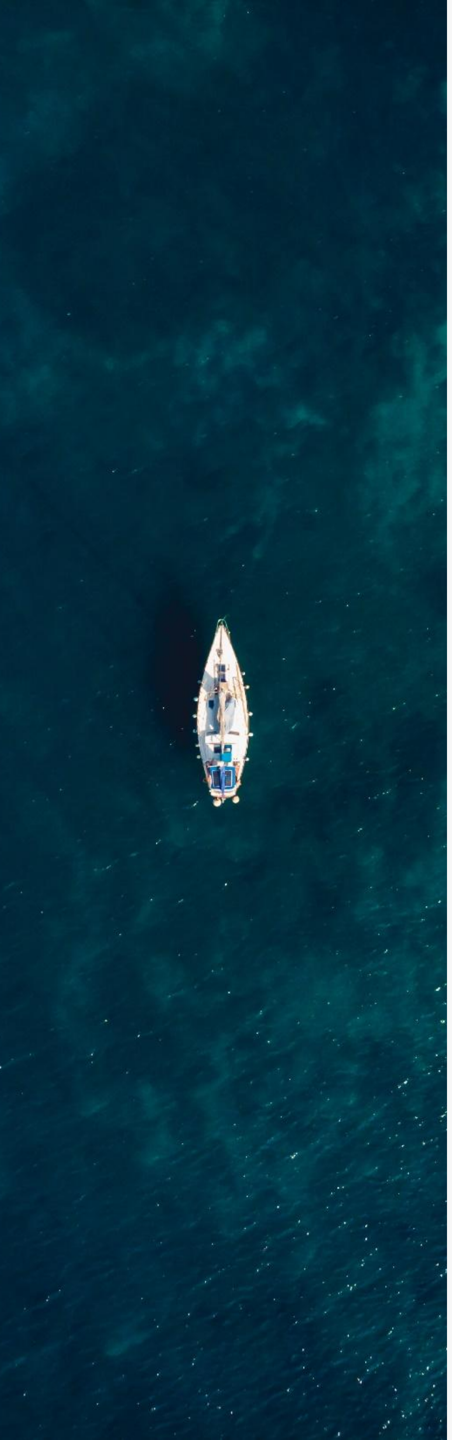
These relationships are the result of a complex system of antagonisms and synergisms. Among the antagonisms are interactions with phytophages, parasites, phytopathogens, agents of allelopathy, or, more simply, competition with other plants occupying the same ecological niche.

Synergisms include interactions with mutualistic symbionts and agents of stimulation.



Control parameters

Compared to conventional techniques, hydroponics shows significant advantages as contact with soil pathogens (in particular nematodes, agents of basal rot and trichomycosis) is eliminated at the source.



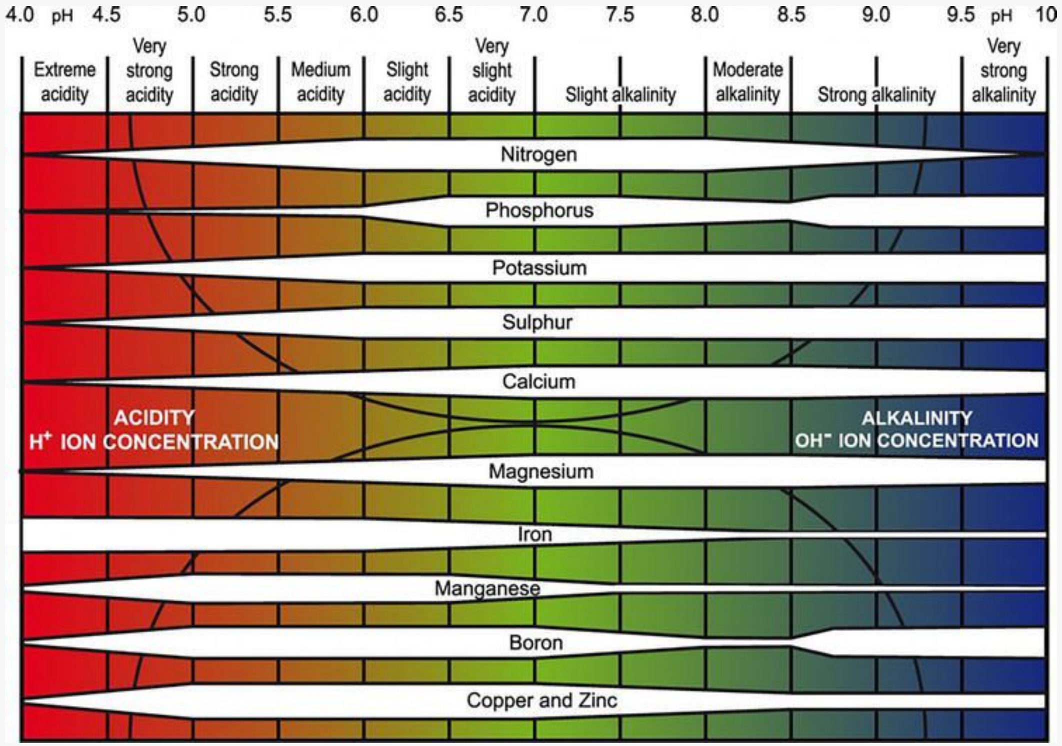
Control parametres

PH level of the nutrient solution

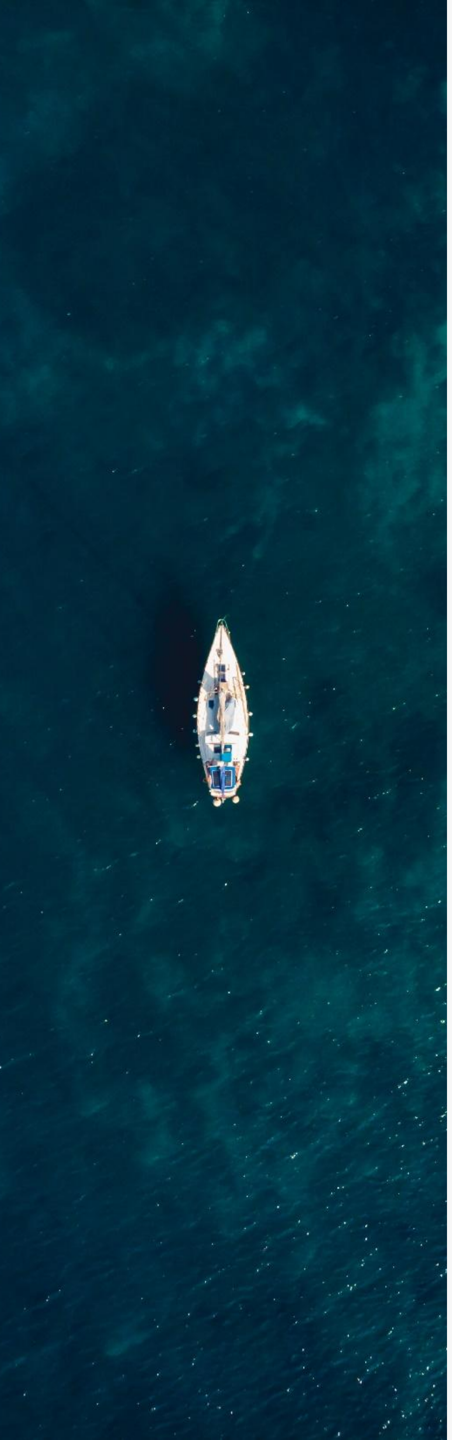
This is fundamental for maintaining the solubility of elements and optimizing the exchange processes between the roots and the nutrient solution.

Nutrient solution pH is typically managed between 5.5 and 6.5, and it seems to be a range where almost all hydroponically grown crops exhibit normal growth and nutrient uptake, and the optimum pH range for different crops grown hydroponically

A pH deviating from the optimal range worsens the nutritional status of plants due to chemical or physiological immobilization of one or more mineral elements.



The nutrients added to the nutrient solution are available for the uptake by the plant are soluble in water only at particular pH levels



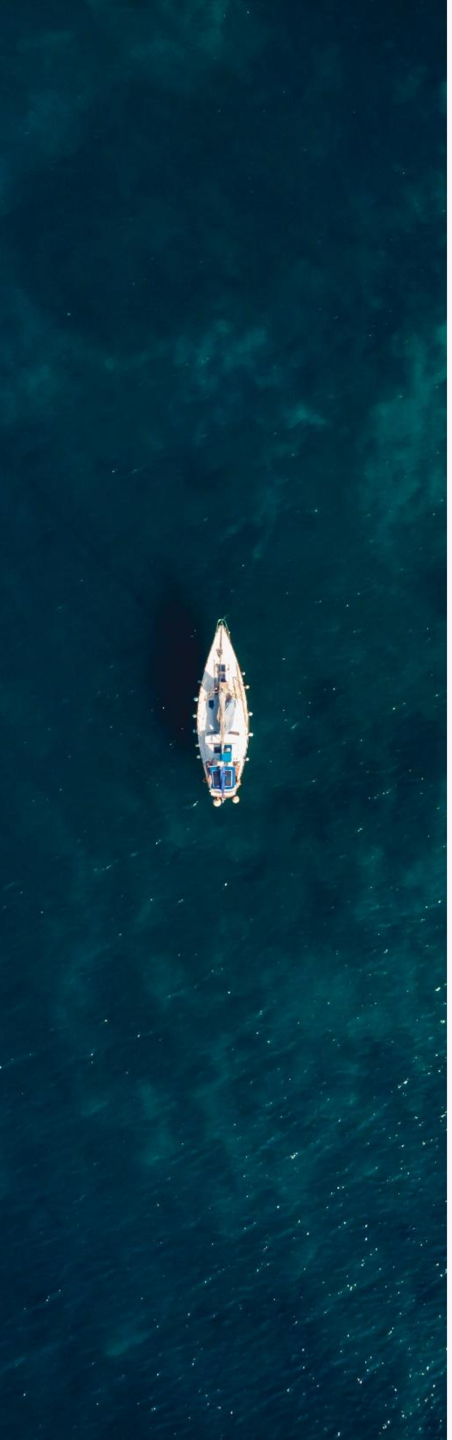
Control parametres

PH level of the nutrient solution

However, species-specific pH responses of leafy greens grown in liquid culture hydroponic systems are largely unexplored.

However, the optimum pH for maximum growth differs not only between species, but also between cultivar, climatic conditions, and soil, substrate, or nutrient solution conditions

In general, the pH of the plant root environment is affecting nutrient uptake, nutrient availability, ion antagonism, ionic species present, and solubility of fertilizer salts.
Due to this, it is important to measure and maintain the pH value to the required level because a little drift in the pH value can make a lot of nutrients unavailable for the plants

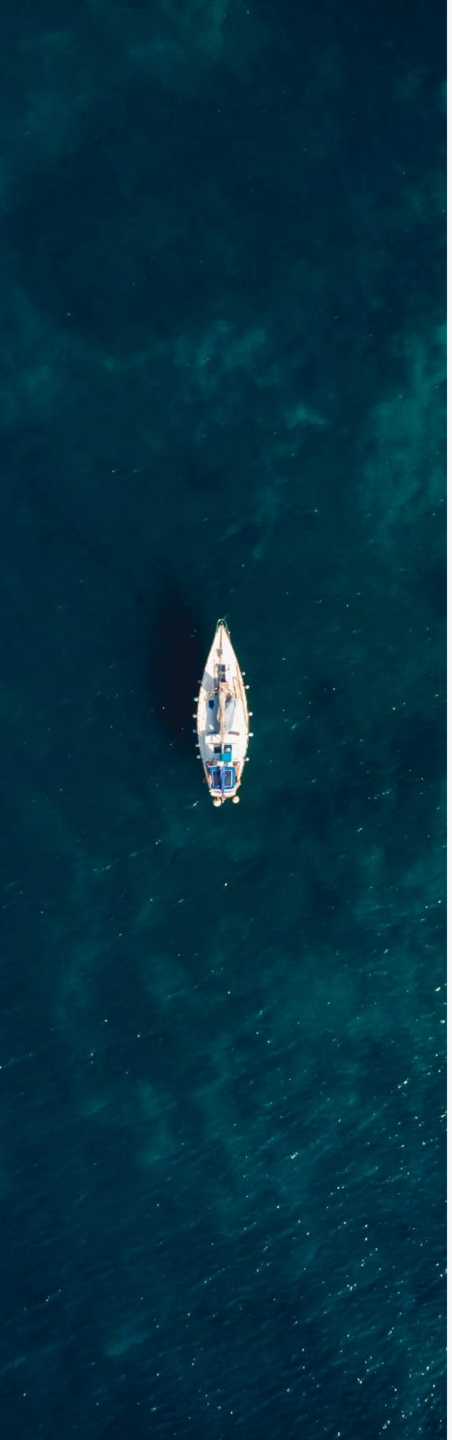


Control parametres

ELECTRICAL PRODUCTIVITY

A low conductivity is related to an excessive dilution of the solution, so the plants are in a condition of deficient mineral nutrition.

An excessively high conductivity is correlated to a high concentration of the solution and an excessively high osmotic tension (in absolute value): within the critical thresholds the plants show suffering and consume energy resources to overcome the osmotic potential to the detriment of the productive yield, beyond the critical thresholds the root uptake stops resulting in withering or wilting.



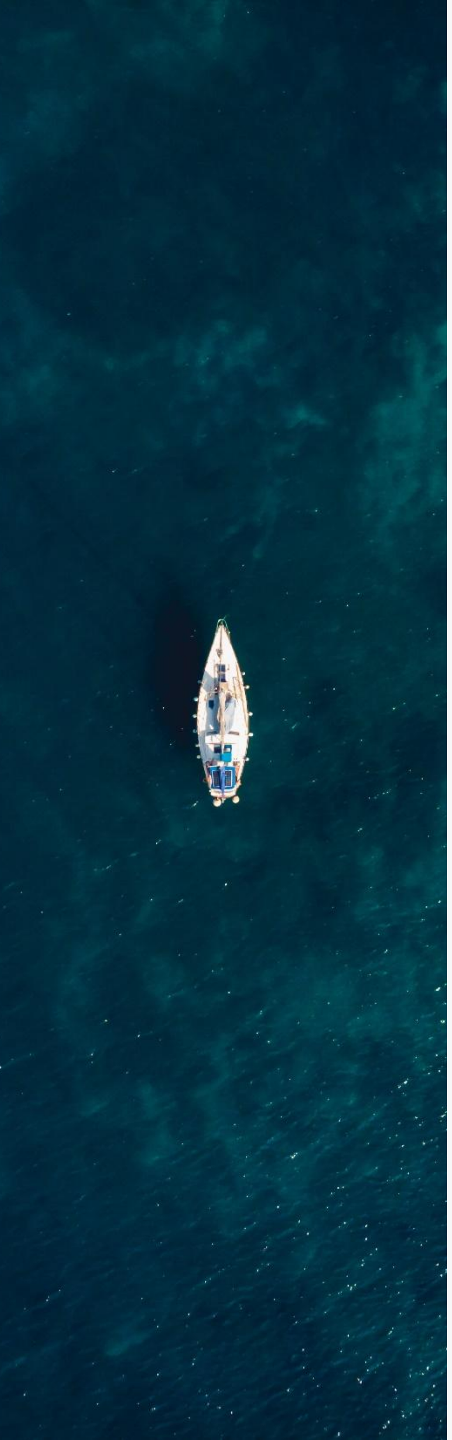
Control parametres

FLOW RATE, TIMING
& DISPENSING CYCLES

These are the parameters by which mineral nutrition is controlled overall through the replacement of the solution in contact with the roots.

Excessively frequent dispensing and too high volumes (in relation to flow rate and duration of dispensing) increase economic and environmental costs as excess solution is lost through drainage unless the system is equipped with a system to recycle excess solution.

Thinning out and too low volumes reduce production yields because the nutritional state of the plants is not optimal.

