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Gardening for Planet Earth



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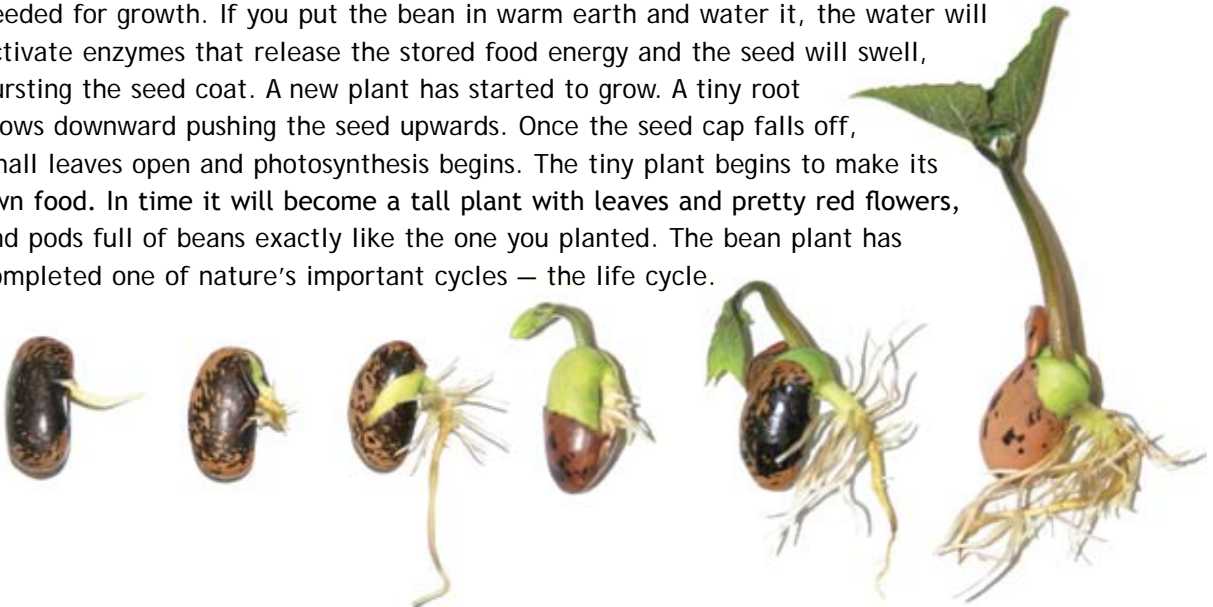
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Biological Gardening for Earth's Future

Have you ever looked at a bean? Really looked at it I mean.

A bean is a seed. It is the genetic link between generations of bean plants. The creamy white stuff inside the tough skin carries the genetic code to make a new bean plant and the energy needed for growth. If you put the bean in warm earth and water it, the water will activate enzymes that release the stored food energy and the seed will swell, bursting the seed coat. A new plant has started to grow. A tiny root grows downward pushing the seed upwards. Once the seed cap falls off, small leaves open and photosynthesis begins. The tiny plant begins to make its own food. In time it will become a tall plant with leaves and pretty red flowers, and pods full of beans exactly like the one you planted. The bean plant has completed one of nature's important cycles — the life cycle.



How does this happen? How does a bean — or any plant — know what to do? This is one of the miracles of nature. Another miracle of nature is the process called photosynthesis which means “putting together with light”. Photosynthesis is the MOST IMPORTANT process on Earth and ensures our survival. It is the source of all foods and all of our important fuels — coal, gas, oil and wood. Photosynthesis makes plants unique. Plants use photosynthesis to transform light energy from the sun into chemical energy that is stored as sugar ($C_6H_{12}O_6$). Plants use atmospheric carbon dioxide to sequester vast amounts of carbon in their tissues and with the help of photosynthesis plants produce oxygen. Without rainforests and the phytoplankton in the oceans there would not be enough oxygen for respiration. Growing plants not only provide oxygen and food, they also keep the carbon cycle in balance. Without plants and photosynthesis we would die.

What has all this to do with organic gardening?

Everything! Organic gardening is nature's way, and organic gardeners work with nature. We depend on Nature's cycles to provide everything from seasonal changes, soil, oxygen and plant pollination. Nature's way of gardening can also be called biological gardening, ecological gardening or permaculture.

