

ABUNDANT BORDERS

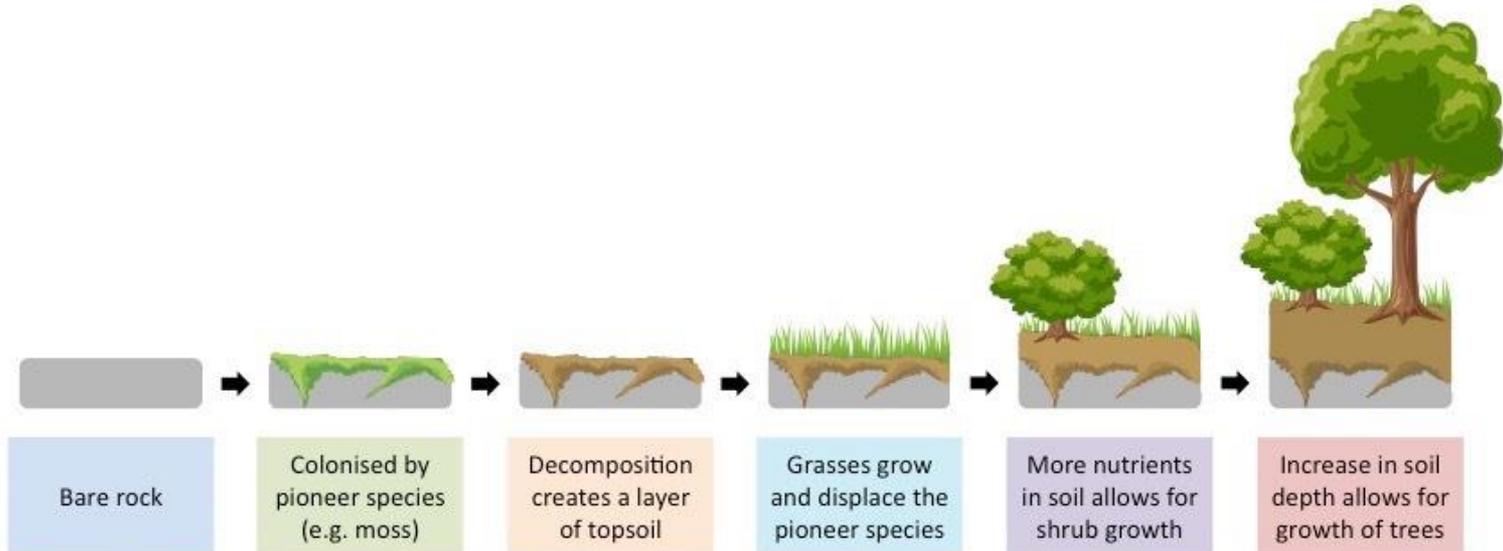


Creating a network of local food production in the Scottish Borders

visit www.abundantborders.org.uk **contact** robin@abundantborders.org.uk

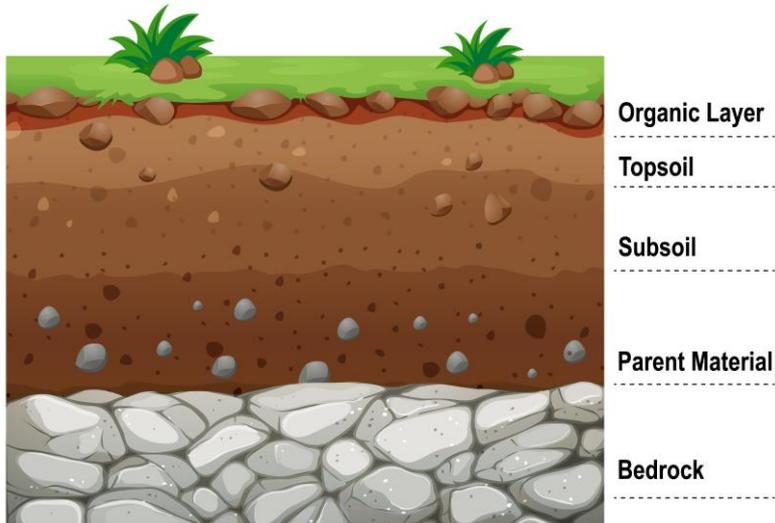
SOIL

We saw in the first module how plant succession leads to the creation of soil.