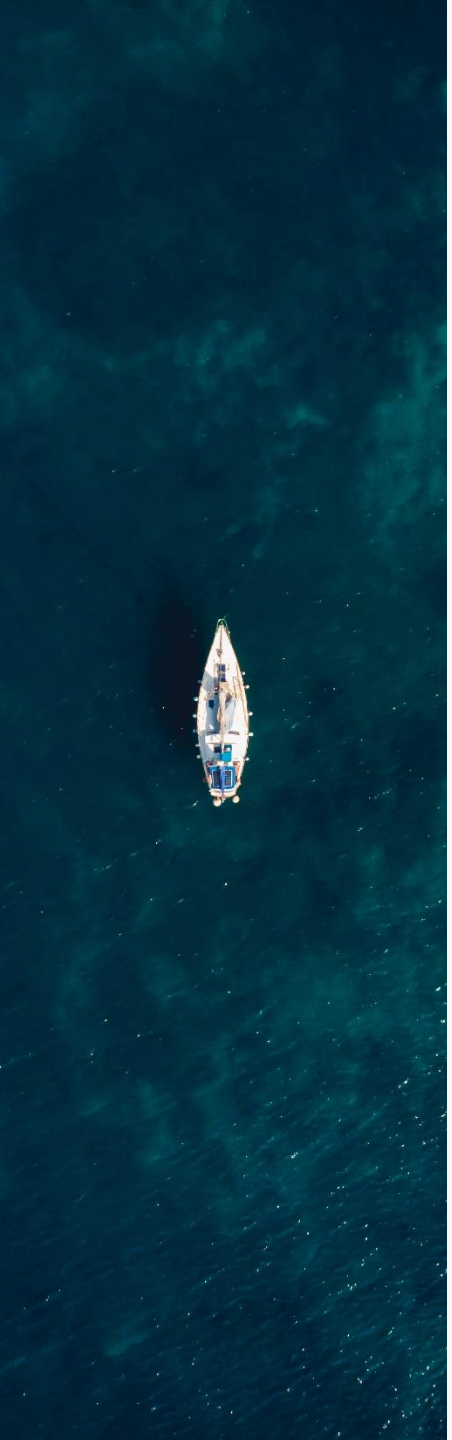


Control parametres

CHEMICAL COMPOSITION OF SOLUTION

This is used to check the nutritional balance of the plants compared to the various nutrients, the antagonism ratios between potassium and alkaline earth metals, and the solubility of the various salts.

Since plants require different fertilizer ratios depending on the species, type of production and quantitative/qualitative yield ratio,



Control parametres

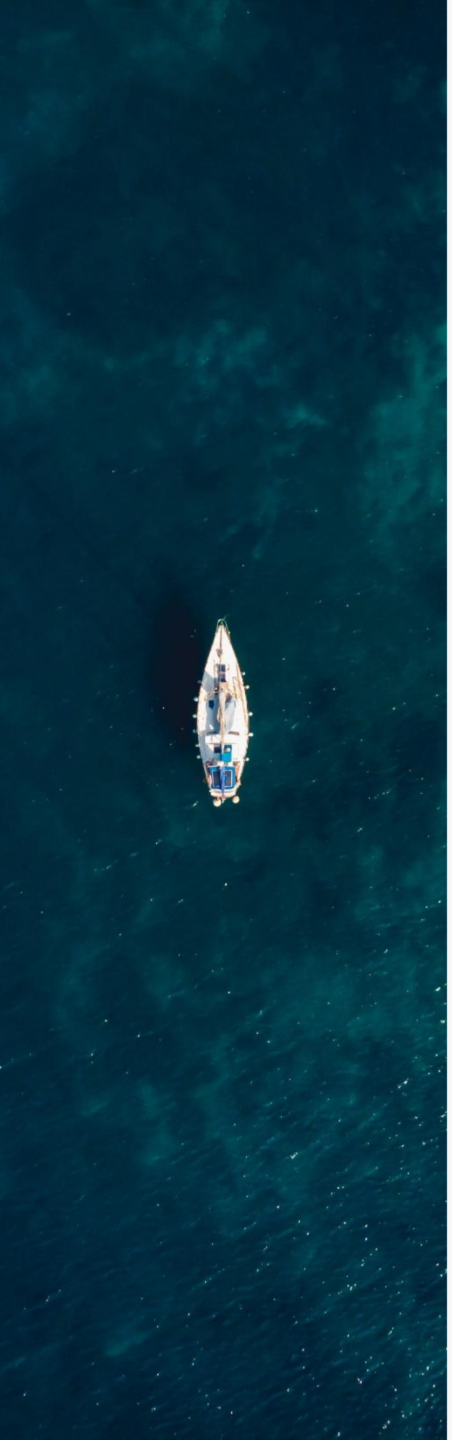
CHEMICAL COMPOSITION OF SOLUTION

The composition of the solution is crucial in achieving the objectives.

Fertilizers with high water solubility must be used to prepare solutions.

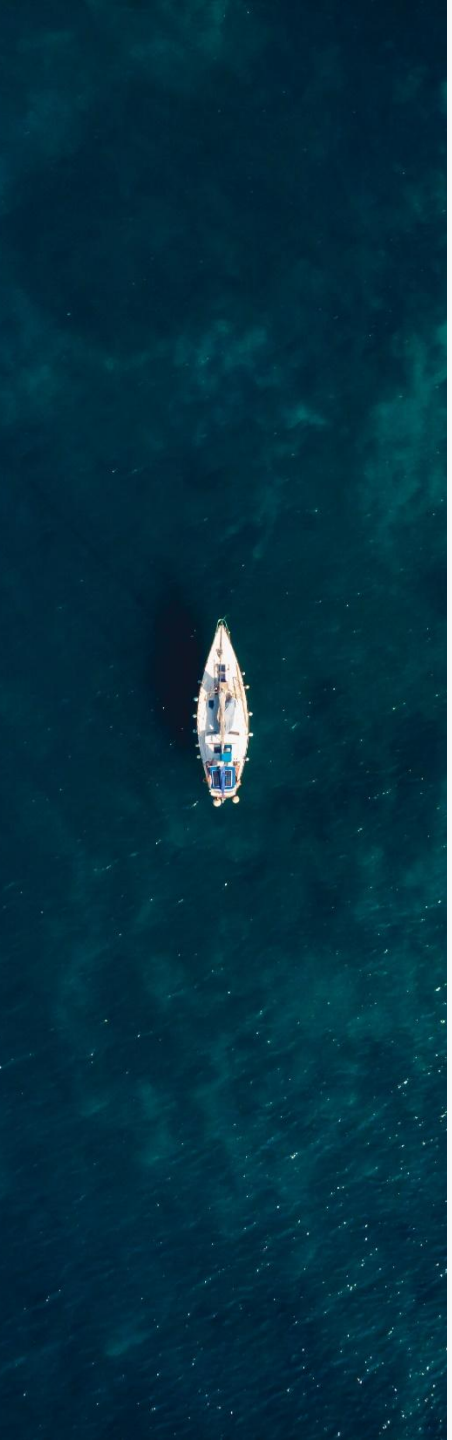
The preparation must respect a priority in the sequence starting with the less soluble salts, and fertilizers using two mother solutions are preferable, keeping the less soluble salts separate from the more soluble ones.

For certain trace elements, chelating formulations are preferred.



Above-Ground Cultivation

Above-ground cultivation is essentially based on a reduction of the variables at play and, above all, of mutual interference by replacing the soil with a physical environment in which parameters are easier to control.



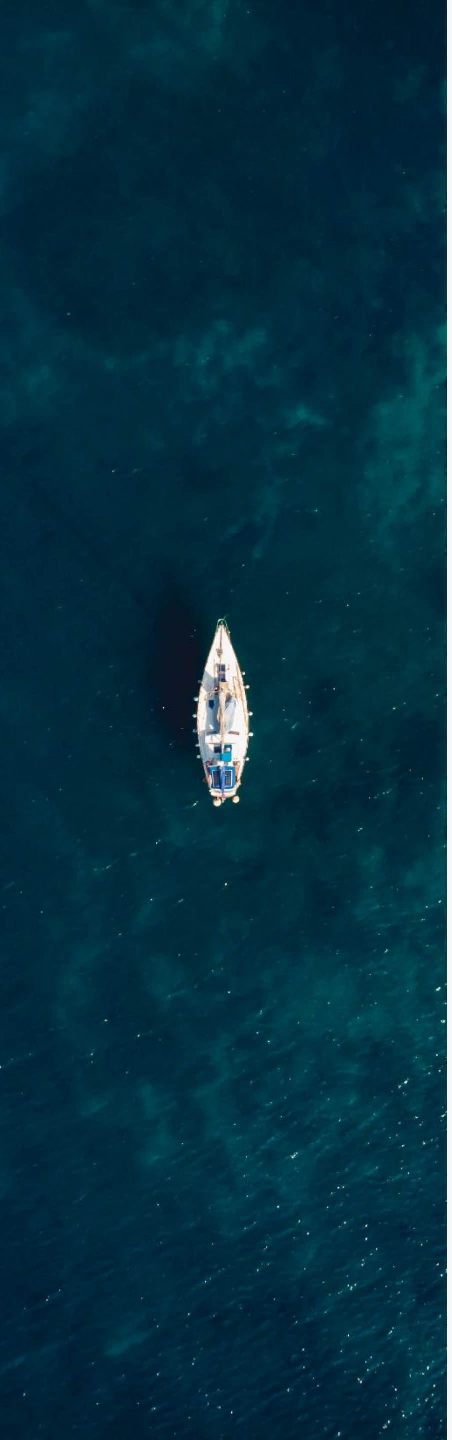
Above-Ground Cultivation

PROTECTIVE FUNCTION

The 'protective function' of the roots against weathering is performed by an inert and tendentially aseptic solid substrate.

The substrate has no anchoring function. The plant does not need to expand its root system because the anchoring function is lost and it finds the water and mineral salts it needs in the immediate vicinity, and the roots must be almost in contact with the atmosphere to avoid root asphyxia phenomena.

In some hydroponic growing techniques, the substrate is therefore entirely replaced by a thin liquid film in which the roots develop.



Above-Ground Cultivation

ANCHORING FUNCTION

The 'anchoring function' is replaced, if necessary, by a system of wires that keep the plants suspended, i.e., the anchoring of the plant is ensured by attaching its aerial apparatus to a suspension system.

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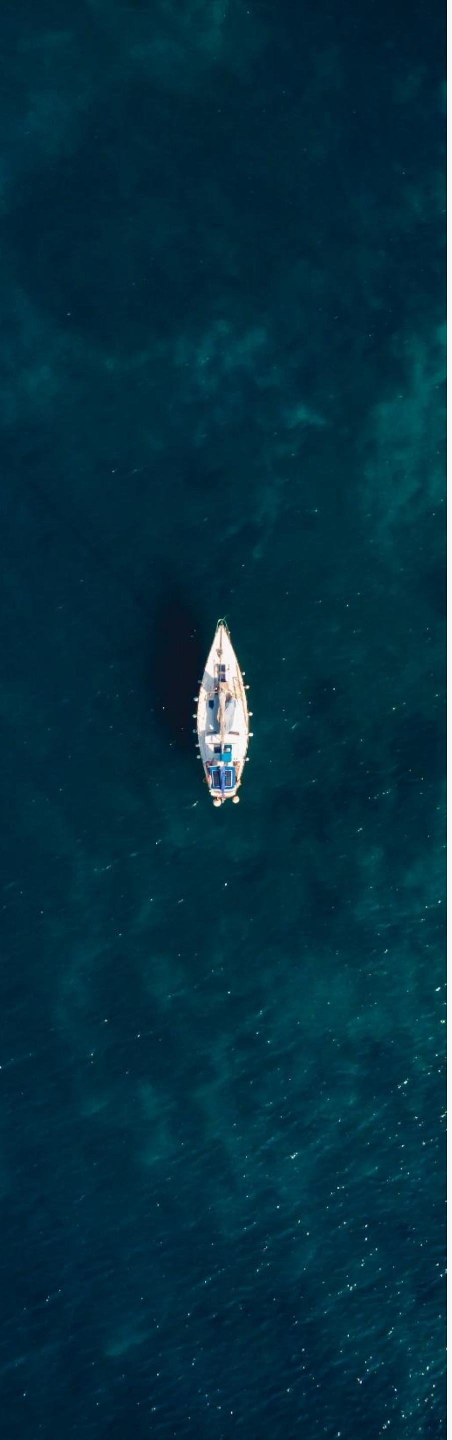
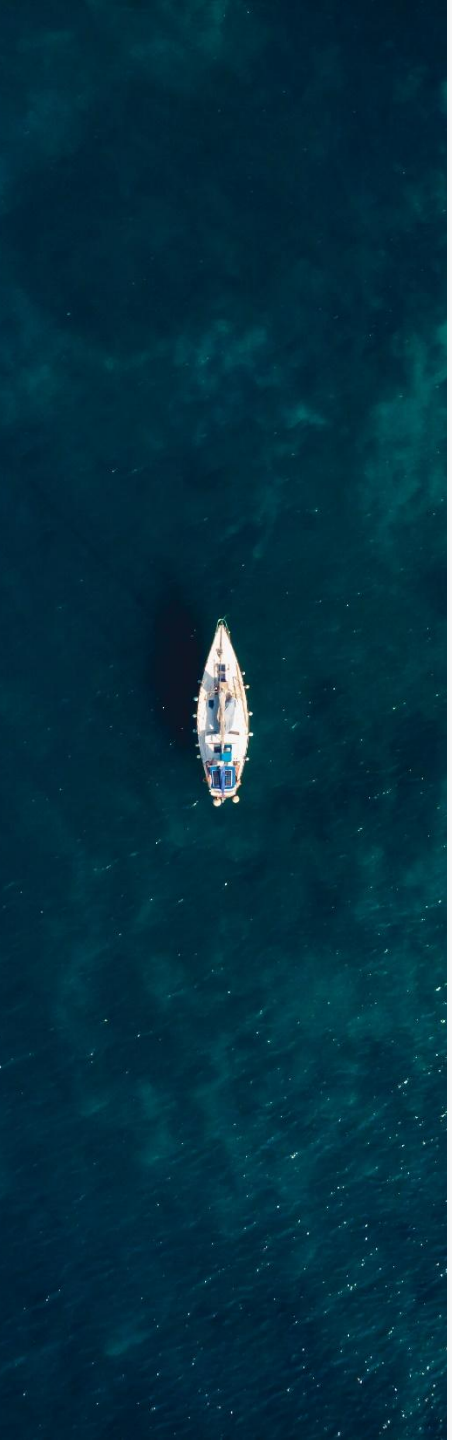


Above-Ground Cultivation

TROPHIC FUNCTION

The 'trophic function' of the soil is fully replaced by the supply of a nutrient solution by means of a fertigation system, in which irrigation water is used as a carrier of mineral salts.

The substrate must be chemically inert in order to avoid interference of chemical factors (e.g. ion exchange and pH) with the parameters controlled by fertigation.