The Hot Compost Method



- Gather enough material to fill your compost bin. Make sure you have a mixture of greens and browns.
- Start by placing the woody coarse materials on the bottom.
- Mix the remaining ingredients making sure grass clippings are mixed with dry brown materials.
- Mix in comfrey leaves, nettles, seaweed, chicken manure and urine as activators; they will speed up the biological decomposition.
- Leaves from trees are a good source of micronutrients not found in upper layers of the soil. Leaves have a much higher mineral content than manure, but they don't contain enough nitrogen to feed the bacteria. Use 5 parts leaves to 1 part manure.
- Add kitchen scraps and egg shells and add some finished compost or garden soil.
- If your material is too dry, dampen with a fine spray from the garden hose. Cover and leave.
- Within a week or ten days turn the heap. Decomposition uses up the oxygen in the centre of the pile.
- By turning the compost regularly you will speed up the process. Mixing the materials and introducing air allows the aerobic bacteria to continue decomposition.
- Never add lime to your compost; your decomposers will become an ammonia factory and the nitrogen will be lost into the air.
- If you are going to turn the pile to provide air you do not need to put a layer of branches down as a first layer. Layering is not essential because you will be mixing the ingredients every time you turn the pile.

This method will give you compost in six to eight weeks in the summer. The finished compost will be dark brown to black in colour. Don't worry if the compost is lumpy with twigs and eggshells still evident. It can be used as mulch and the soil food web will continue its work in the garden. In particular, potatoes, tomatoes, pumpkins, courgette (zucchini) and brassicas need plenty of compost. Composting is not rocket science. People have been doing it for hundreds of years. Just get the materials together and pile them up!

Green Manure

Soil needs lots of compost if it is in continuous use and growing soil is almost as important as growing vegetables in the sustainable home garden.

And how do you grow soil? You begin by growing carbon and compost crops known as green manure. Green manure crops have been used for centuries to cycle nutrients between plants and soil and they are the cheapest sources of compost.

Once the summer vegetables have been harvested it is time to think about setting aside a few of your beds for growing green manure crops over the winter. These crops are grown to be dug into the soil or harvested when mature to add carbon to your compost heap. As these crops grow, their root systems bring nutrients up from the subsoil and when the plants decompose nutrients are returned to the soil.



Oats & Alfalfa



Lupins



Marigolds



Phacelia

Almost any crop will do, including weeds, but make sure you use them before they set seeds. If the crop is left to flower it will provide a food source for beneficial insects. When the plants are cut down and used as green manure, pest and disease cycles can be interrupted. Clover, sorghum, borage, corn stalks, marigolds, alfalfa, oats, mustard, sunflowers, phacelia, lupins or broadbeans are all suitable green manure crops.

Organic gardeners grow all the organic matter used for soil fertility. All plant material is cut back and used as mulch on the soil surface so the nutrients slowly become available during decomposition.

Earthworms

Earthworms are nature's soil naturopaths and they digest their own weight in organic matter every day. They have no eyes, but the sensory cells in their skin are very sensitive to light.

In the cool of the night, earthworms crawl out of their garden burrows to harvest fallen leaves and plant debris. They feed on the bacteria in the garden mulch, expelling casts rich in calcium, phosphorous, potassium, nitrogen and bacteria-building soil nutrients. Three pairs of glands in their gut secrete calcium carbonate (CaCO_3), which helps to make non-acidic soils.

As earthworms crawl through the soil they create aeration and drainage channels. An earthworm looks like a very small flexible segmented tube. Each fluid filled segment is separated from the next by a partition. When circular muscles contract the fluid is forced into a narrow column which elongates the body of the worm. When longitudinal muscles contract they force the fluid into a short, fat cylindrical shape. Changing the body shape using the pressure of fluid and the action of the muscles allows the earthworm to move.



Digging Deeper

Watch an earthworm move and you will see Pascal's Law in action. Pascal was a French mathematician and his law states that if you apply pressure to fluids that are confined, the fluids will transmit that same pressure in all directions. Using fluids to do work is called hydraulics and the science of fluids in motion is called fluid dynamics. Centuries before Pascal's law (1647), earthworms which are 85% fluid, were using fluid dynamics to tunnel in the soil.