SOIL LAYERS

As plants and rock and weather interact soil develops in layers



- The organic layer contains organic material such as decomposing leaves. It is thin in some soils, thick in others, and not present at all in others
- Topsoil and subsoil contain minerals from parent material with organic matter incorporated. A good material for plants and other organisms to live.
- The deposits from which the soil developed is called the parent material
- Bedrock is the solid mass of rock such as granite, basalt, quartzite, limestone or sandstone from which the parent material developed

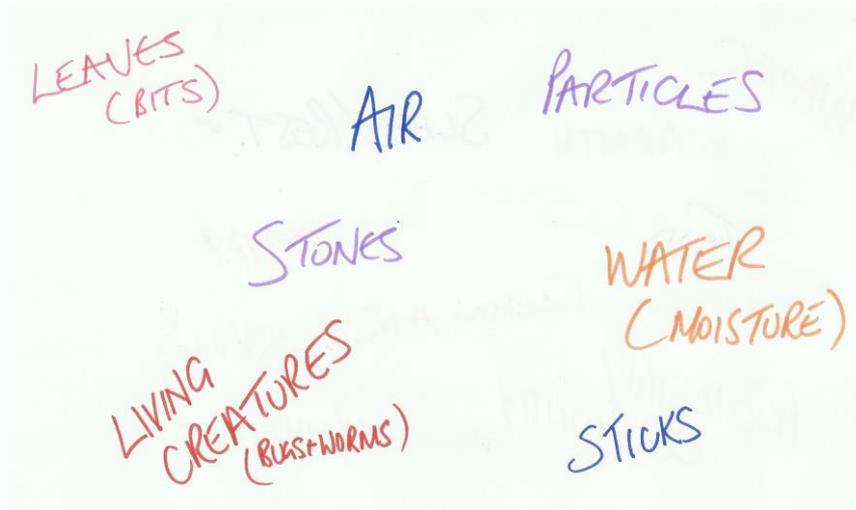
WHAT IS SOIL?

Take time out to get a small (jam jar) sample of soil from your own garden

Spread half the contents onto a sheet of white paper

What do you see?

SOIL COMPOSITION



**Fill up the jar containing the remainder of the soil with water
SHAKE VIGOUROUSLY and SET ASIDE**

SOIL COMPOSITION

Soil is a mixture of organic matter, minerals, gases, liquids, and organisms that together support life.

- 40% of the soil is mineral particles - basically formed by the break down of the bedrocks. Some of the most common minerals found in soil are Iron, Potassium, Magnesium, Calcium
- 25% of soil is air and 25% water - important elements of the soil which allows living organisms to perform their functions
- 10% of soil is organic substances that are formed due to decomposition of dead and decomposing plants and animals

**Take a look at the jar of soil and water you set aside
It will have settled into different layers depending upon the particle size**

SOIL MINERALS – PARTICLE SIZE

CLAY

The finest particles are known as clay, defined as having a diameter of less than 2 micrometres (one thousandth of a millimetre. Just for comparison, a red blood cell is about 7 micrometres in diameter). Clay does not easily separate into individual particles as it is very cohesive.

SILT

The next size of particle is called silt and has a diameter of 2 to 60 μ m.

SAND

Particles larger than this can be seen with the naked eye, and are known as sand sometimes divided into fine, medium and coarse sand.

STONES

Particles larger than 2000 μ m (2 mm) are included with stones which vary from fine grit, or gravel to large boulders.

SOIL MINERALS – PLANT NUTRIENTS

As the particles in the soil break down, they release their component minerals. Plants need thirteen different minerals from the soil in order to fully develop. Six of these nutrients are needed in large quantities.