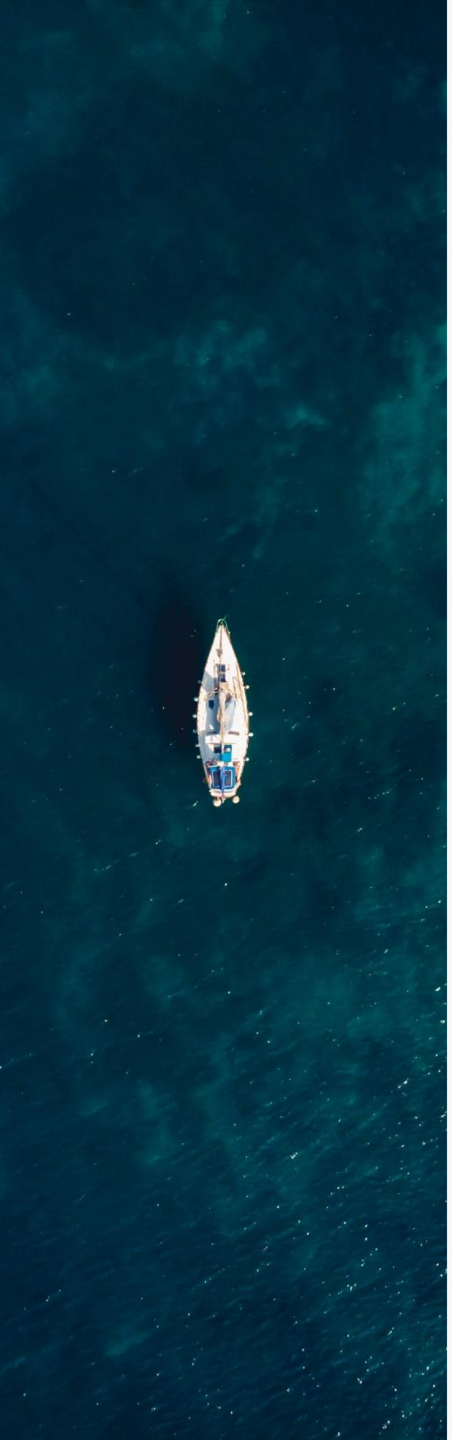


Above-Ground Cultivation

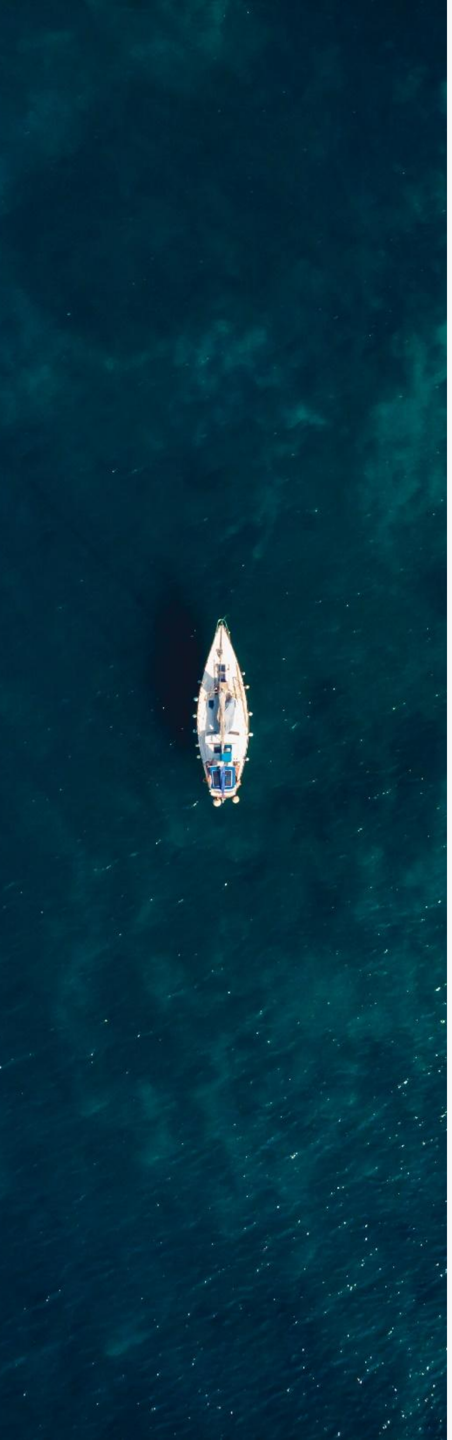
ECOLOGICAL FUNCTION

The 'ecological function' of the soil is completely canceled out by hydroponics.

Since the prerequisites for the creation of a favorable biocenosis do not exist, the substrate that replaces the soil is completely inert from a biological point of view, and the medium only accommodates the roots of the cultivated plants.



Food is essential to human life

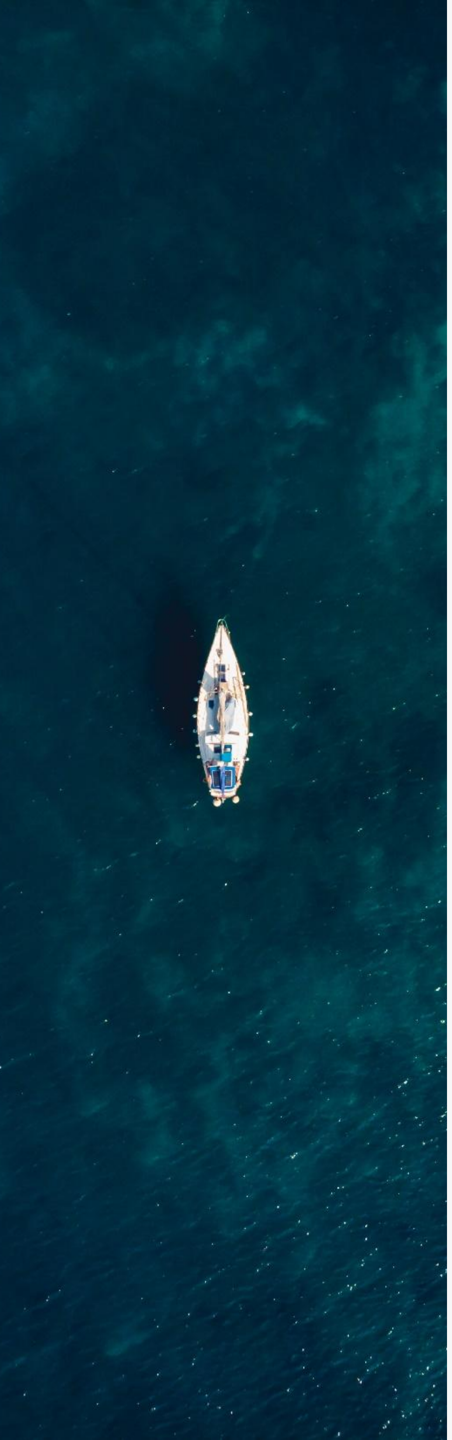


The Agri-food Sector

Food – an essential component of a sustainable global future

The agrifood sector has a strong cultural and social importance considering its strong tradition and the contribution of the sector to keeping rural economies alive and maintaining rural areas and landscapes across the EU and beyond.

Food has also become very topical in the light of COVID-19 and Russia's invasion of Ukraine as the importance of resilient food systems and food security has risen dramatically in Europe.

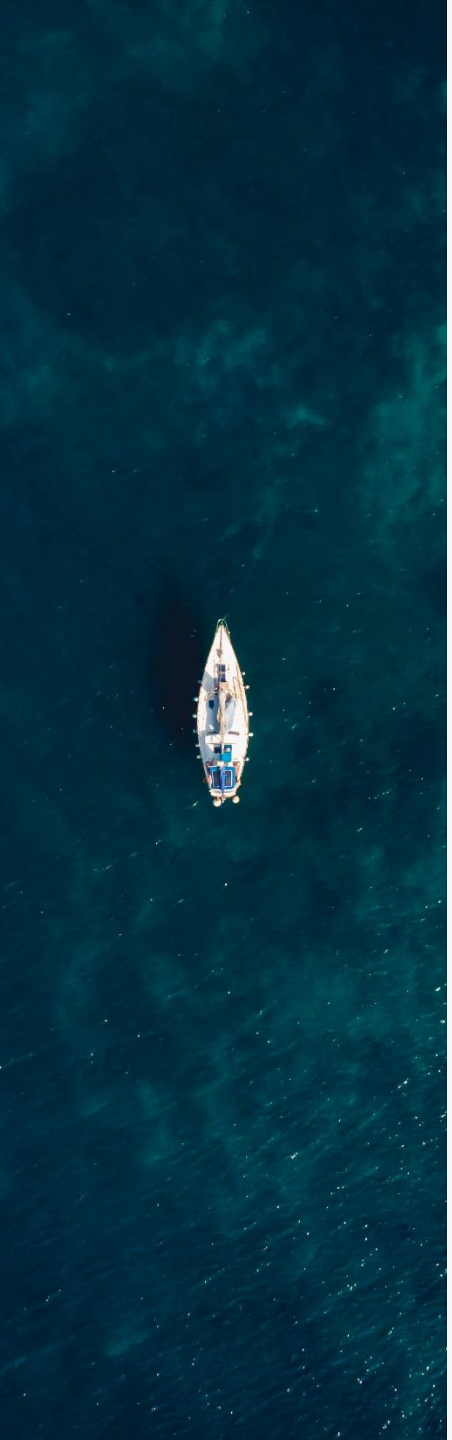


The Agri-food Sector

Food – an essential component of a sustainable global future

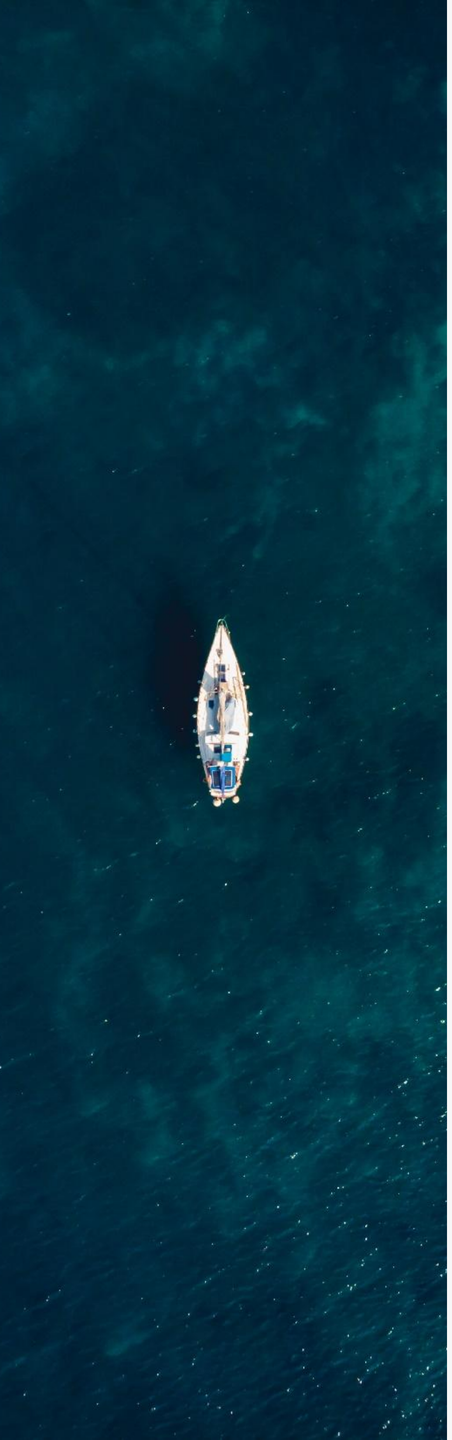
The well-being of the agrifood sector is connected to the well-being of humankind. **Multiple UN Sustainable Development Goals (SDGs)** - “*Zero Hunger*”, “*Good Health and Well-Being*” and “*Ensure sustainable consumption and production patterns*” - are directly linked to the global food system.

These SDGs are the blueprint for achieving a better and more sustainable future for all.



“The world is moving backwards in its efforts to end hunger, food insecurity and malnutrition in all its forms”-

2022 Report, Food and Agriculture Organizations (FAO) Report



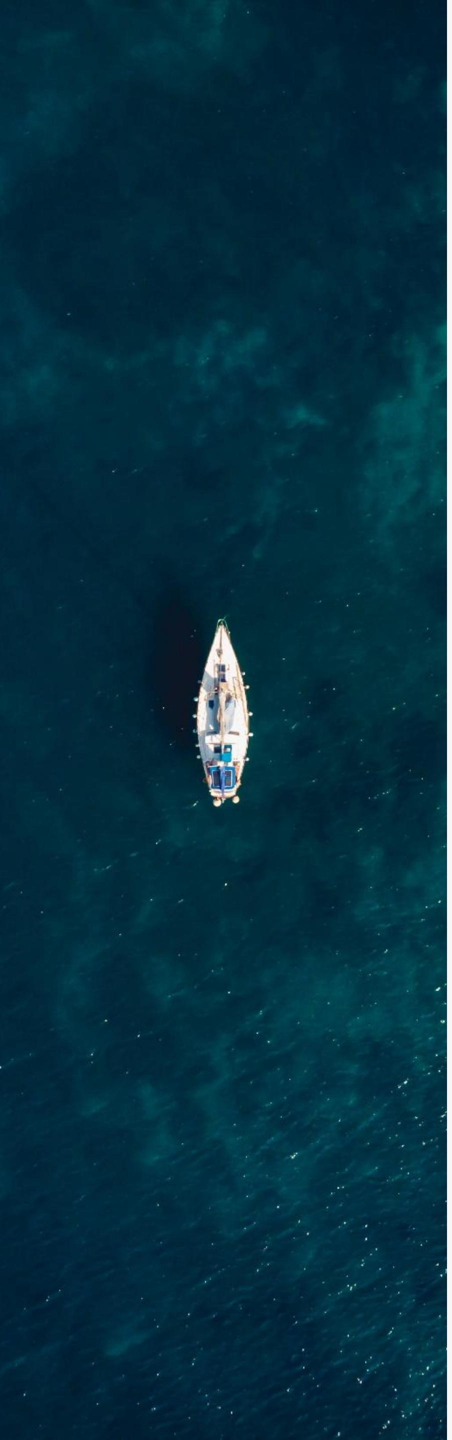
The global food situaton

Around 39% of the world's adult population is overweight and 39 million children under the age of 5 were **overweight or obese** in 2020(WHO).

Almost 3.1 billion people could not afford a healthy diet in 2020 which was 112 million more than in 2019, reflecting the **inflation in consumer food prices** stemming from the economic impacts of the COVID-19 pandemic and the measures put in place to contain it (FAO).

Almost 20% of the total food produced each year is lost or wasted in the EU. This accounts for 88 million tonnes or 173 kg/per person of **food wasted** with an estimated cost of 143 billion.

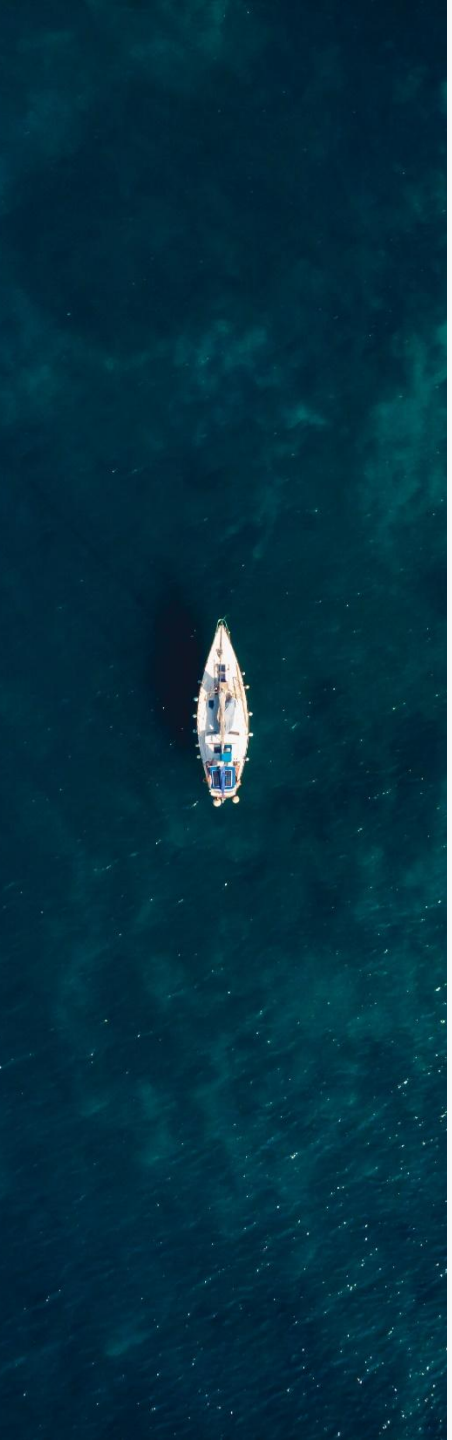
Food waste is also responsible for about 10% of **global greenhouse gas emissions.**



The global food situation

According to *EIT Food* preventing food loss and food waste at scale, would offset huge amounts of environmental damage and biodiversity loss as well as increase the accessibility of food for food insecure populations.

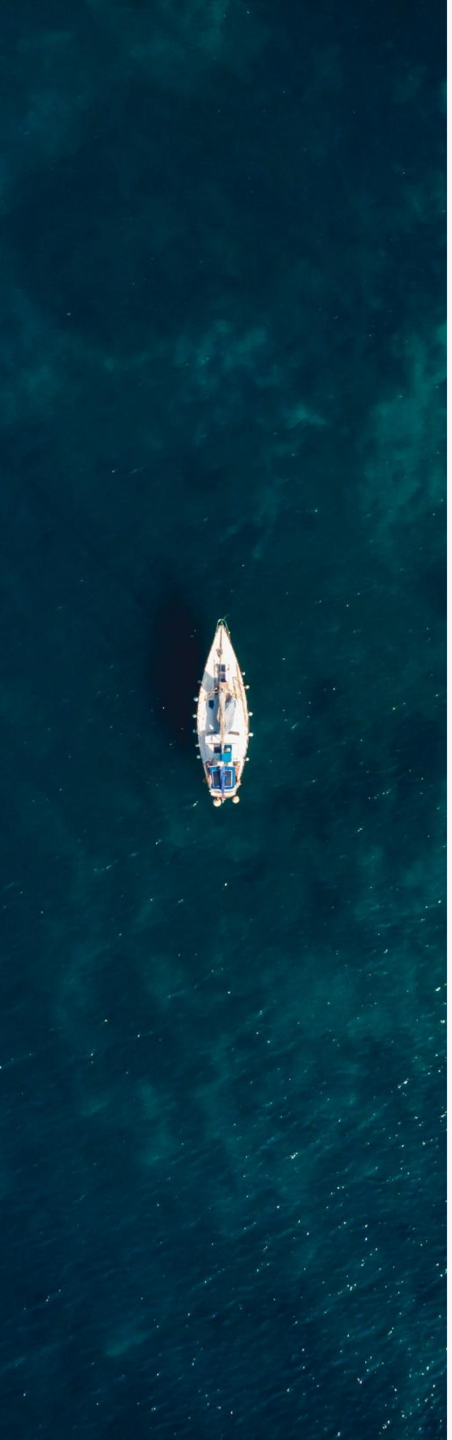
Furthermore, according to the *European Commission* food consumption is the main driver of negative environmental impacts generated by households in the EU, followed by housing (especially space heating) and mobility (particularly the use of private cars).