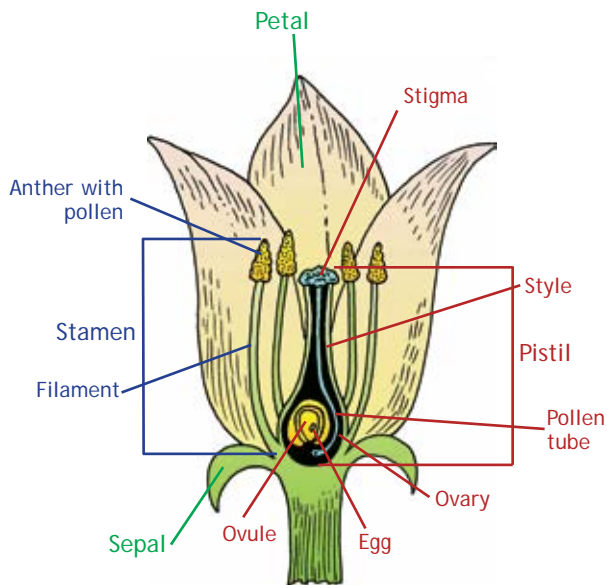
Male and female squash flowers with a fertilised female flower (closed) and embryonic squash fruit (ovary) in the centre.

Sprengel's observations showed why flowers develop their smell, colour, shape and size. In 1793 he published his work, but people didn't want to believe that plants had male and female parts. His theories were overlooked until they were confirmed by the work of Charles Darwin.

A cone flower with pollen grains clearly visible.



Pollination



Parts of a flower.

Today we know that pollination is essential for life itself. Nearly 80% of the world's crop plants need to be pollinated.

Pollination, the transfer of pollen grains from the anthers to fertilise the seed producing ovaries, is a vital stage in the life cycle of flowering plants.

Pollination ensures that a plant will produce healthy fruit and a set of fertile seeds that will be able to germinate.

In an organic garden every flower is important. The carbohydrate-rich nectar powers the flight of insects while the protein-rich pollen is needed by bee larvae as well as many beetles.

Organic Gardening

Ready to Start!

A great garden starts with a well thought out plan:

- First, choose the right site. On your plan draw in the buildings, fences, trees, direction of prevailing winds, shaded areas and direction of sun. Label areas that get plenty of sun in the summer and the winter. Label the sheltered areas (the micro-climates).
- Perhaps you will have a few areas that are suitable to grow vegetables, so choose areas close to the kitchen.



- Make a list of the fruits and vegetables you will want to grow in the limited space you have. Can you use planter boxes or hanging baskets to increase garden area?
- Start small and expand your garden over the season as you improve your skills and knowledge. Plan to use raised garden beds and plan paths for easy access. Make sure the bed size allows you to reach across the beds without walking on them – 1 to 1.5 metres. Can you fit the wheelbarrow in your new garden?
- Begin your own garden diary. Date all your entries and keep in a logical order. Take photographs as you plan each new area. Keep track of successes and failures and soon you will have your own organic gardening book.
- Resources are important and a continuous supply of compost is critical to success. Where will you site the compost bins, worm farms and containers for making liquid fertilisers?
- Do you have space for a beneficial insect garden? Or can you grow flowers and herbs in containers or under fruit trees?
- Cats are especially dangerous to all life in the organic garden. As well they will scratch up seedlings, and poo in the garden. Keep your cat inside at night or ideally, gardening homes can build cat enclosures. Check out the website <http://www.catsofaustralia.com/cat-enclosures.htm> for ideas on building cat runs and enclosures.

Gardens of many shapes and sizes...

Garden design depends on many factors, including how much space and time you have, the climate and what you want to grow.



From design and build...



to harvest!

Digging Deeper Tracking Climate Change In The Garden

The climate we experience is a result of our interactions with the environment. Over time our actions change both the environment and the climate. Phenology is a branch of science that keeps track of nature's cycles and environmental changes from year to year and how they relate to weather patterns.



What role does the weather play in the appearance of insects, when birds nest or when flowers bloom and set seeds? Observing plants will help you understand changes in the environment. Use a garden diary to record your observations and it will help you study phenology in your backyard.

Raised Garden Beds

Raised garden beds make efficient use of limited space and are more productive. By planting intensively rather than in rows the gardener is able to conserve water and concentrate soil building.