Take a moment to see if you know what these are

SOIL MINERALS – PLANT NUTRIENTS

Phosphorous - is responsible for assisting with the growth of roots and flowers. Phosphorus also helps plants withstand environmental stress and harsh winters.

Nitrogen - helps foliage grow strong by affecting the plant's leaf development. It is also responsible for giving plants their green coloring by helping with chlorophyll production.

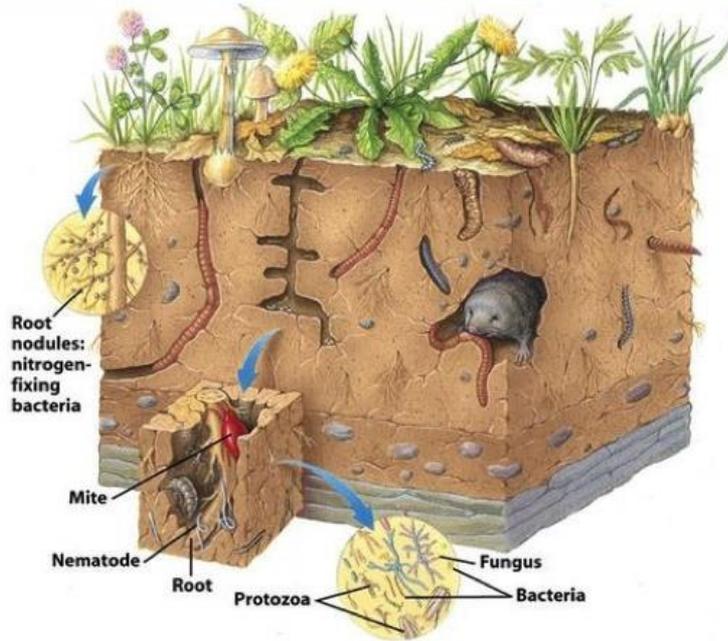
Potassium - strengthens plants, contributes to early growth and helps retain water. It also affects the plant's disease and insect suppression.

Magnesium - contributes to the green coloring of plants.

Sulphur - helps plant resist disease and grow and form seeds. They also aid in the production of amino acids, proteins, enzymes and vitamins.

Calcium - aids in the growth and development of cell walls. This is key because well-developed cell walls help resist disease.