The food sector as a whole is a complex network made up of vast supply chains

The agri-food chain consists of multiple *NACE classification* sections: “Agriculture, forestry and fishing”; “Manufacturing”, “Wholesale and retail trade”, and “Transportation and storage”, “Accommodation and food service activities”

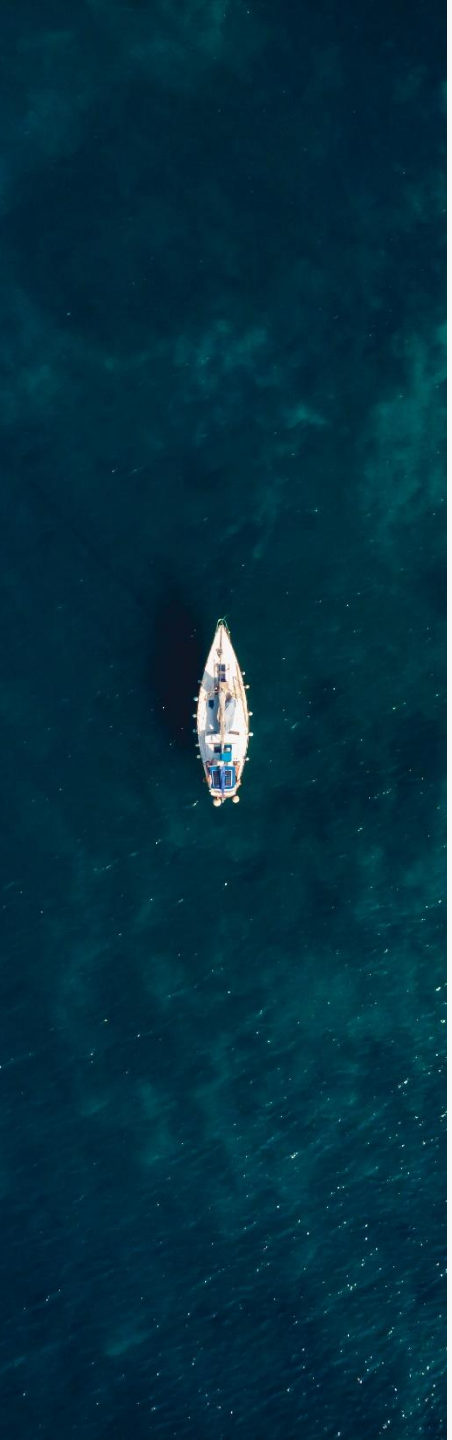
NACE (Nomenclature of Economic Activities) is the European statistical classification of economic activities.



The food supply chain

The food supply chain is a major source of jobs and economic activity. People are employed in producing, preparing, processing, packaging, storing, transporting and selling.

According to the *European Commission* the farming and food sectors together provide nearly 40 million jobs in the EU.

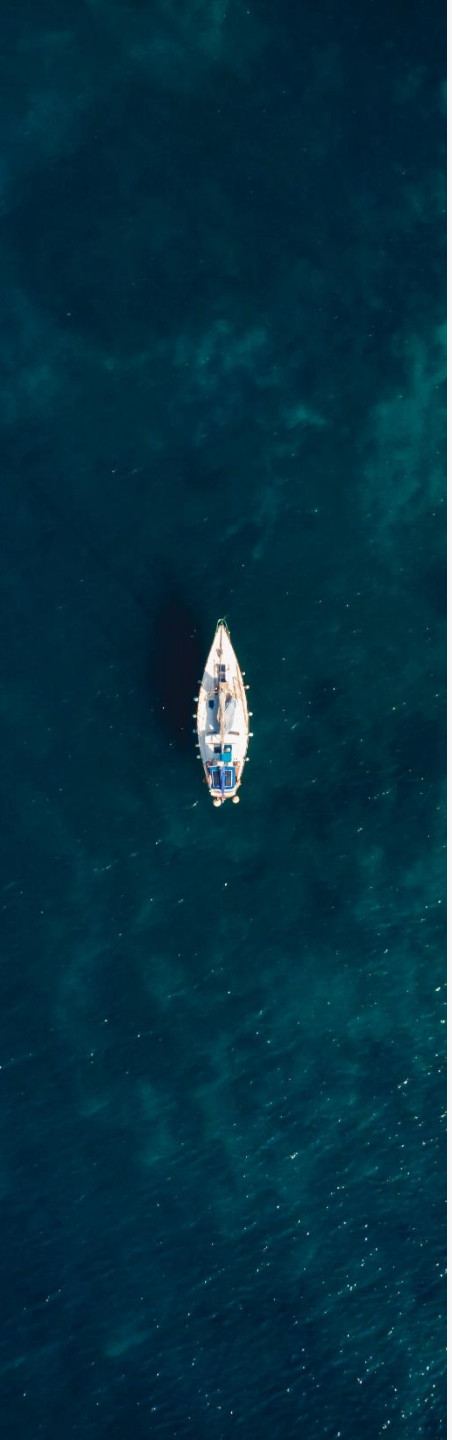


Challenging times for Agri food SMEs

Agricultural businesses are unique in the sense that they depend more on the **weather and climate** than many other sectors and that there is an "inevitable time gap" between consumer demand and farmers being able to supply.

Other challenges:

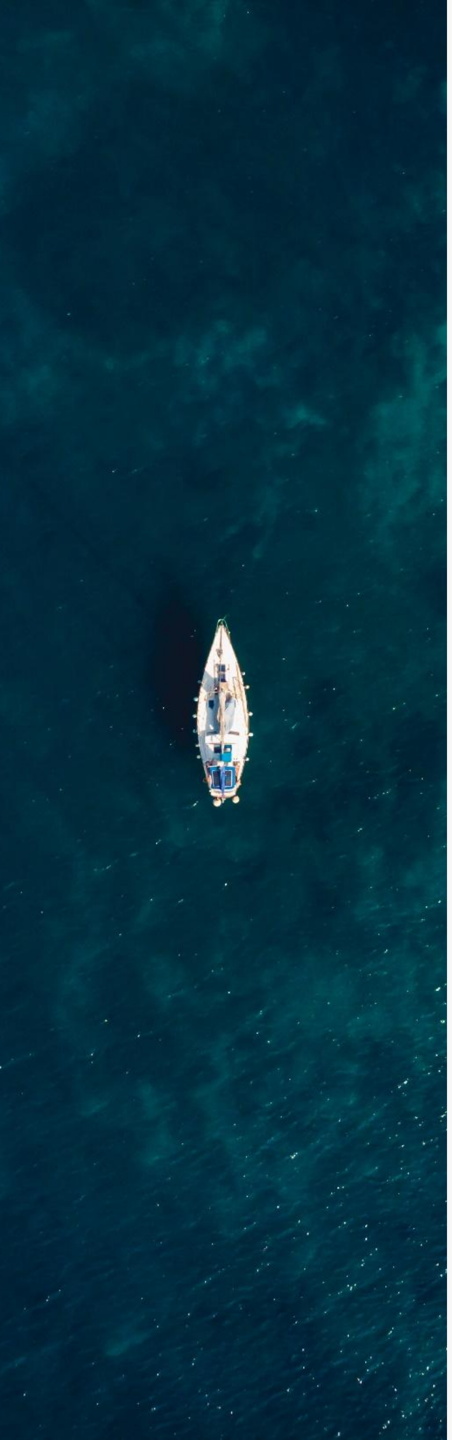
- Greener and smarter solutions transition from businesses is expensive and not without its risks for the businesses;
- Access to financial resources and pricing and payment conditions;
- Scale of production and workforce skills.
- Brain drain in the rural areas
- Missing cooperation culture, and unwillingness to network and involve external partners in the company's processes



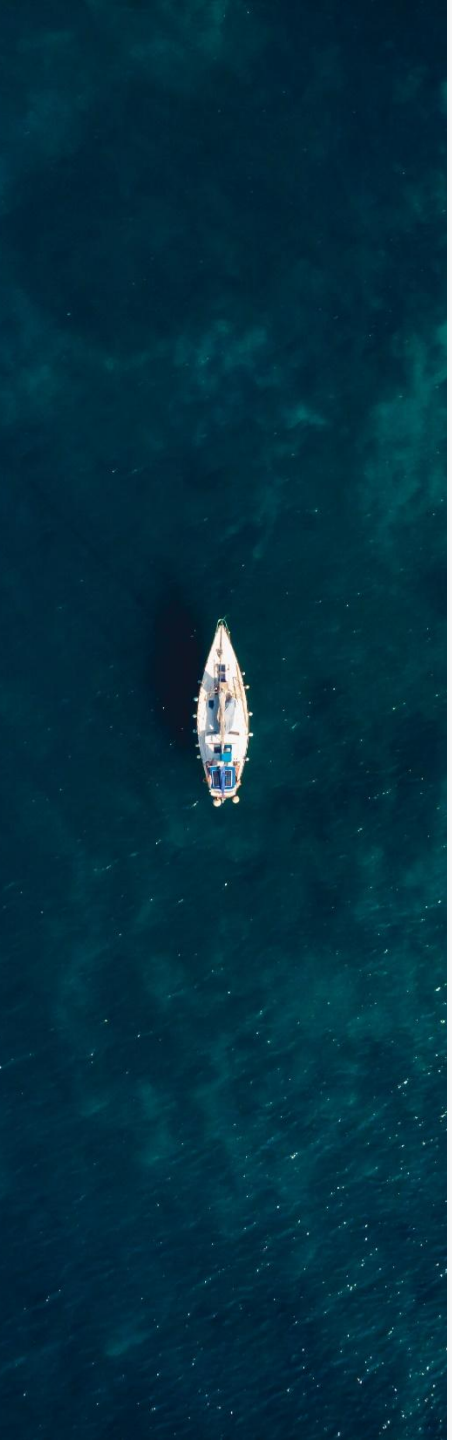
New trends in the Agri food SMEs

Existing Agri food SMEs need to adjust to the changing conditions to remain competitive.
It also means that new innovative food startups can emerge.

- Digitalization,
- Personalized nutrition and sustainability
- Innovation
- Organic farming
- Improving opportunities for **women and younger farmers,** and respecting their experience in land stewardship and food production.
- Addressing **sustainable livelihood** of **farmers and rural communities needs**



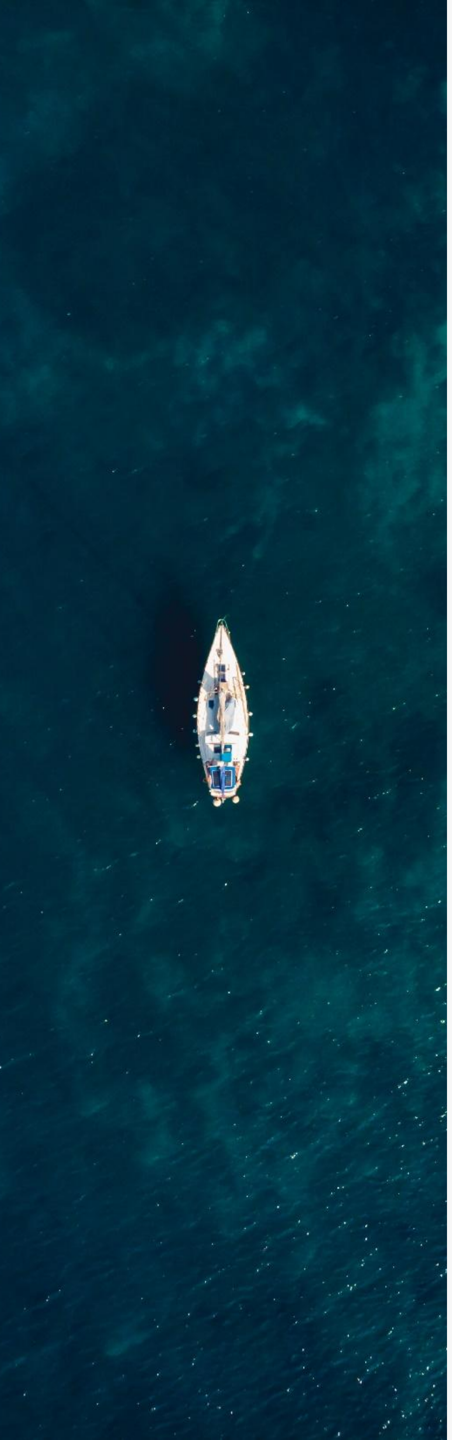
The Short Food Supply Chain



Shortening the supply chain

Smooth cooperation along the food value chain is especially important for reducing costs and food waste.

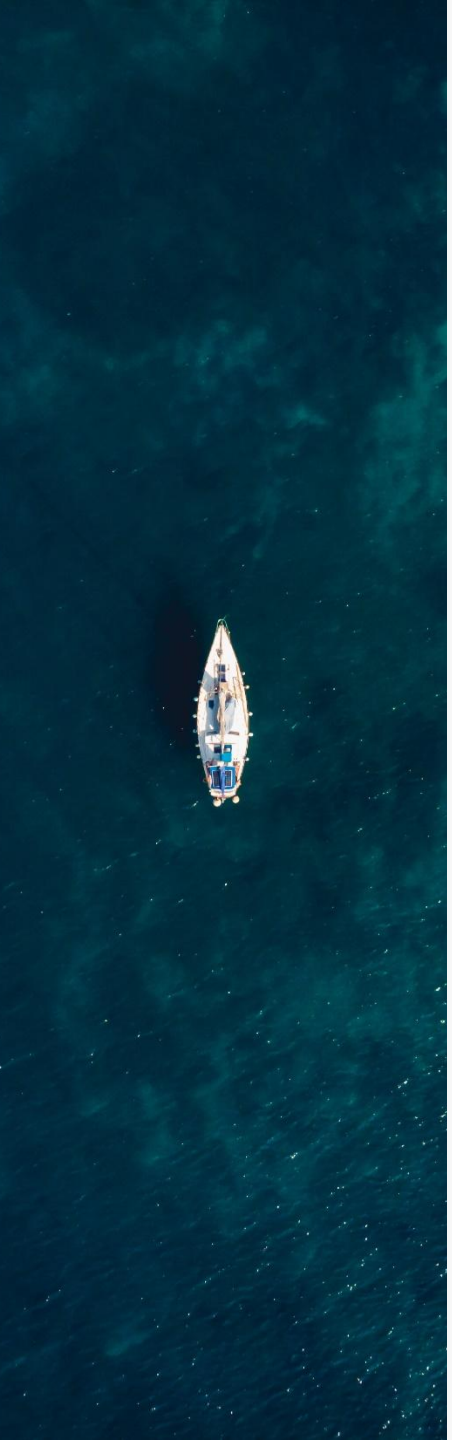
In light of COVID-19 and global conflicts disrupting pre-existing value and supply chains, it has become more important to set up shorter local and pan-European value chains in the food sector.