Most gardeners think digging is essential, but digging disturbs the soil structure and the soil micro-organisms and kills earthworms. One of the easiest ways to make garden beds is to build on top of the existing soil:

1. Start by making a frame for each of the beds. You can use old or untreated timber, bricks or anything that will hold the rich organic mixture in place. These beds can be made on concrete, existing soil or grass.
2. Using wet newspaper, thickly cover the area inside the frame. The newspaper will kill any plants underneath by preventing light from reaching them.
3. Cover the newspaper with heaps of compost. You can add seaweed, sheep pellets, chicken manure, and blood and bone.
4. Now pile straw or lucerne hay over the compost and water well.



5. If you are planting seedlings of peppers or tomatoes, eggplants, cucumbers, courgette, or silverbeet just pull the straw apart and plant the roots into the compost layer. You can build bean teepees, pushing the stakes right into the ground. Then place a circle of compost at the base of each stake and plant your bean seeds.
6. If you are planting seeds just pull back the straw and lay down a row of compost. Plant seeds into the well rotted compost and cover. Water well.

This type of garden does not need digging. Like nature which is always laying down a layer of mulch to make soil for the planet, the soil organisms will turn your mulch into soil too.



Plant salad vegetables that you can eat raw, if you are going to begin with a small garden. Raw vegetables will increase your enzyme intake. Lettuce, spinach, beetroot, chickweed, rocket, parsley, calendulas, kale, cress and chives are good choices.

7. The Next Season: After a few months the layers of the garden will have decomposed. You do not need to dig the garden, just add more compost — plant and mulch.

Raised garden beds in English allotment gardens.



Progress on the gardens at Hato Petera College in Auckland.



Growing Vegetables From Seed

Sowing Seeds Indoors



1. Make sure seed trays are clean and use a fresh moist seed sowing mixture. Do not use garden soil as it contains weed seeds and the nutrient levels are not high enough for quick growth.
2. Read the directions on the seed packet.
3. Fill the trays and firm the seed mix and sow the seeds.
4. Sprinkle smaller seeds like lettuce and cleome thinly. Sow larger seeds like sunflowers and beans individually in a dip at a depth twice the size of the seed. Cover lightly with good quality compost or seed sowing mix.
5. Water using fine spray from watering can and cover with damp newspaper or shade cloth and put into a cold frame. If you are not using a cold frame you can insert the trays into a clear plastic bag. Tie the end and put in a warm place.
6. Check for germination and remove the glass and newspaper when seedlings appear. At this stage do not put into direct sunlight. Water with a fine spray but don't let the soil get soggy.
7. Too much water can cause the seedlings to damp off. A soil-dwelling fungi causes the new seedlings to collapse.
8. When seedlings start to grow their first true leaves (not the little round embryonic leaves), transplant into larger containers and put outside to harden off – not in direct sunlight – while they get acclimatised to weather conditions. If it is cold at night you may have to bring them inside until they are big enough for transplanting. Protect seed trays from slugs, snails and cats.
9. Transplanting seedlings can be stressful for young plants. So hold the seedling by its leaves and handle carefully when transplanting.
10. Sow only what you can eat. If you sow in small numbers regularly you will have a continuous supply of vegetables.

Crop Rotation

Gardeners rotate (or change) crops grown in their garden beds each year to keep the soil healthy and stop the build up of pests or diseases. Rotation helps make the best use of nutrients in your soil. If your garden beds are not constantly replenished with compost then you should rotate crops. There is no proper order of rotation but you shouldn't follow one crop with another in the same family. Vegetables have families so get to know the eight main ones: leguminosae, brassicaceae, chenopodiaceae, compositae, solanaceae, cucurbitaceae, amaryllidaceae and umbelliferae.

Root crops, including turnips, carrots and parsnips and the allium family (onions, leeks and garlic), need potassium for root development.



Fruiting crops include the solanaceae and the cucurbits. These plants need phosphorous for flower and fruit production.



Legumes include peas, beans, clover and alfalfa, which give nitrogen to soil.



Leafy crops include brassicas and the leafy salad vegies like spinach (chenopodiaceae) and lettuce (compositae). These crops have high nitrogen needs.



Keep a separate area for rhubarb, Jerusalem artichokes, asparagus and comfrey.

Crop rotation requires planning so keep track of your garden rotation plan in your garden diary. Make sure it is based on the seasonal vegetables you want to harvest.