

Virtual Organic Garden

This week's unit is about soils and legumes. We hope you'll try to answer the questions in the text and maybe e mail us your version of the answers. This simple course is no substitute for practical experience but we think that discussing other people's points of view helps the learning process.

Week 2 SOILS AND LEGUMES

Soil Texture (What the soil feels like!)

What do you know about the soil?

Here are some questions to get you thinking about the "Texture of the soil."

Write down your answers. Now compare them with our answers at the end of this week's notes.

1. *What is soil?*
2. *What are the names of the main mineral particles in the soil?*
3. *Which kind of soil particle is likely to be most fertile?*
4. *What are the benefits and problems of: a.) Clay soil; b.) Sandy soil?*
5. *Which kind of soil texture do gardeners dream about?*

Soil structure (How the soil particles fit together.)

Sadly most gardeners cannot change the texture of their soil... "you're stuck with what you've got!"

However, it is possible to improve the soil structure.

The key word that is linked with soil structure is CRUMBS! A crumby soil has space for air, particularly oxygen, and has both moisture and plant nutrients.

So now test yourself on soil crumbs.

1. *What do you think soil crumbs are?*
2. *What do you think "sticks soil particles together to make crumbs?"*
3. *Where can you find "naturally good crumby soil?"*
4. *How can you accidentally destroy a good crumby soil structure?*
5. *List some organic gardening rules to help maintain a good crumby soil structure.*

Acid or alkaline soils

Whenever you grow organic food the characteristics of your cultivated soil are constantly changing. Digging, watering, rainfall, adding manure etc. all alters the structure of the soil and the availability of nutrients for plants. Particularly in wet areas, such as the Dyfi Valley, there is a tendency for useful nutrients to be washed out (leached) of the soil and for it to gradually become more acid. Alkaline soils are usually associated with hot, drier areas so at present are unlikely to be a problem in this area!

The degree of soil acidity or alkalinity is measured on a pH scale from 1 -14.

In theory water is neither acid nor alkaline and has a neutral pH of 7.

Acid soils have a pH less than 7. Conversely, alkaline soils have a pH of more than 7.

Most soils are in the range pH 4 – 8.5

You might want to test the pH of your garden soil with a simple kit sold in garden stores.

Your target range ought to be a slightly acid soil, pH 6.3 – 6.8, because most essential nutrients are available to plants in that range and it suits the majority of soil organisms.

Does soil acidity matter?

I know several reputable organic growers who never test the pH of their soil. Their attitude is summed up "If a variety of weeds grow healthily, then the soil is healthy!" They regularly feed the soil with compost in the knowledge that this tends to neutralise the soil from either acidic or alkaline extremes.

In this area, if soils are allowed to become acidic then it is more difficult for plants to obtain supplies of key nutrients such as potassium, phosphorous and calcium. In contrast, certain nutrients such as aluminium and manganese become predominant in an acidic soil and become toxic to plants.

Last week we mentioned a fungal root disease that can afflict cabbages called *clubroot*. This disease is linked to acid soils and believed to exist at Ynys Las. Once this fungal problem afflicts a site it is difficult to eliminate. It may be impossible to grow good crops of brassicas.

In the past, if growers at Ynys Las had made a determined effort to reduce the acidity of the soil in which they grew brassicas, the problem may have been avoided.

All the course participants are going to test both the pH of the soil at Ynys Las and in their own garden with a cheap kit bought from garden suppliers.

We'll report their results next week.

Reducing Acidity

If you discover that the soil is too acidic the traditional method of correction is to add small quantities of ground limestone to the soil. Beware; there are a couple of "don'ts!"

1. Don't over do it! 200grams for each square metre is enough.
2. Also, don't add lime and manure at the same time. They react together and valuable nitrogen from the soil is lost in the form of ammonia gas.

As well as neutralising the acidity, "liming" can improve the crumb structure of the soil. Other particles in the soil adhere to the lime (Called "*flocculation*"). It will also reduce the likelihood of *clubroot* becoming established in the soil.

In the traditional rotation we're using at Ynys Las we will add ground limestone to the pea and bean (legume) area. (This is the area that follows the potatoes in our rotation.) These legumes grow well in less acidic conditions and the conditions will persist for the brassica plants that follow.