Shortening the food supply chain

A new process of revaluation of the local product

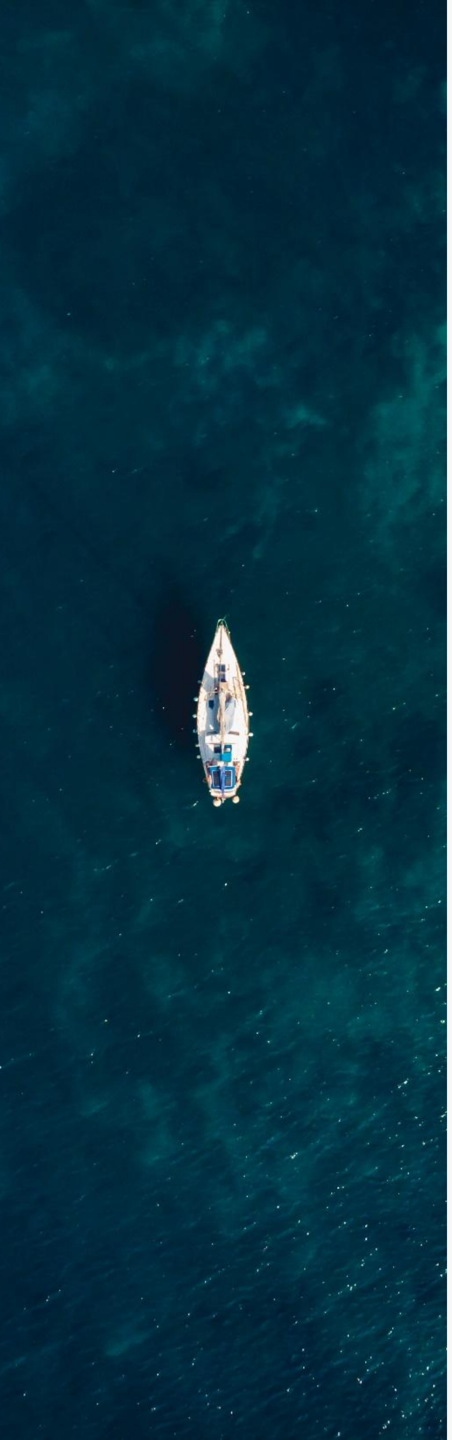
A short food supply chain (SFSC), as defined by the EU, is a supply chain involving a limited number of economic operators, committed to cooperation, local economic development, and maintaining close geographical and social relations between food producers, processors and consumers.



Different forms of SFSCs:

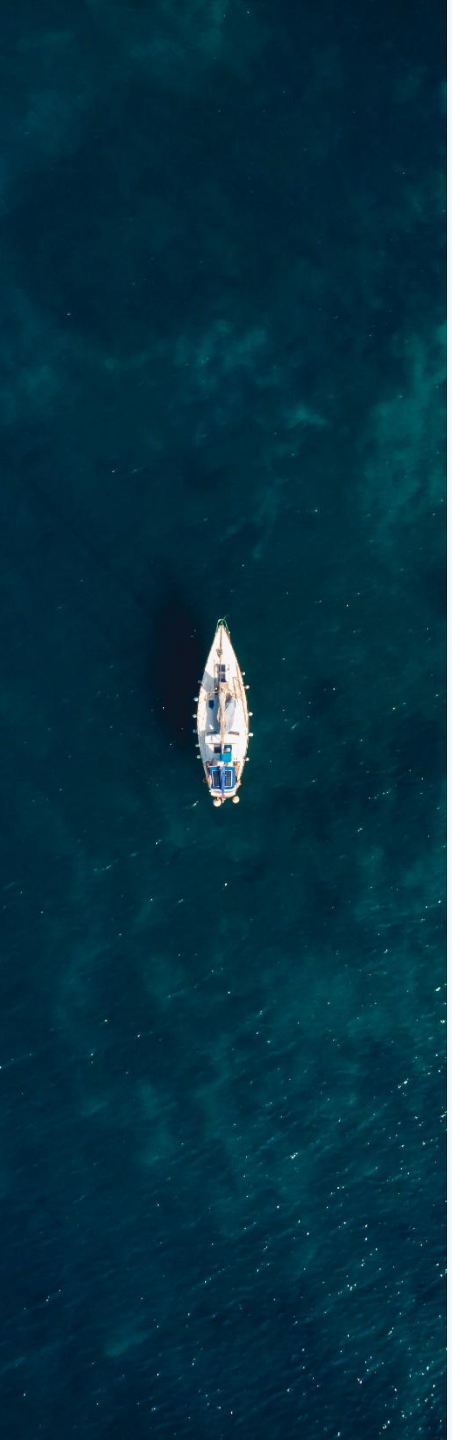
- Direct sales from the farmer to the end-consumer (on-farm, farmers' markets, internet deliveries).
- Box delivery schemes,
- 'Pick your own' and community-supported agriculture (CSA), where consumers financially support local growers by purchasing a 'subscription' to their fresh produce for a particular growing season.

The main products typically traded in a SFSC are fresh seasonal fruit and vegetables, followed by animal products (mainly meat, fresh and prepared) and dairy products as well as beverages.

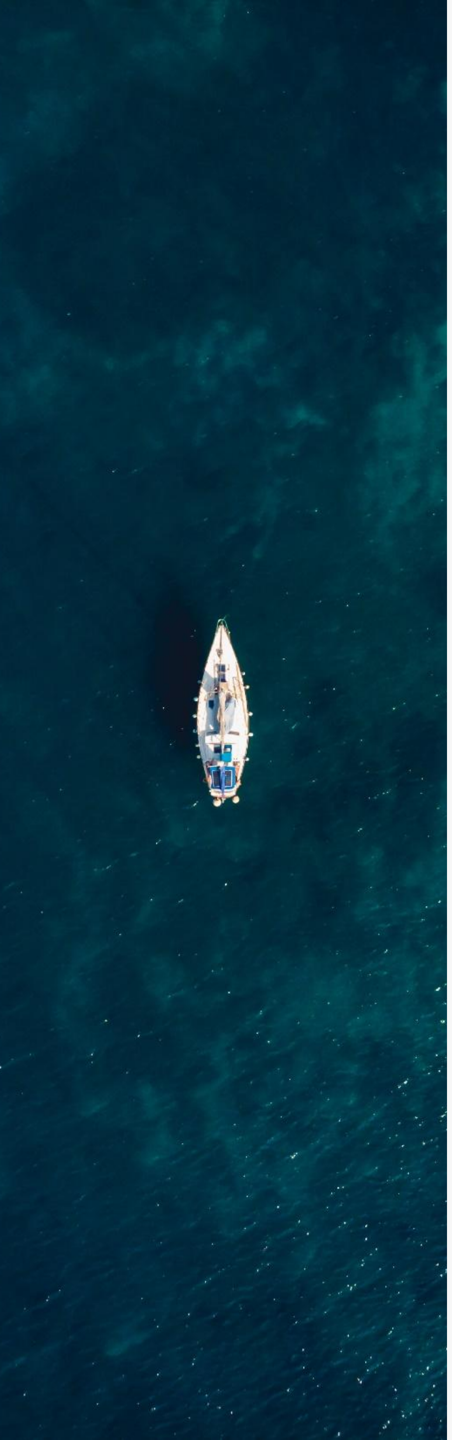


The multifunctionality of agriculture

- Cultivation and sale of organic products where the obvious strength lies in the concept of auxiliary energy
- Offering fresh and genuine products free of chemicals, reducing environmental impact through short supply chains
- production diversification
- Recovery of traditional plant varieties and craftsmanship
- Valorization of rural landscape and maintaining the vitality of rural communities



The value of forestry and fishing production

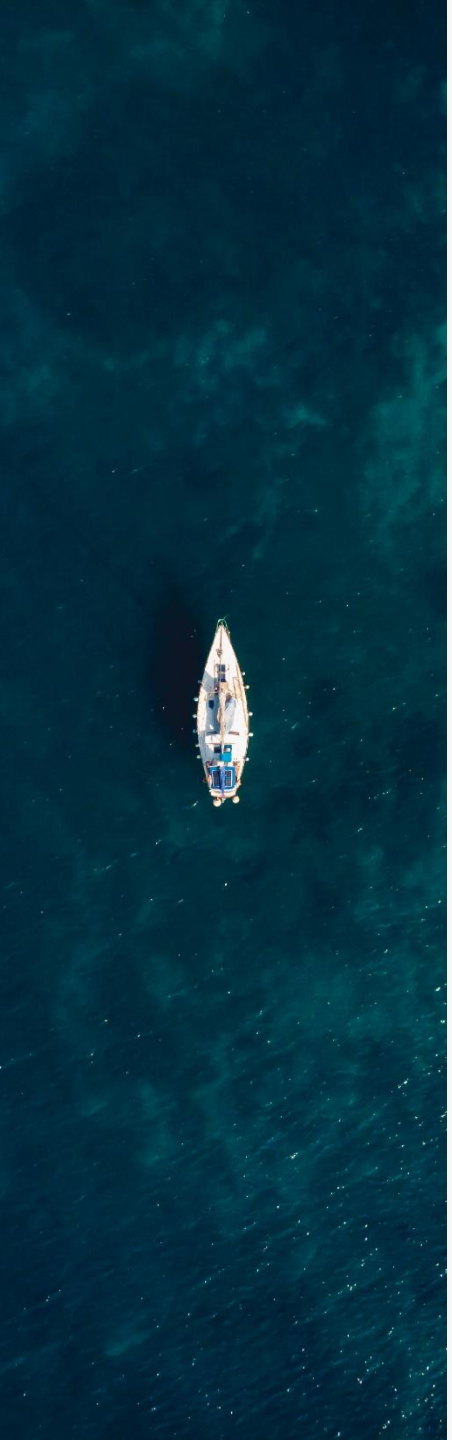


Forestry

Nearly one-third of the global population depends on forest goods and services to provide food, woodfuel, building materials, medicines, employment and income.

Cooking is a primary means to ensure proper nutrient absorption, and globally 2.4 billion people make use of woodfuel for cooking and for sterilizing water.

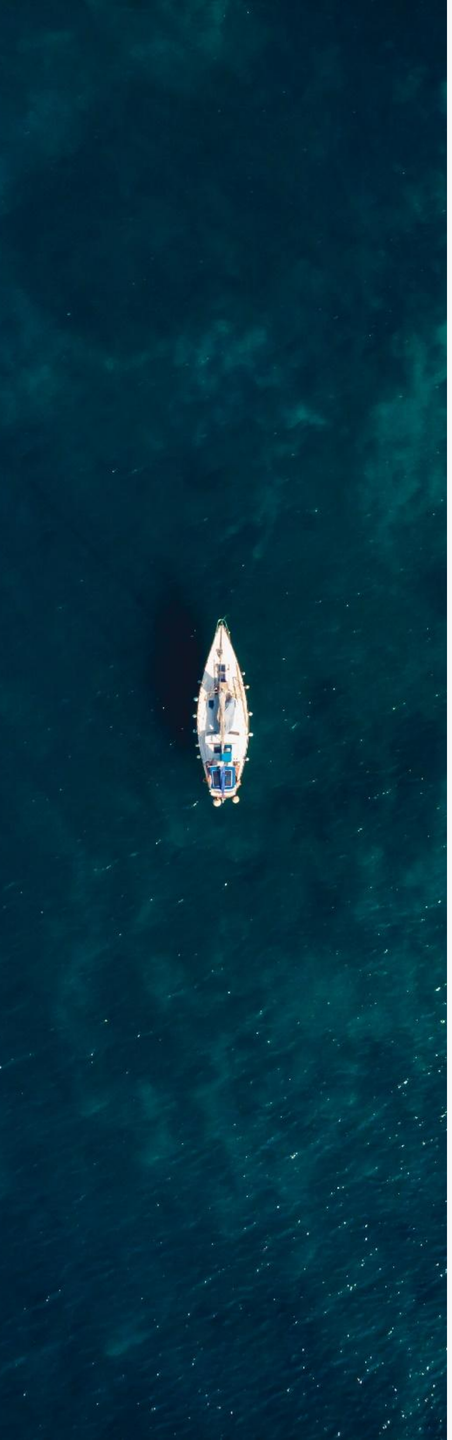
Forest's role in the maintenance of biodiversity as a "gene pool" for food crops helps to secure the diversity needed to promote adequate quality of diets.



Forestry

Wild foods from forests provide nutritious food to millions of rural women, men and children.
Wild animals and edible insects from forests are often the main source of protein for rural populations.

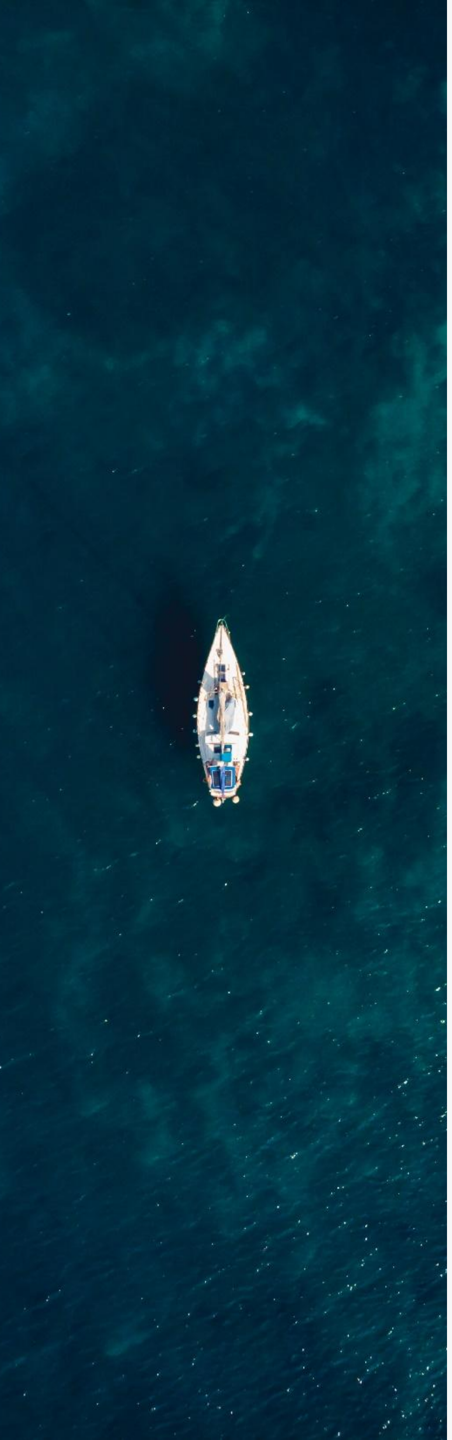
Some countries have shown that increasing forest cover while achieving food security and nutrition is possible by putting simultaneously in place sound food security and forest policies.



Forests' contributions to food security and nutrition

HOW?

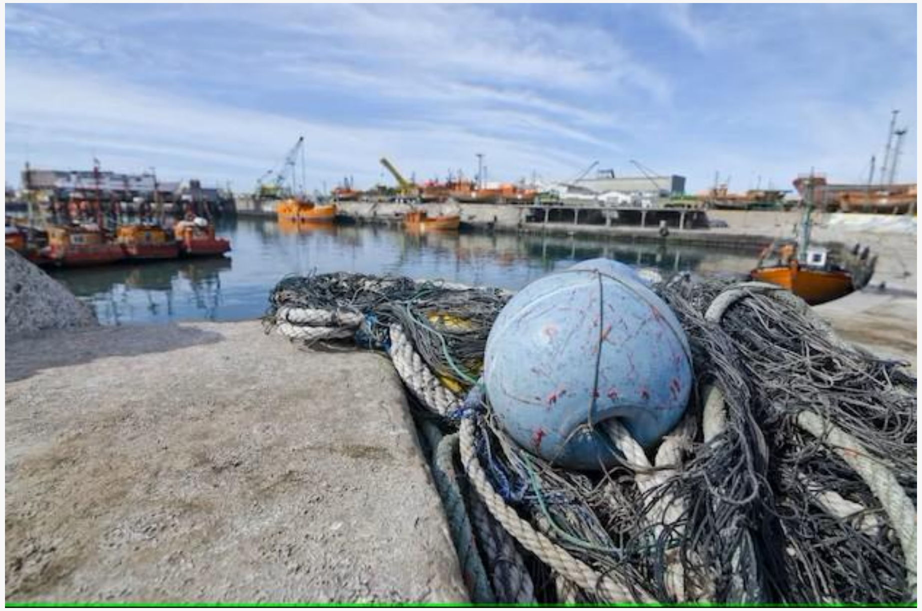
- Keeping healthy forests is essential to provide the sustainable ecosystem services that are required for food security and nutrition.
- Improved land governance combined with institutional and tenure reforms as well as political will are necessary to reduce the current rate of forest degradation and increase the contribution of forest resources to food security and nutrition.
- Forest policies need to ensure that food security and nutrition objectives are integrated into forest management practices.
- Secure forest tenure, community-based forestry, agroforestry, adapted forest management practices, small and medium-sized enterprises and capacity development are some of the measures that can significantly enhance the contribution of forests to food security and nutrition.