SOIL ORGANIC MATTER

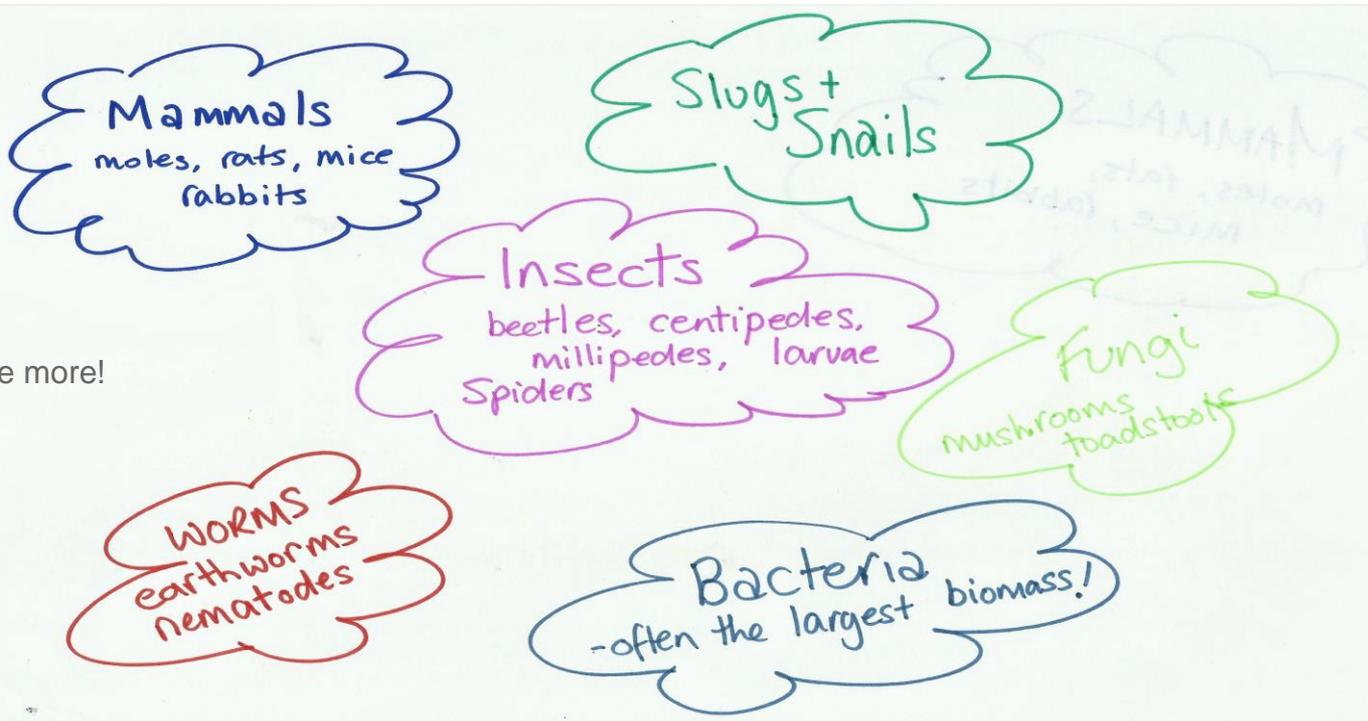


The organic material in soil comes from the breakdown of plants mixed with substances excreted by animals and micro-organisms.

Some of this material is readily recognisable as fragments of plant tissue, but most of it is broken down – either by passing through the digestive tracts of animals, or by being incorporated into microbial material.

Take a moment to think about the living organisms

SOIL CREATURES



There will be more!

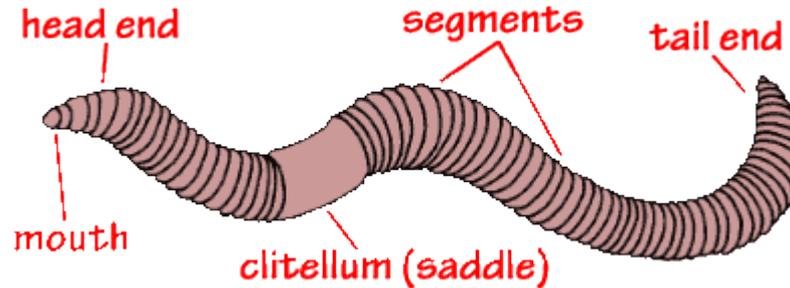
SOIL ORGANIC MATTER

EARTHWORMS – SOIL ENGINEERS

Worms have a positive effect on crop yield; increasing yield by an average of 25%.

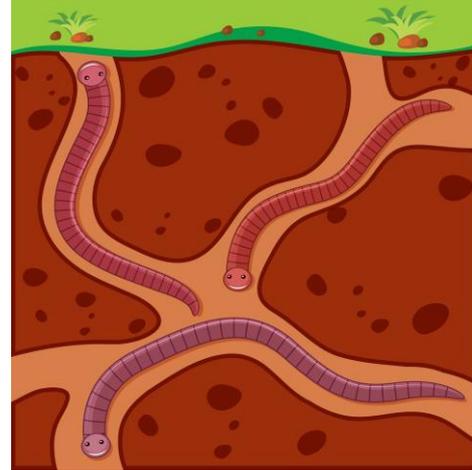
THREE TYPES OF EARTHWORM:

- **litter dwellers** - live close to the surface and eat plant remnants
- **subsoil and topsoil dwellers** - eat their way through the soil and contribute to a good soil structure
- **vertical burrowers** - dig permanent vertical tunnels in the topsoil and contribute to good water infiltration and oxygen provision



EARTHWORMS

- In ONE ACRE there can be a million earthworms
- The largest ever found was 22 FEET long
- Worms eat their weight in soil each day
- Worms can replace their segments
- Worms are neither/both male and female
- Earthworm slime is sticky and contains nitrogen
- Earthworms don't have lungs, ears, eyes



There is an information sheet all about earthworms which can be downloaded with this module

A close-up photograph of several green leaves with prominent veins and numerous small water droplets on their surfaces. The leaves are arranged in a fan-like pattern, filling the entire frame. The lighting is bright, highlighting the texture of the leaves and the clarity of the water droplets.

