

Virtual Organic Garden

We are going to look at a variety of topics this week.

Remember, we are trying to build up our knowledge in “small digestible chunks1”

Week 3 SOIL FERTILITY, EARTHWORMS AND BRASSICAS

Firstly, try and answer these questions then compare your answers with ours below.

1. List the main chemical elements that plants need to grow. E.g. Oxygen
2. Which of these elements is obtained from air and water?
3. How do plants absorb nutrients obtained from the soil?
4. Non organic growers may add fertiliser nutrients with the symbols N, P and K to their soil. What are these elements and what do you know about them?
5. In natural unmanaged vegetation how would the fertility of the soil be maintained?
6. What are the advantages and disadvantages to non organic growers of using chemical fertilisers?
7. What suitable forms of organic matter could be added to the soil?
8. What are the advantages and disadvantages of using organic matter to fertilise the soil?

Our answers.

1. *List the chemical elements that plants need to grow.*

Oxygen, hydrogen, carbon, nitrogen, phosphorous and potassium are the six major elements. Calcium, sulphur and magnesium are also important. Traces of elements such as iron, boron, zinc, copper and molybdenum all help the health of plants.

2. *Which of these elements is obtained from air and water?*

Air and water supply plants with carbon, hydrogen and oxygen. The remaining elements have to be obtained from the soil.

3. *How do plants absorb nutrients obtained from the soil?*

The nutrients are dissolved in soil water. They are absorbed through tiny root hairs.

4. *Non organic growers may add fertiliser nutrients with the symbols N, P and K to their soil. What are these elements and what do they do?*

	Fertiliser	What does the fertiliser do?
N	Nitrogen (Nitrogen is a gas. However it is present in many compounds such as ammonia, ammonium, nitrites and nitrates. The compounds that are useful for plants are nitrates .)	Nitrogen compounds are essential for all living organisms. They are involved in the production of amino acids and proteins. In plants they are essential for leaf and stem growth. The production of chemical nitrate fertilisers uses large amounts of fossil fuel energy to create the heat and pressure required in the “Haber Process.” Nitrates are soluble and can easily be leached from cultivated soil. Leached nitrates and phosphates (see below) can help cause environmental problems in waterways. Nitrates can be produced as a by-product of industrial and agricultural air pollution and may be having an effect on local upland ecosystems.
P	Phosphorous (Phosphorous is a very reactive chemical and is often stored in water. Phosphates are the compounds which are useful for plants.)	Phosphates are important for the growing process in plants. I.e. cell division, the growth of roots and the development of the plant’s life cycle. Some phosphate fertilisers seem to have a negative effect on soil organisms that can play a vital role in plant development. E.g. mycorrhizas, soil fungal species that can attach themselves to plant roots and help increase nutrient intake.
K	Potassium or Potash (Is a very reactive metal. Its chemical symbol is derived from its Latin name Kalium)	Potash is important for the development of fruit and flowers. Wood ash is a good source of potash. It can be very alkaline and may be easily leached from the soil. The potassium compounds that are used in chemical fertilisers include potassium sulphate and potassium chloride.

5. *In natural unmanaged vegetation how would the fertility of the soil be maintained?*

In such a situation, the soil would be permanently covered with living or dead vegetation. The natural recycling of organic matter by soil organisms would maintain soil nutrients. They produce small but appropriate quantities of the soluble plant nutrients. There would be very little nutrient loss due to leaching.

6. *What are the advantages and disadvantages to non organic growers of using chemical fertilisers?*

Chemical fertilisers are more easy to store and probably easier to apply to the soil than bulky organic alternatives. Collections of chemical compounds can be put together as fertilisers to match the nutrient demands of a particular crop. The disadvantages include: the production of chemical fertilisers consumes large amounts of energy derived from fossil fuels; and, they have leached into and polluted water supplies with consequences for human health (E.g. blue baby syndrome) and the environment (E.g. the growth of algal blooms that can effectively suffocate other water organisms).

7. *What suitable forms of organic matter could be added to the soil?*

The traditional forms of organic matter that were added to the soil included: farmyard manure, stable manure, leaf mould, peat, garden compost, seaweed, composted straw, spent hops and mushroom compost. Other organic material is available and could be used in certain circumstances. E.g. shoddy (wool and cotton waste), waste paper or cardboard, human composted manure, worm compost etc. There are some specific “organic fertilisers” such as bone meal and “hoof and horn” but many growers try to build up sufficient organic matter in the soil to make the use of these materials unnecessary.

8. *What are the advantages and disadvantages of using organic matter to fertilise the soil?*

Organic matter comes from plants and animals and is renewable. It is an appropriate way to use this waste material. (Probably better than dumping it in landfill!) The organic matter is degraded by soil organisms and releases the nutrients slowly over, and sometimes beyond, a growing season. There are disadvantages compared to chemical fertilisers. Organic matter is bulky and difficult to store. The nutrient value is imprecise. Organic material either inappropriately stored or spread on the land can also cause water pollution. Nothing is perfect!

Wildlife

When we look at the wildlife that shares our organic garden we are going to use a star system. We'll rate each species on its usefulness and nuisance value.

The Earthworm* Useful * nuisance.**

(The nuisance value is hardly justified and only because the earthworm's presence attracts moles and consequently their mole hills to your lawn!)

Before you read the description below jot down what you know about the life cycle of an earthworm, what it eats, how it breaths and how it benefits an organic gardener.

Now read on.