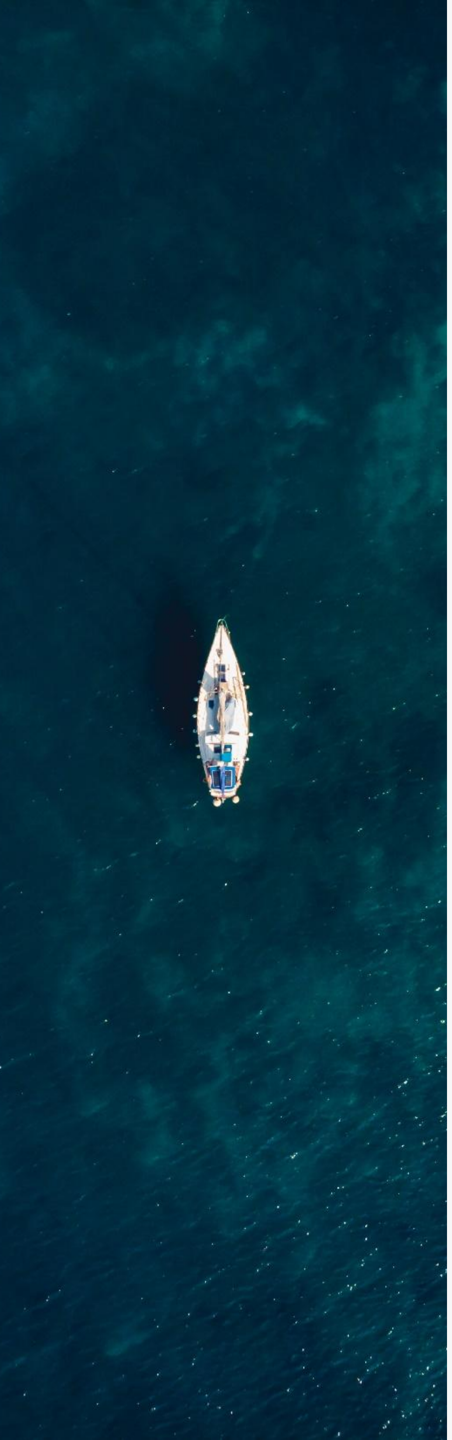


Fisheries

The Main Challenge of fisheries

Create a balance between maximising the social and economic potential of the fisheries industry while protecting the integrity and quality of the country's marine and coastal ecosystems and addressing transformation in the sector.

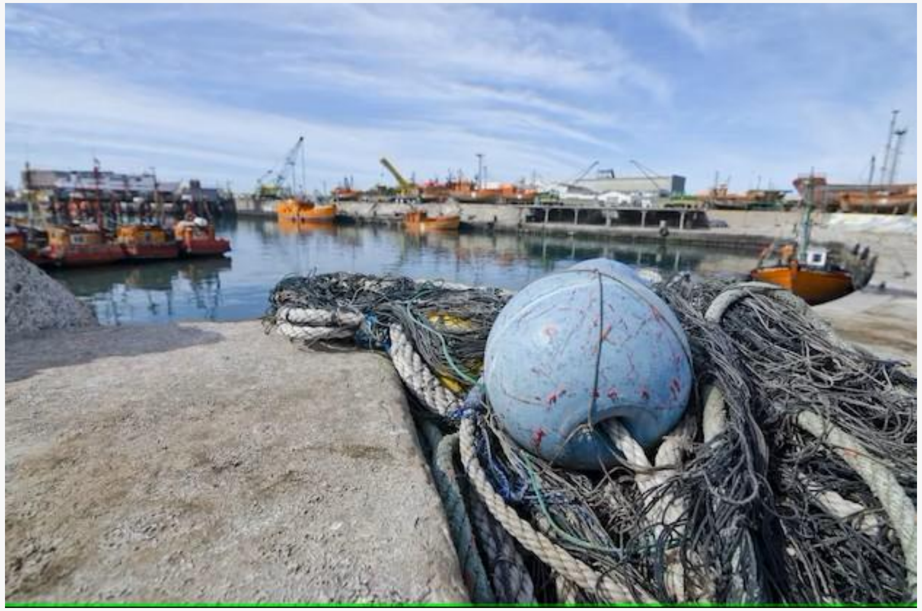


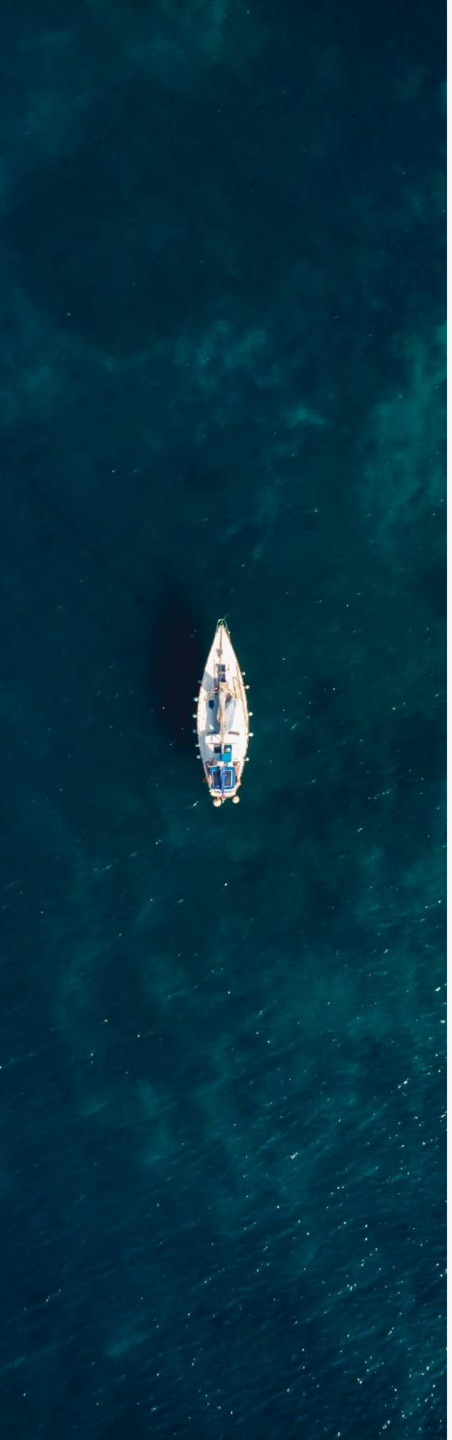


Fisheries

The major threats

- Overfishing, which is driven by illegal fishing, capacity-enhancing subsidies,
- Lack of alternative livelihoods,
- Lack of incentives to protect the underlying resource,
- Unsustainable mariculture
- Poor local and institutional governance and less than optimal management.
- Climate change, environmental variability, habitat degradation and pollution.



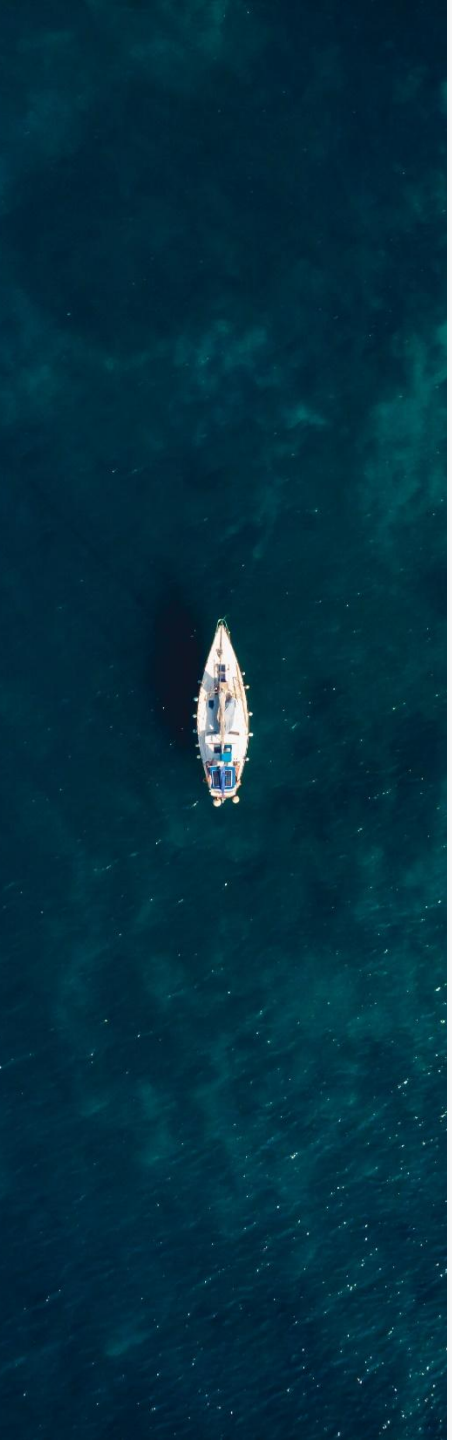


Fisheries

Sustainably increasing food from the sea

Four main pathways by which food supply from the ocean could increase:

1. improving the management of wild fisheries;
2. implementing policy reforms of mariculture;
3. advancing feed technologies for fed mariculture;
4. shifting demand, which affects the quantity supplied from all three production sectors.

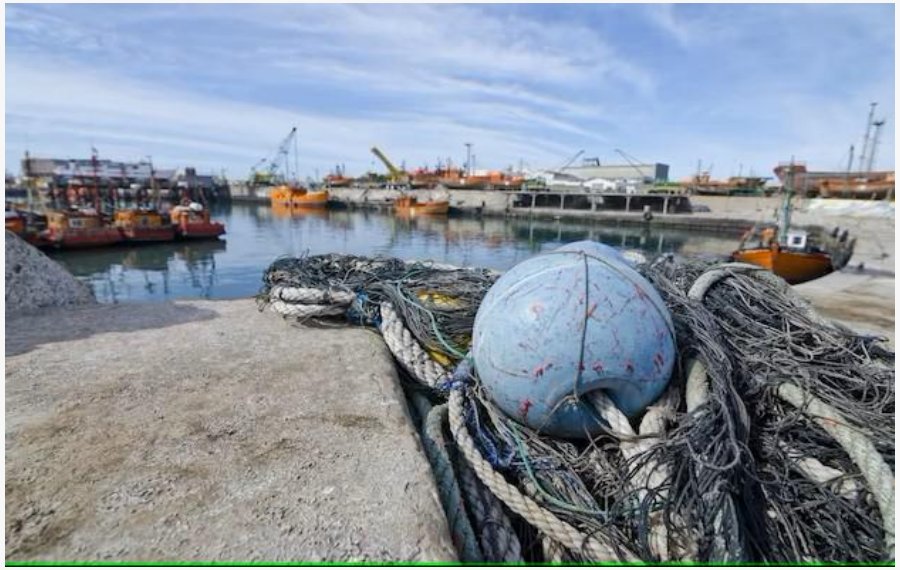


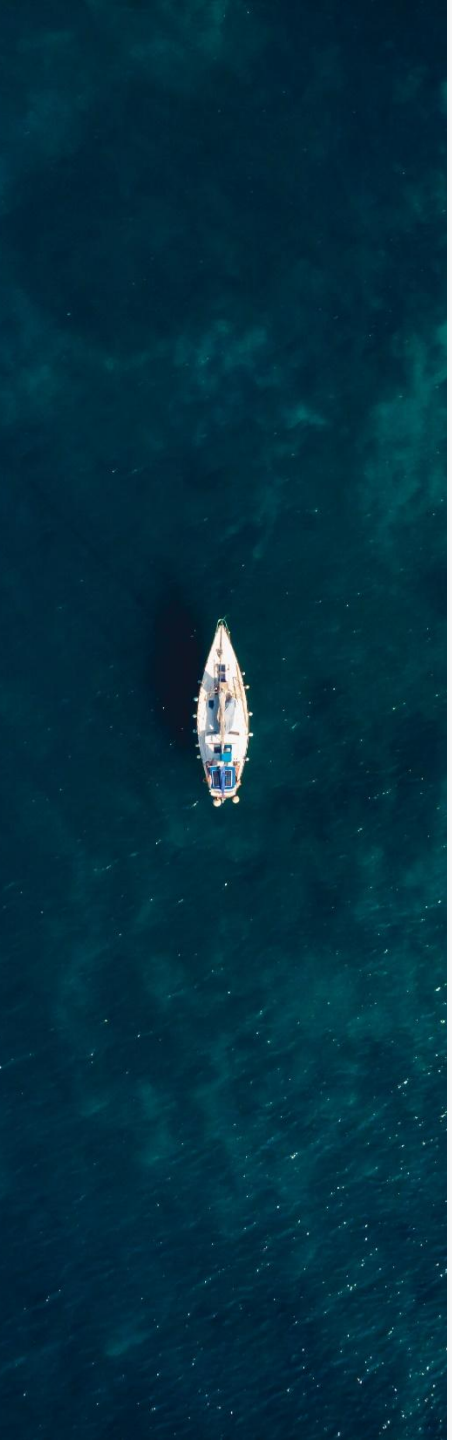
Fisheries

Fish in food security and nutrition strategies

Increased consumption of fish, and its addition to the diets of low income populations (including pregnant and breastfeeding mothers and young children), offers important means for improving food security and nutrition:

- The bioavailability of fish protein is approximately 5–15 percent higher than that from plant sources. Fish also contains several amino acids essential for human health; especially lysine and methionine.
- The lipid composition of fish is unique, having long-chain, polyunsaturated fatty acids (LC-PUFAs) with many potential beneficial effects for adult health and child development. Many low-cost, small pelagic fish such as anchovy and sardine are some of the richest sources of LC-PUFAs.
- Fish is an important source of essential micronutrients –vitamins D, A and B, minerals (calcium, phosphorus, iodine, zinc, iron and selenium) – especially so for many small fish species that are consumed whole (with bones, heads, and viscera).



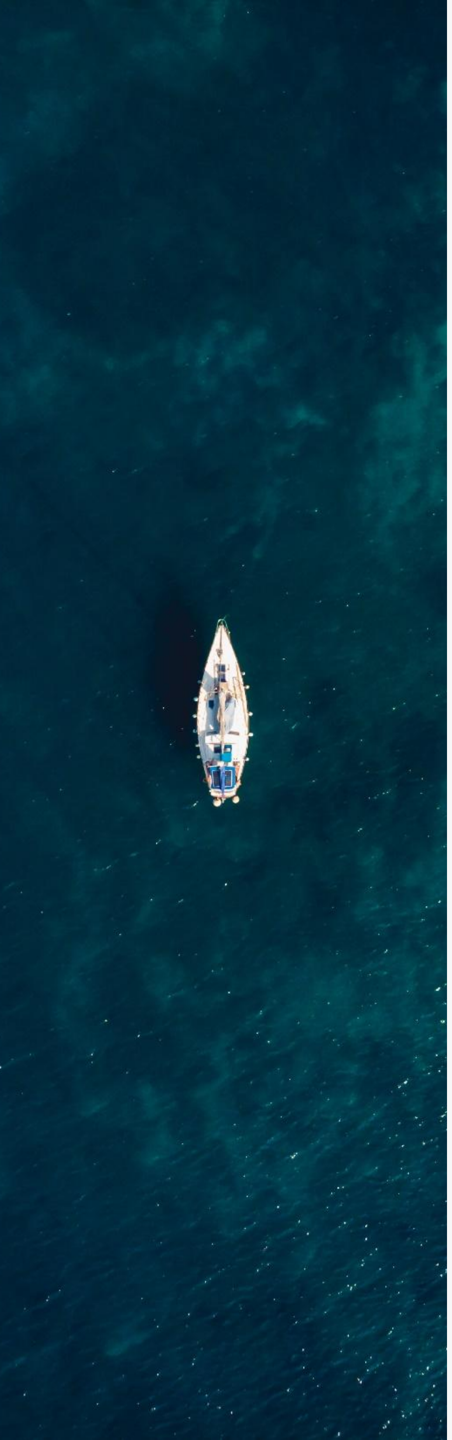


Opportunities and challenges in aquaculture

Aquaculture fish convert more of their feed into body mass than terrestrial animals. the production of 1 kg of beef (resp. pork and fish) protein requires 61 kg (resp. 38 kg and 13 kg) of grain.

Moreover, aquatic animal production systems also have a **lower carbon footprint** per kilogram of output compared with other terrestrial animal production systems.