Any Questions?

We will have a Q&A each Wednesday morning 10am to 12 noon to answer questions in real time. But please feel free to post your questions to the group at any time.

FEEDING THE SOIL

What do we mean by 'feed the soil'.
You can't feed rock, water, air or the dead vegetation.

But you can feed the organisms that live in the soil, from bacteria to earthworms and everything in between.

The addition of compost, partially composted matter and even freshly dead vegetation like grass clippings will, with aid of the army of soil creatures, enable the creation of humus - dead vegetable matter and micro-organisms converted by the action of the soil microbes into a dark material that gives topsoil its dark colour.

The earthworms will burrow around, improving the soil as they go and leaving tunnels behind to help with water absorption and drainage.



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FEEDING THE SOIL

How to Feed the Soil

- **Compost**

Composting is a natural process of recycling of materials such as leaves and vegetable scraps

- **Plants**

Living plants can be grown for the purpose of improving the soil directly or as a liquid fertilizer

- **Supplements**

Including, Seaweed, Wood Ash, Manure



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COMPOSTING

Compost Bins

- Bins retain warmth and moisture and make better compost more quickly than an open heap
- Bins are resistant to being damaged by rodents and animals
- Bins can be a lot less intrusive, particularly in a small garden
- You can carry the bin to where you want to distribute the finished compost

Compost Heaps

- Having an earth base allows drainage and access to soil organisms
- An open heap means that you can turn it, aerate it, and easily add to it while it decomposes
- It is important that the site is not subjected to extremes of temperature and moisture, as the micro-organisms (bacteria and fungi) that convert the waste to compost work best in constant conditions.
- Position in light shade or shade – a compost heap is a good way to use a shady area of the garden.

WORM COMPOSTING

- Worm composting is an efficient method of turning kitchen waste and SMALL amounts of garden waste into nutrient-rich compost
- However, it is not a substitute for conventional composting
- A 'worm bin' or 'wormery' usually consists of at least two compartments; an upper composting area where the kitchen waste goes in and the worms actively work and a lower collection sump
- The worms used for composting are known by various names; brandling, manure, red or tiger worms – they are not the same as earthworms found in the soil
- Compost is produced in about 8-12 months and you must separate the worms out before using the compost. The worms can be used again



Available from <https://www.quickcrop.co.uk>

HOT COMPOSTING

- The term "hot composting" refers to a method in which microbial activity within the compost pile is optimized, resulting in finished compost in 2-3 weeks
- With hot composting, you assemble all the materials you want to compost at the same time and mix the materials instead of layering them gradually over time
- The pile needs to be at least four feet wide by four feet high and placed in full sun
- The optimal temperature for microbial activity is 130 to 140 degrees and the pile needs to be kept moist, but not wet. The heap should be turned every 3-4 days to maintain the heat



HOW TO COMPOST

5 easy steps

- **Buy a bin or build a heap**

This will depend upon the size of your garden and the closeness of your neighbours

- **Pick the right spot**

Shade is best, but choose a spot that doesn't heat up and cool down a lot

- **Put the right stuff in**

Nitrogen Rich Material - grass, plants - 50%

Carbon Rich Material - paper, straw, wood –50%

- **Don't put the wrong stuff in**

Coal ash, pet faeces, meat, fats, oils, coloured/shiny paper

- **Let the air in**

Regularly turn the heap to let in the air that the micro-organisms need

COMPOST WITHOUT COMPOSTING

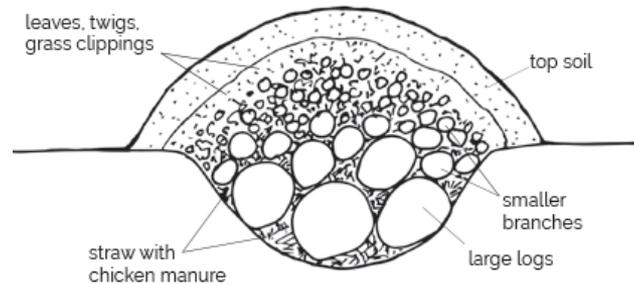
HUGEL BEDS ..