Potatoes and tomatoes both dislike lime. Potatoes produce an unattractive scabby crop in limey conditions, so it makes sense to add the stuff to the soil after the potato crop has been removed from the soil.

One of the dilemmas facing organic growers.

What is limestone? Is it organic or ethical?

The ground limestone used by organic gardeners is made by crushing rocks quarried in areas such as Derbyshire. The rock is the remains of shellfish and other marine organisms that probably lived in warm seas nearly 300 million years ago. It is organic.

For those interested in *Climate Change*, indirectly, the calcium carbonate material was derived from the carbon dioxide that existed in the atmosphere in those ancient geologic times. Some of the carbon dioxide in our atmosphere today is gradually being converted into limestone. E.g. coral.

What is certain is it will take a long time for the limestone that we consume in our lifetime to be replaced.

If you're an organic gardener for ethical reasons you could easily argue that:

- Quarrying, grinding and transporting limestone is not sustainable agriculture since lots of fossil fuel is used in the process;
- Digging holes in Derbyshire to improve soils in Wales doesn't feel like an environmentally friendly practise.

Of course you could equally argue that the amount of limestone used by organic gardeners is inconsequential compared to the vast amounts used in cement production!

There are alternatives for organic gardeners. Egg shells and seashells are both predominantly calcium carbonate. Several experienced local organic gardeners never lime their soil, but add egg shells to their compost heap instead. Of course they'll need to think about how ethically the eggs were produced. Equally, if all organic gardeners were to collect and crush sea shells from the local shoreline there would eventually be an environmental impact too!

Legumes (Peas and beans in the vegetable garden.)

This week at Ynys Las we're going to sow some broad bean seeds directly into the soil. Can you answer these questions on legumes?

1. What are the four commonly grown leguminous crops and when should you grow them?
2. How might growing legumes enrich the soil?
3. What are the important soil conditions for growing legumes?
4. How can organic gardeners ensure that legumes receive adequate supplies of water?
5. Which common pests can spoil the legume crops and how would you "deal" with them?

Here are our answers:

1. *What are the four commonly grown leguminous crops and when should you grow them?*

Broad Beans, Peas, French Beans and Runner Beans are widely grown in the UK. Of these Broad Beans are the hardiest and can be planted even when frosts are expected. Some varieties can be planted in autumn but spring planted varieties are often more reliable.

Peas are slightly less hardy. Early varieties can be planted from late March onwards. Main crop peas can be planted in May and June. French Beans can be planted in April if you can protect them with fleece or cloches. Don't think of planting Runner Beans outside until the last chance of a late frost has gone.

2. *How might growing legumes enrich the soil?*

Legumes can help improve the fertility of the soil. The growing roots of the plants form a relationship with a specific soil bacterium (Rhizobium). Together they can convert nitrogen in the air into nodules of fertiliser attached to the root of the plant. Although the plant uses much of this fertiliser to produce the peas and beans we eat, if the roots of the plant can be left in the soil after harvest, the fertiliser can help the following crop.

3. *What are the important soil conditions for growing legumes?*

Neutral pH Legumes seem to grow better in a less acidic soil. In the rotation we're using at Ynys Las we're adding lime to the "Legume area."

Lots of moisture and organic matter. Peas and beans need plenty of moisture especially as the seed pods of the plant are forming. If water is scarce flowers won't "set" and the crop will be small. You may have noticed some gardeners digging "Runner Bean Trenches" during winter. They often bury in these pits organic material that is slow to decompose on the compost heap. E.g. Brussels Sprout stems, cardboard etc. When these trenches are filled and the legumes planted in the soil above them, they provide a moisture retentive environment for the growing plants. For many organic gardeners, living in urban environments, it might make more sense to bury waste organic matter in "legume trenches" during winter rather than store it "above ground" in compost heaps. This helps avoid the problem of rats setting up home or feeding in your compost heap and it also provides a soil environment in which bacteria like Rhizobium can thrive.

4. *How can organic gardeners ensure that legumes receive adequate supplies of water?*

Many organic gardeners collect and store rainwater from roofs. This is probably more environmentally sensitive than spraying plants with drinking water from the tap. However as well

as “legume trenches” (see above) organic gardeners can mulch around the legume plants when the soil is wet. An organic surface covering of grass clippings, compost, cardboard etc. laid on top of wet soil can reduce evaporation from the soil and keep roots of the legumes moist.