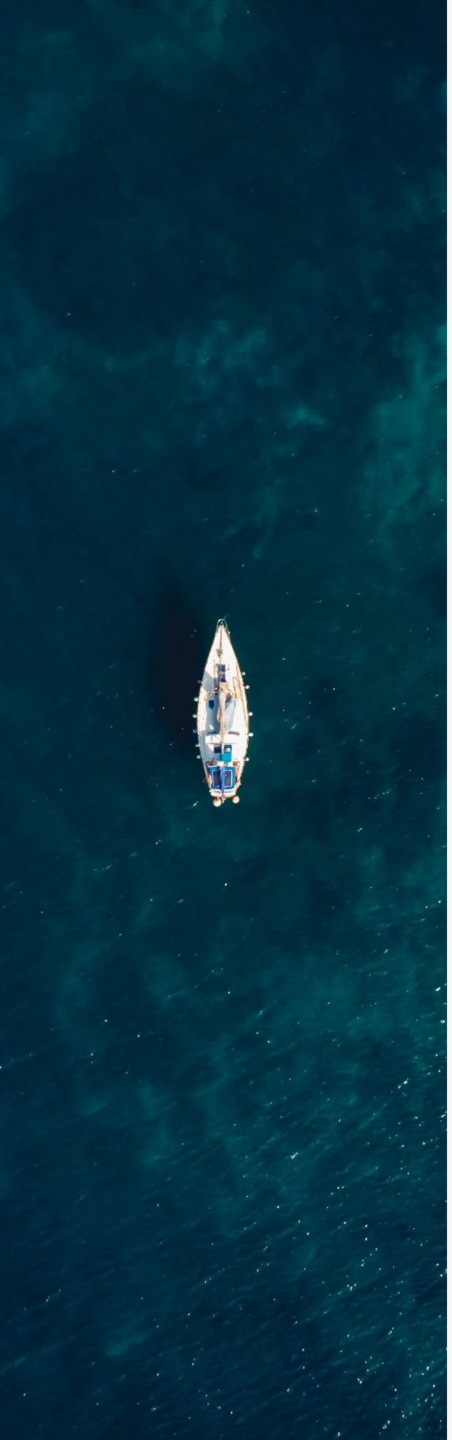
Nitrogen and phosphorous emissions from aquaculture production systems are much lower compared to beef and pork production systems though they are slightly higher than those of poultry.



Opportunities and challenges in aquaculture

As more space is progressively allocated to aquaculture operations on lakes, water-bodies or along the coast, smaller wild stocks and more congestion are likely to affect the fishing activities in the areas remaining open for wild harvest.

Conflicts are common when aquaculture is introduced into a region where fishery activities are already established, particularly at subsistence level.
The use of antibiotics and chemicals in intensive systems are also sources of concern and many countries have put in place regulations on the use of antibiotics, drugs and chemicals in aquaculture production.

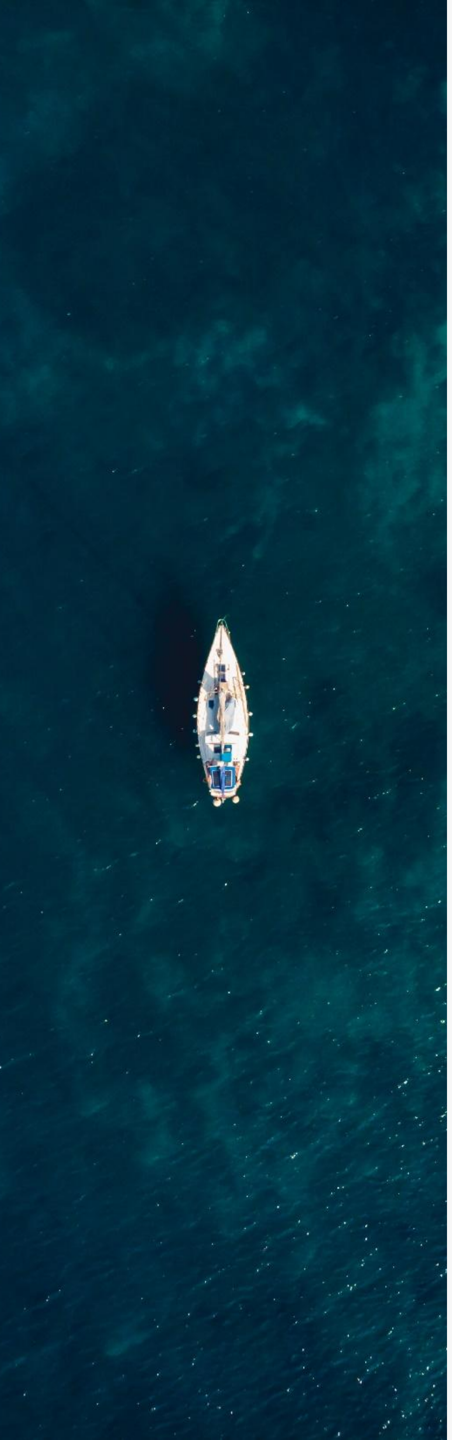


Opportunities and challenges in aquaculture

Yet from a food security and nutrition perspective, debate continues on whether it would not be preferable to use such fish directly for human consumption instead as for fishmeal, especially as ‘lower grade’ but nutritious fish could be consumed by food insecure people, instead of being used to feed fish consumed by wealthier consumers.

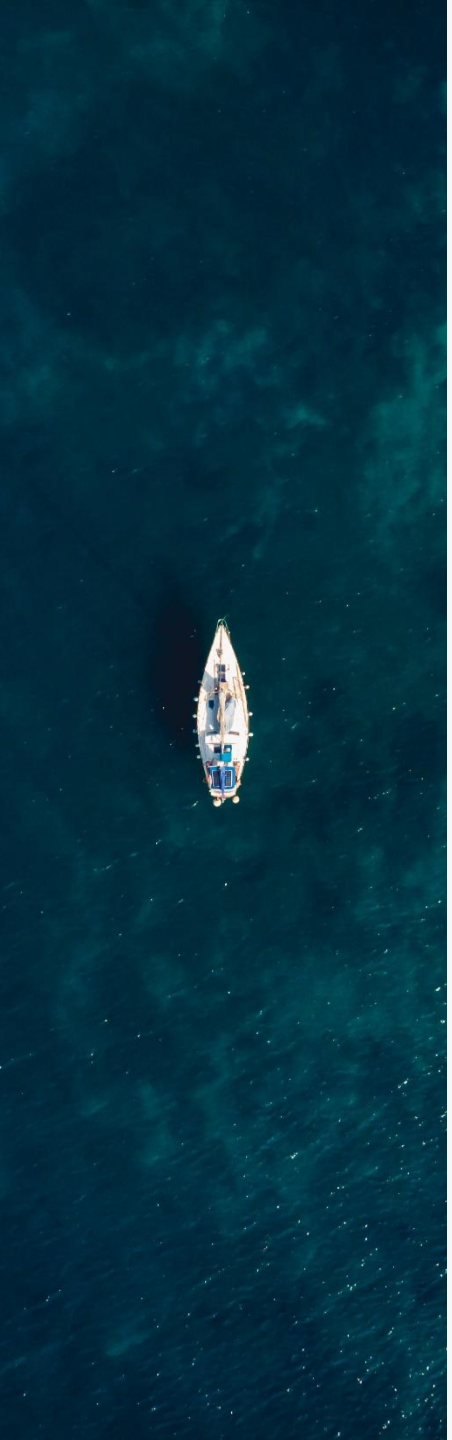
Gender equity

Gender, along with intersectional factors (such as economic class, ethnic group, age or religion), Is a key determinant of the many different ways by which fisheries and aquaculture affect food security and nutrition outcomes, availability, access, stability and diet adequacy, for the population groups directly involved in fish production and supply chains, but also beyond.



Food Processing

Advancing the Role of Food Processing for Improved Integration in Sustainable Food Chains



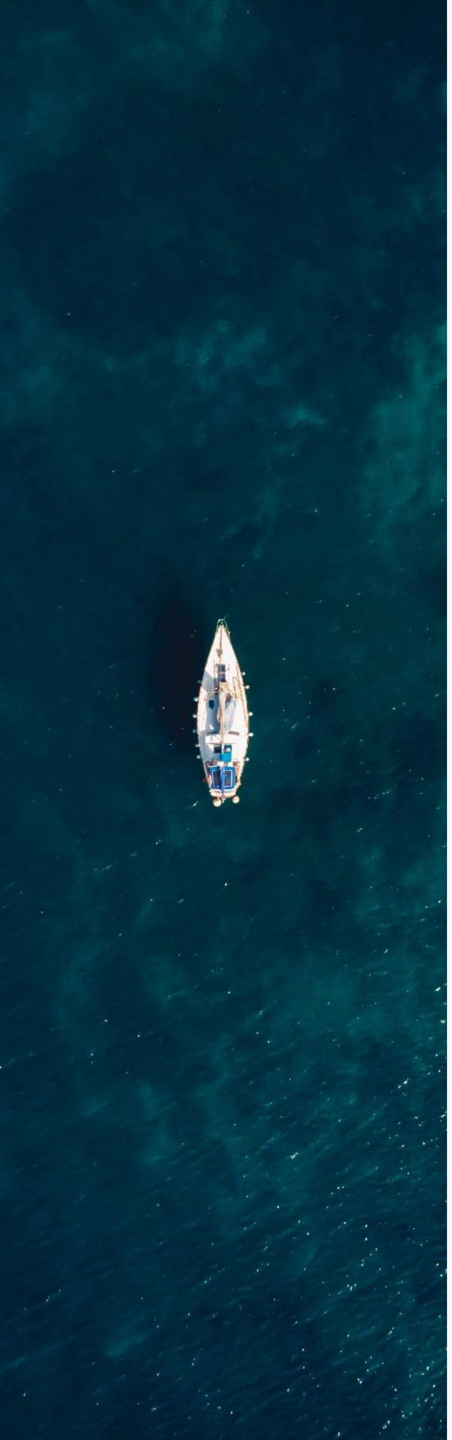
Food processing

A critical element in the food supply chain.

Even in ancient times, both primary (e.g., drying, milling, oil extraction) and secondary processing (i.e., when products of primary processing are formulated and manufactured into processed foods) were employed to convert produce into safe and palatable foods and to extend shelf life.

Food processing also creates important opportunities for generating income and employment for communities.

Processed foods are an integral part of today's diet and a significant contributor to food and nutrition security.



Sustainable Food Processing

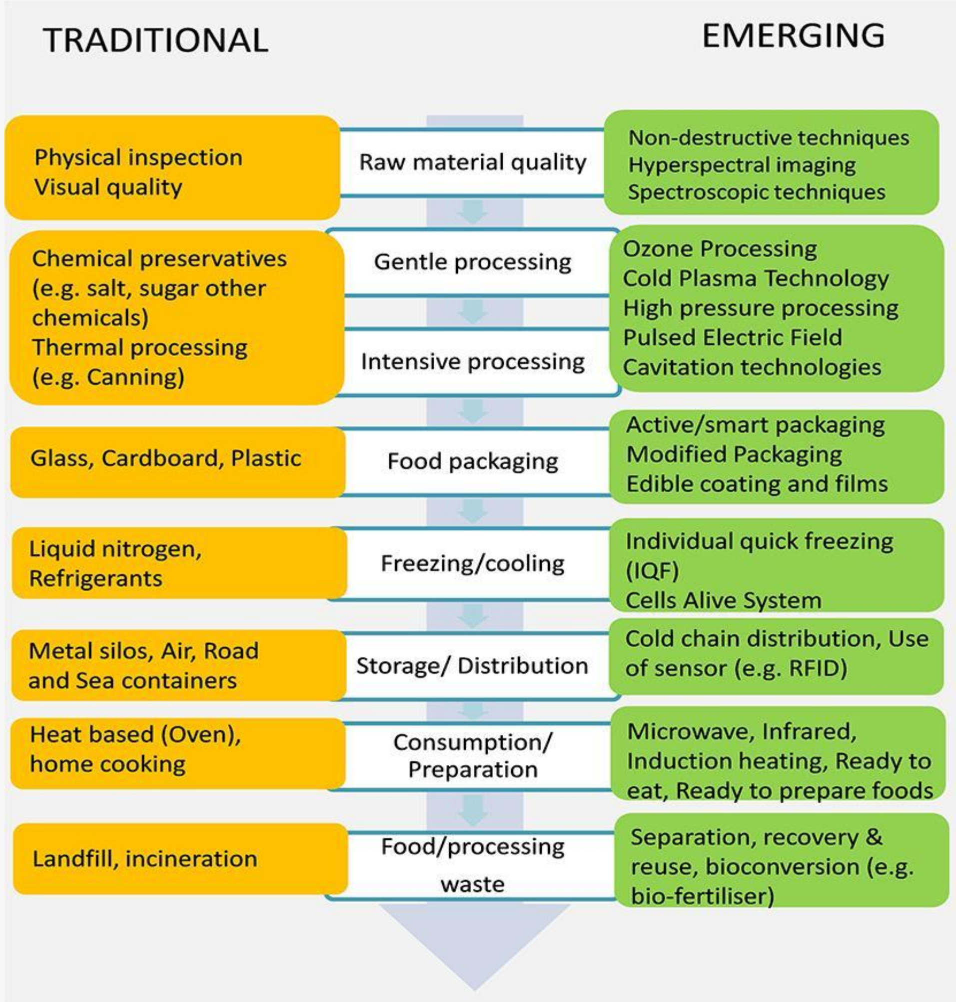
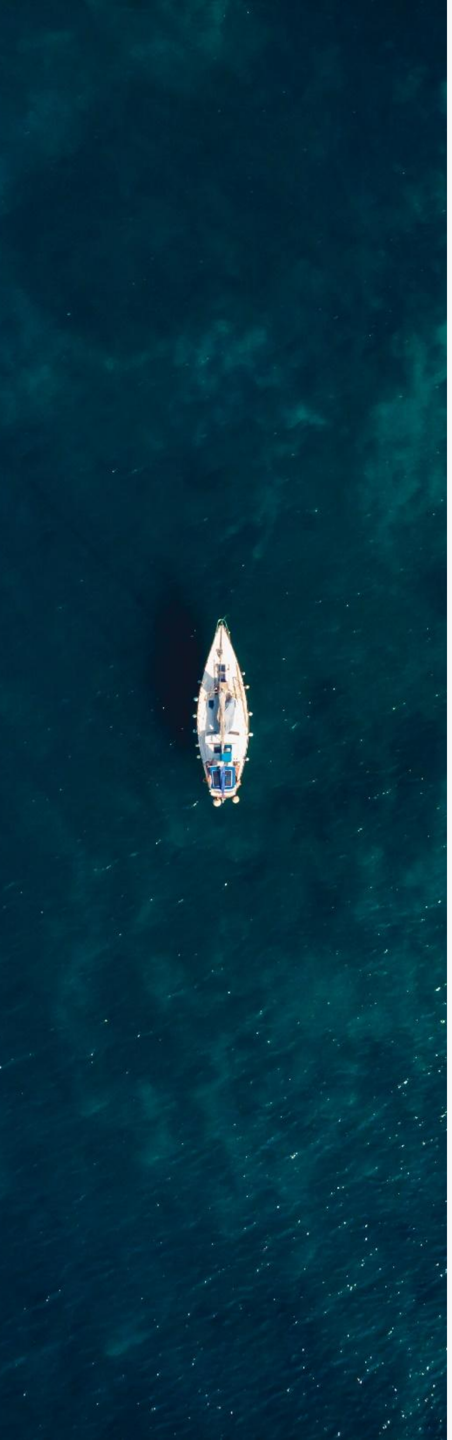


FIGURE 1. Traditional and emerging technologies and approaches used along the food chain.