.. are raised beds built over rotting wood. This means that the bed has its own inbuilt source of nutrients.

Over time the soil of the raised bed becomes rich and full of life.

For the first few years, the composting process will slightly warm the soil and so might even lead to a longer growing season.

The woody material also helps to keep nutrients from leaching away.



COMPOST WITHOUT COMPOSTING

Hugel beds can be built up to create a large amount of vertical planting space which is useful in smaller gardens to create maximum yield



COMPOST WITHOUT COMPOSTING

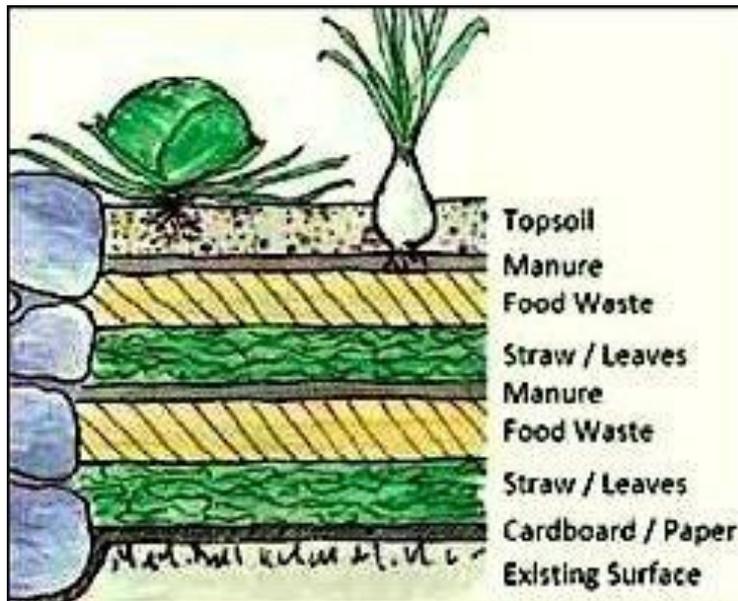
LASAGNE BEDS ..

Are simple raised beds built up from the ground with layers of cardboard (carbon rich), green material like grass cuttings, and other waste materials, topped of with a soil layer.

Lasagne beds can be planted straight away.

As the material decomposes it produces nutrient rich compost.

As the level of the bed drops, more layers can be added.



COMPOST WITHOUT COMPOSTING



1. Larger weeds removed from old bed
2. Cover with cardboard (newspaper)
3. Cover with grass cuttings
4. Cover with topsoil
5. Bed ready to plant

FEEDING THE SOIL - PLANTS

Living plants can be grown for the purpose of improving the soil directly or as a liquid fertilizer.

Green Manures

Fast-growing plants sown to cover bare soil. Their foliage smothers weeds and their roots prevent soil erosion. When dug into the ground while still green, they return valuable nutrients to the soil and improve soil structure.

Liquid Fertilizers

The leaves of plants can be harvested and allowed to rot down in water to make liquid feeds.

Nitrogen Fixers

Nitrogen fixation is the capture by microbes of atmospheric nitrogen gas and its conversion to ammonia, which can then be used by plants. These microbes can mainly be found in the nodules on the roots of legumes (peas, etc) and clovers. Having nitrogen naturally produced in the soil reduces the need for fertilisers.

Dynamic Accumulators

Are plants that gather minerals and nutrients from deep down in the soil. These plants can then be used as fertilizer or as a mulch.