5. *Which common pests can spoil legume crops and how would you “deal” with them?*

Black fly. This is a problem with broad beans. These aphids attack the growing tips of the plants just before harvest. Look out for the aphids. Ants are often found with them, feeding on the sap the aphids have exposed. If pods are forming remove the growing tips of all the plants and deprive the aphids of food. If the pods have not formed on the plant get out a spray and knock the creatures off the plant with a jet of cold water.

Slugs These are a real problem with French and Runner Beans. It’s probably best to start these plants off in a protected environment and transplant them when they are just about to produce their vigorous vine. Once the tips of the plants are 20 cm. above the ground they are usually safe from slugs. However you may be wise to grow a few spares to replace plants damaged by “athletic” slugs!

Mice These can steal “ungerminated” broad bean and pea seeds. Some gardeners used to soak the seeds in paraffin before planting to discourage the pests. These days this is not an organically acceptable method. If mice are a big problem it’s probably best to soak the pea and bean seeds in cold water for 24 hours then germinate them out of the soil between sheets of damp cardboard etc. Once they have developed a growing shoot plant them outside. Cover the seeds with fleece to speed up growth and make theft of the seeds more difficult. Finally, cross your fingers and hope!

Soil Texture

Our answers to the questions.

1. *What is soil?*

Soil is composed of the broken down pieces of rock, air, water, organic matter and billions of living organisms such as worms, bacteria and fungi.

2. *What are the names of the main mineral particles in the soil?*

Gardeners talk about “sand, silt and clay” particles. The names reflect the different sizes of the particles. “Sandy soils have 35% of their particles 0.1 -0.5mm in diameter, silt soils 35% 0.002-0.05 mm and clay soils 30% 0.002mm or less.” (Elphinstone and Langley, *Organic Gardener’s Handbook* 1995)

3. *Which kind of soil particle is likely to be most fertile?*

Clay soils are likely to be the most fertile partly because it is more difficult for nutrients to be leached out of them. However, although they stay damp longer, they are colder than other soils, heavier to dig and can bake rock hard in summer... so they are not all good news!

4. *What are the benefits and problems of: a) Clay soil; b) Sandy soil?*

Clay soil. See 3 above.

Sandy Soil. These are easy to dig and warm up quickly in spring. They dry out more quickly than other soils and are always “hungry” because nutrients are easily leached out of them.

5. *What kind of soil texture do gardeners dream about?*

The ideal soil is a compromise! It contains equal proportions of sand, silt and clay and is described as a “Medium Loam!” Dream on!

Soil Texture (CRUMBS)

1. *What do you think soil crumbs are?*

They are collections of soil particles that are sticking together.

2. *What do you think “sticks soil particles together to make crumbs?”*

The adhesive is a sticky combination of moisture and plant nutrients.

3. *Where can you find “naturally good crumby soil?”*

If you scrape about in the soil in woodland or at the bottom of hedges you'll usually find crumby soil. Anywhere where there is vegetation and organic material has naturally accumulated.

4. *How can you accidentally destroy a good crumby soil structure?*

If you leave the soil “bare,” heavy rainfall or over watering can spoil the structure. Compaction by walking on the soil can cause damage, as can digging too often!

5. *List some organic gardening rules to maintain a good crumby soil structure.*

Good crumby soil provides plants with moisture, air and nutrients.

Don't compress the soil by walking on it. Organise your growing areas to avoid compaction. E.g. narrow beds, clear pathways, etc.

Keep the soil covered with vegetation or organic matter for as much of the time as possible. I.e. Use green manures and mulch.

Don't over water your plants.

Don't dig more than is necessary. Be lazy for a purpose!

Useful extra reading

Try getting these from the library, The C.A.T. Bookshop or Amazon if you want some extra information:

“Soil,” Ryrie, Gaia Organic Basics, 1 85675 122 8

“The Organic Gardener's Handbook,” Elphinstone and Langley, Thorsons, 0 7225 3121 4

A good website for more detailed information on Rhizobium is: www.microbiologyonline.org.uk