Sustainable Food Processing

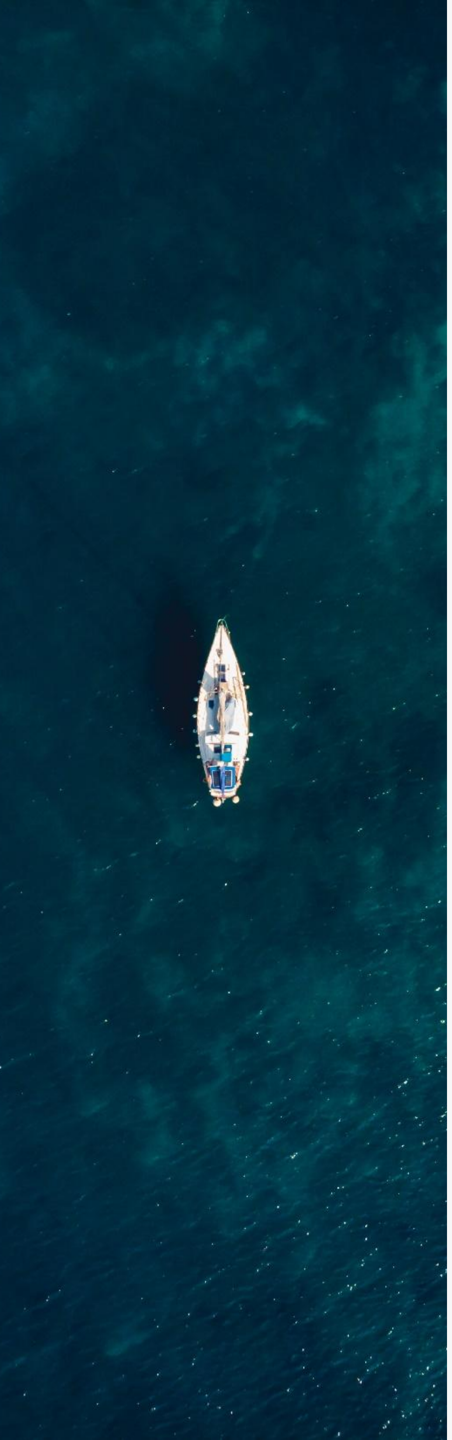
(A)

Sun	Air/wind	Light	Water	Earth
Heat	Flow	Electric energy	Wave power/tidal	Pressure
Light	Gases	Heat	Flow	Temperature/geothermal
Wavelengths	Dense gases	Fire	Hydroelectric	Gravity
Radiation	(Ultra) sound	Plasma	Ice and modifications	Sand and soil organisms
Conductivity	Pressure	Ozone	Supercritical water	Biopolymers
	Vacuum		Hydrostatic pressure	Minerals
			Temperature	Acids
			Conductivity	Lye
			Organisms	
			Biopolymers	
			Acids	

(B)

New raw materials	New processes	New packaging materials
Underexploited and ancient plants	Combination processes	Marine biopolymers
Insects	Diverse pulsed energy processes	Microbial platform chemicals
Leaves	Gravity and magnetism (low/high)	Renewable sources
Aquatic and marine organisms	Wavelengths (all)	
Artic/Antarctic organisms	Gasses (all)	
Cell cultures	Robust, scalable, and flexible processes	
Root cultures	Appropriate/intermediate technologies	
Microbial biomass	Food structuring for property generation	
Edible food losses and waste	Consumer-driven technologies	

The key existing and potential sources for food process operations.



Sustainable Food Processing

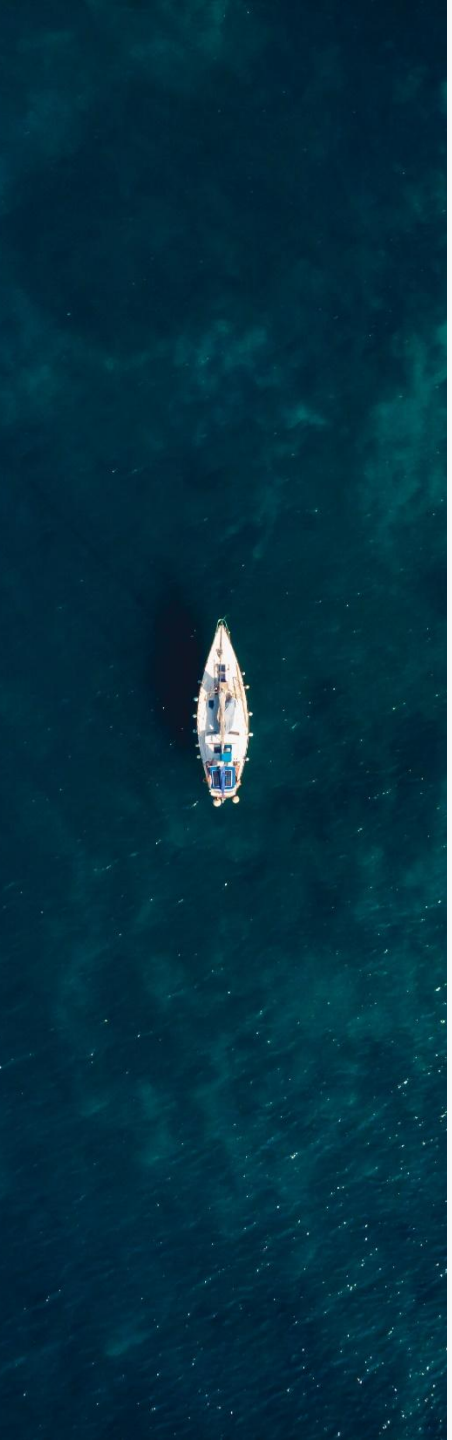
Emerging processes:

- high-pressure processing, pulsed electric field (PEF), pulsed lights, cold atmospheric plasma,

- microwave, ohmic heating, and ultrasound, high-pressure assisted sterilization,

- PEF-supported sterilization processes,
- drying rates for foods or minimizing excess sludge production during wastewater treatment,

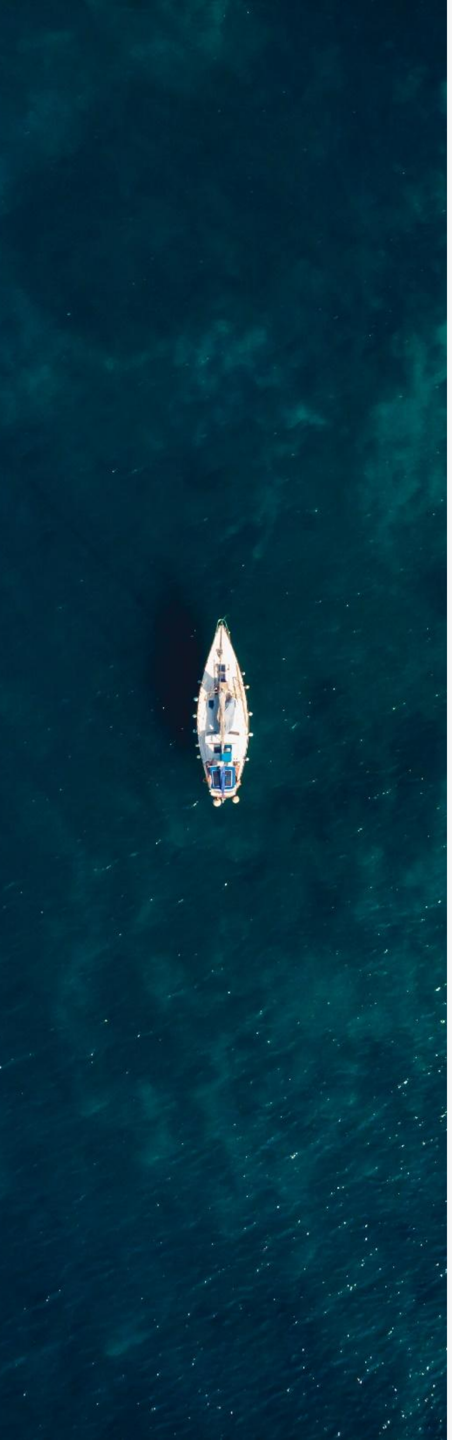
- alternative PEF-assisted process developments for the energy intensive beet sugar processing.



Sustainable Food Processing

Nanotechnological innovations in the food and agriculture

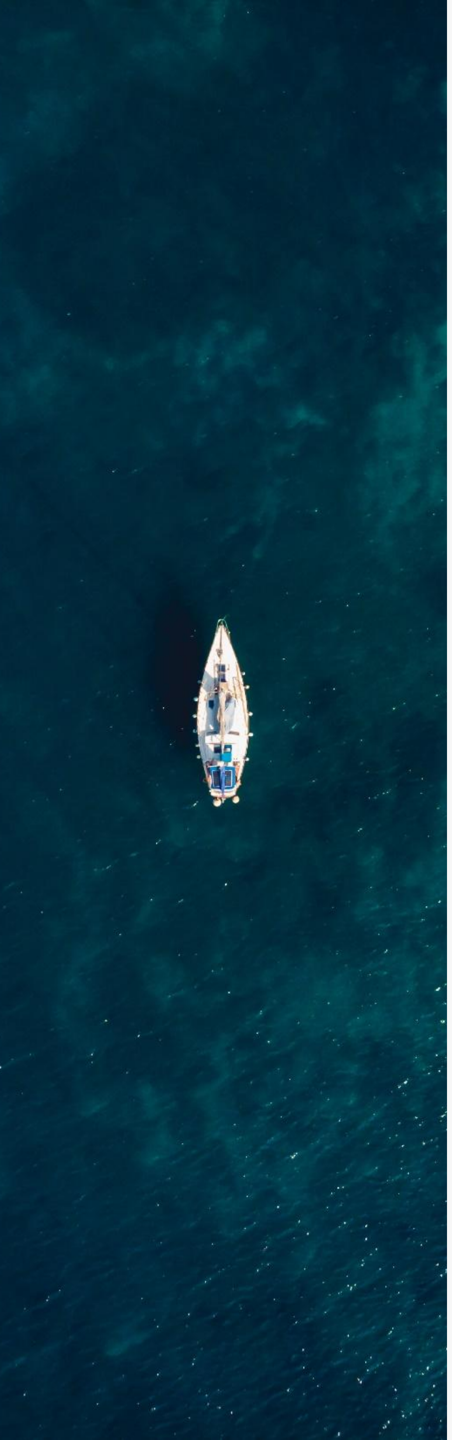
Nanotechnological innovations include encapsulated ingredients that provide protection of sensitive bioactives(e.g., omega-3 fatty acids, vitamins) and increased nutrient delivery, nanomaterials for controlled delivery of anti-microbials, smart sensors for improved food safety management, and nanocomposites for improving barrier properties of packaging materials.



Strategies for improving the sustainability of food systems

Resource management:
- manage food and water scarcity;
- reduce waste, retain, and recover/reuse nutrients within the food chain;
- generate a worldwide compendium of indigenous and traditional raw materials, processing, and preparation methods.

Sustainable processing and improved food delivery
- develop sustainable, efficient, and responsible food packaging, storage, transportation, and delivery systems;
- exploit alternative energy sources and biosystem-based production/processing;
- build sustainable practices into food preparation and processing;
- create flexible, scalable, and appropriate urban food processing, preparation, delivery, and consumption models;
- develop food processes based on PAN (preferences, acceptance, and nutritional needs)



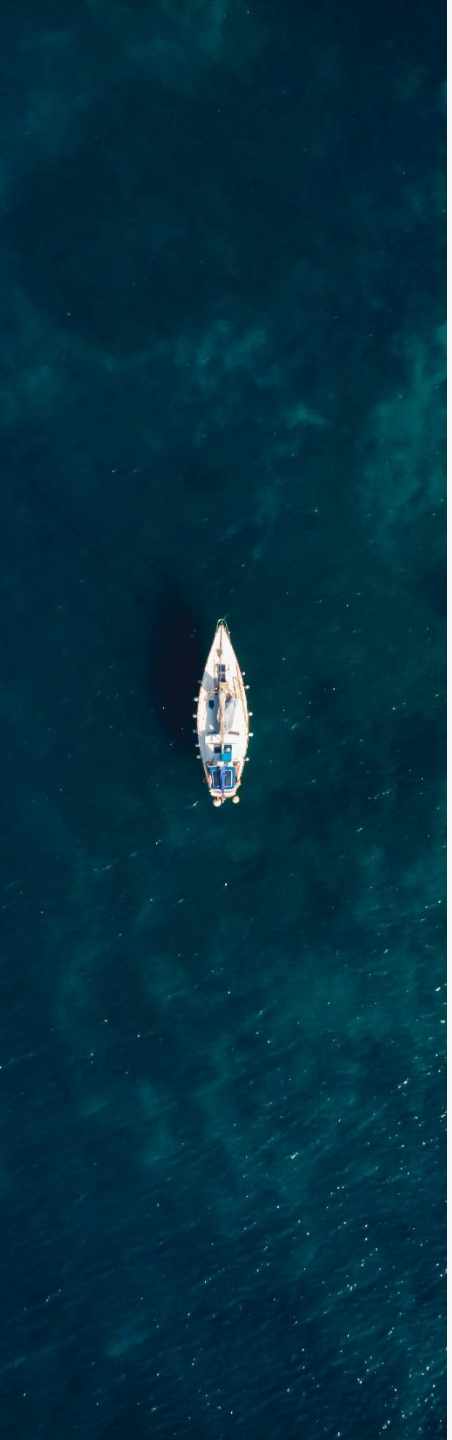
Strategies for improving the sustainability of food systems

Influencing behavior and developing consumer trust:

- encourage sustainable and responsible processing, preparation, and consumption of foods;
- improve transparency and gain consumer trust by providing consumers unbiased information.

Integration along the food value chain:

- reevaluate existing food chains and improve integration along the food supply chain to improve sustainability;
- create a systems approach for the agricultural food chain;
- promote digital transformation and development of a “precision” food chain;
- expand interdisciplinary and intradisciplinary food research and development; and involve multiple stakeholders from agriculture, nutrition, trade, government, and consumer organizations.



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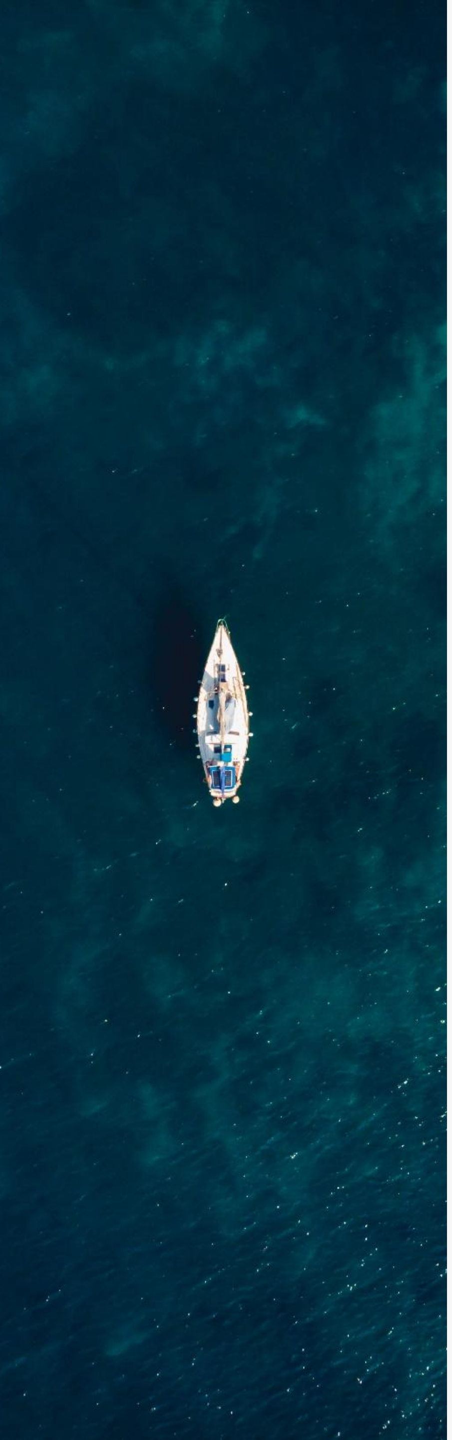

Resources

Food and EU policy

EU's common agricultural policy (CAP)

The European agricultural guarantee fund (EAGF)

European agricultural fund for rural development (EAFRD)

EU Green Deal

Farm to Fork strategy

Biodiversity strategy for 2030

Relevant initiatives on the pan-European level:

• **EIT Food** is a large European food innovation initiative, supported by the European Institute of Innovation and Technology (EIT) under Horizon Europe, working to make the food system more sustainable, healthy and trusted and to illustrate the central position of the agrifood sector in Europe's industrial and innovation strategy.

• **The European Innovation Partnership for Agricultural Productivity and Sustainability (EIP-AGRI)** is one of five European Innovation Partnerships launched in 2012. It aims to foster competitive and sustainable agriculture and forestry sector. It bridges the gaps between research and practice in agriculture, forestry and agribusiness, and encourages sharing innovative ideas.

• **The Smart Specialisation Platform for Agri-Food** orchestrates and supports the efforts of EU regions committed to work together for developing a pipeline of investment projects connected to agriculture and food.

• **The European network for rural development acts** as a hub of information on how rural development policy, programmes, projects and other initiatives work in practice and how they can be improved to achieve more. The ENRD supports the effective implementation of EU countries' rural development programmes by generating and sharing knowledge, as well as facilitating information exchange and cooperation across rural Europe.

• **LEADER / Community Led Local Development (CLLD)** is a "bottom-up" approach that has been used for 30 years, in which farmers, rural businesses, local organisations, public authorities and individuals from different sectors come together to form Local Action Groups to improve the potential of their areas.

Discussion & Remarks

IDEAS

REMARKS

SUGGESTIONS

FURTHER QUESTIONS

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Thank you