A close-up photograph of several green leaves with prominent veins. Numerous small, clear water droplets are scattered across the leaf surfaces, reflecting light. The leaves are arranged in a fan-like pattern, filling the entire frame.

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NO DIG GARDENING

- No-dig gardening is a method that aims for minimal disturbance of the soil, so that the natural processes can be preserved. This allows the natural organisms to thrive, increasing the soil's overall health
- When you dig the soil, it recovers from the disruption by re-growing weeds, either from roots of weeds still in the soil and from seeds blown onto the freshly cleared soil. When left undisturbed the soil has less need to recover and grows less weeds
- Undisturbed soil is full of beneficial organisms and a fungal network which help plants to find nutrients and moisture
- Warmth is retained by soil in winter because deep-level heat can rise better through undisturbed soil
- Carbon stays in the soil rather than being converted to CO₂. Bare soil after cultivation releases large amounts of CO₂ into the atmosphere
- Undisturbed soil feels firm, but plants root better in dense, firm soil compared to one that has been dug and raked

GETTING STARTED

No-dig gardening includes Hugel Beds and Lasagne Beds.

1. START SMALL – maybe an area as small as 4ft x 8ft
2. Most weeds DO NOT need to be removed, though docks and woody plants such as brambles are best removed with a sharp spade
3. Cut/chop grass weeds down to ground level

4. Apply a mulch to the bed. The mulch is to clear soil of weeds by preventing light getting to the plants. Mulches of organic matter also feed soil

5. WAIT! Leave time for weed roots to be exhausted by trying to grow without light

Typically, annual weeds take two to three months while perennials take six months or sometimes longer. If you look under the mulch and still find white stems of weeds, the roots are still alive

After the mulch has done its job, you will have a clean surface to sow and grow!

MULCHING

A mulch is anything that prevents weed growth by depriving the plant of light. A polythene weed barrier would do but we prefer layers of biodegradable materials

WEED BARRIERS

Cardboard - is a fantastic resource, particularly the big sheets like those that large electric goods come in, as large sheets are easy to lay down. Worms love cardboard and happily incorporate it into the soil.

Remove any plastic packing tape first

Newspaper - is good, though much more difficult to lay over soil. Best wet the paper first

ORGANIC LAYERS

Grass Cuttings – thin layer

Weed Free Straw – though in wet conditions straw can be a great home for slugs

Fresh Manure – if this is likely to contain weeds then use a thin layer immediately above the barrier layer

Hay – taking care, as manure, if it contains weeds and seeds

Leaves – are a great free resource and can be collected every Autumn

Seaweed – easy to collect, especially after high tides

Wood chip – takes a while to break down so use sparingly

TOP MULCH – Planting Layer

Compost – well rotted, weed free from the compost heap or bought in

Spent mushroom compost – can be purchased

Topsoil – be careful if this is bought in as it may be poor quality and weedy

A close-up photograph of several green leaves with prominent veins. The leaves are covered in numerous small, clear water droplets, creating a fresh and vibrant appearance. The lighting is bright, highlighting the texture of the leaf surfaces.

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FURTHER INFORMATION

Books

- The Permaculture Way, Graham Bell
- The Permaculture Garden, Graham Bell
- Creating a Forest Garden, Martin Crawford
- Permaculture 1, Bill Mollison and David Holmgren
- Permaculture, A Design Manual, Bill Mollison
- People and Permaculture, Looby Macnamara

On-line

- The Permaculture Association
(www.permacultureassociation.org.uk)
- Permaculture Scotland
(<https://Scotland.permaculture.org.uk>)
- Abundant Borders
(<http://abundantborders.org.uk/training-programme/virtual-community-garden-learners/>)

Facebook groups

<https://www.facebook.com/groups/virtualcommunitygarden/>
<https://www.facebook.com/groups/foodcommunities/>
<https://www.facebook.com/groups/permaculturescotland/>

THANK YOU

We are a small, growing charity (SCO49008) supported by several organisations.

We are grateful for their support - without which we wouldn't be able to do what we do.

Thank you