Arguably the most important wildlife species in an organic garden is the earthworm. A good indicator of the fertility of the soil is the size of the earthworm population. The greater the number of worms, the better the soil fertility!

As they tunnel through the soil, worms ingest the soil and digest any organic matter in it. Although they are the most numerous in the top few centimetres, earthworms also work in the subsoil, bringing to the

surface mineral rich soil from below. This increases the supply of nutrients available to plants. Besides mining minerals and incorporating organic matter in to the soil, earthworms are brilliant natural manufacturers of fertiliser. Their casts are rich in nutrients and they are spread thoroughly throughout the soil.

Earthworm tunnels help to aerate and loosen the soil. This allows more oxygen in, which not only helps the plant directly, but also improves conditions for beneficial soil bacteria that may also be breaking down organic matter. Finally, earthworm's tunnels provide an access to deeper soil levels for the numerous smaller organisms that contribute to the health of the soil.

Earthworms need water too.

As well as organic matter, worms need water to survive. They won't drown when it rains, water is vital for their survival. Worms take in oxygen through their moist skin.

In addition, the moisture in their skin adheres to the side of their underground burrows, effectively preventing their tunnels from collapsing and opening up airways in the soil for micro-organisms and plants in it.

Worms and reproduction.

Worms are hermaphrodite. They have both male and female reproductive organs. They mate by lying head to tail alongside each other on the surface of the soil at night! Sperm is exchanged through temporary canals in the skin. Once they have mated, a ring like organ, called the clitellum, moves along the worm collecting sperm and fertilising eggs. Eventually this organ separates from the worm and infants develop inside.

Brassicas

Try and answer the following questions before you read the paragraphs below.

1. *Which vegetables and salads are in the brassica family? (There are a few root vegetables!)*
2. *What are F1 hybrid seeds?*
3. *What is the best way to sow most brassica seeds?*
4. *What specific soil nutrient do brassica plants need?*
5. *How would you prevent club root?*
6. *What are the pests that spoil brassicas and how would you try and minimise the damage to your plants*

Brassicas is a name for plants in the cabbage family.

Brassicas include Brussels sprouts, cabbage, cauliflower, broccoli and kale.

The family also includes swede, turnip and kohlrabi. The latter are sometimes grown in a "root area" in a rotation. Care needs to be taken to prevent them being planted after another brassica. Next week we will deal with plants that are grown as "Green Manures".

Among green manures, mustard is a member of the brassica family.

F1 Hybrids. Useful but expensive.

It is relatively easy to grow all brassicas from seeds. However, when buying seeds you may come across "F1 Hybrids". These are seeds derived from two sets of plants that have been self pollinated for eight to twelve generations to produce a guaranteed uniform crop. The two genetic lines of plants are cross pollinated and the seeds sold on to you!

These seeds may have been bred for vigour, pest resistance, size or hardiness but are usually more expensive.

Get brassicas growing quickly!

Most growers sow brassicas in a separate seed bed or in containers well away from pests (see below). Using a seed compost in either a greenhouse, cold frame or other protected environment gets the plants off to a quick start.

When the seedlings have four leaves, they are usually transplanted into modules or separate small pots to avoid overcrowding. To keep the seedlings strong and sturdy, bury roots and stem up to their lowest leaf!

Before they are eventually planted out in the soil, the brassica bed needs to be fertile. You may have limed the soil as a protection against club root. In our rotation, we're planting brassicas after the legumes. We're leaving the roots of the latter in the soil because there may be some remaining nodules of bacteria induced nitrogen fertiliser that will benefit the brassica crop. Brassicas are "hungry" for nitrogen and your ambition is to keep the plants growing quicker than pests can eat them. Feeds of liquid manure (see next week) will give the plants a boost as soon as they are established in the garden plot.

Pests and diseases

Growing brassicas feels like a battle. Lots of other creatures enjoy the plants too.

Club root is your worst enemy because it is going to stop you growing this valuable crop for years to come. Making the soil more alkaline for the brassica crop with lime or crushed egg or sea shells should prevent this fungal disease.

Slugs are the next most obvious enemy. Crushed egg shells, bran, sharp sand and prickly twigs are all meant to keep slugs away for the first few days after transplanting the crop. From then onwards, regular hoeing of the soil around the plants will help keep the pests at bay. However the secret of growing brassicas, that are fit to eat, is fast growth. Grow them faster than the pests can eat them! You'll need to accept that the outer leaves of the plants will have to be sacrificed to the slugs and that the final product will need careful washing! Try and resist the temptation to kill the creatures. Like you they are not all bad. Most of the time they are helping produce compost for your soil by biodegrading organic waste.

Some people surround transplanted seedlings with little mats of carpet. This stops the cabbage root fly laying its eggs in the soil next to the plant. A piece of rhubarb leaf in the transplanting hole is also meant to discourage the larvae of this pest which bores into roots and stems.

Aphids and caterpillars can be sprayed off with a powerful jet of water. Companion planting of aromatic flowers such as marigolds can confuse cabbage white butterflies which are meant to search for brassicas by their smell. These flowers can also encourage parasitic insects, such as the ichneumon fly. The larvae of this insect are laid within the caterpillar and devour it from the inside! You can pick off the caterpillars and squash them if you can stomach the odour!

The brassica plants that are often worst affected by caterpillars are the broccoli and Brussels sprouts. Don't panic and pull up particularly tatty summer specimens. They usually recover from the assault and produce good crops in spite of the trauma.

Pigeons can be a nuisance. However, a taut transparent fishing line above the crop can confuse the birds and scare them away!