Key practices for growing soils

Well-functioning soils are important for supporting plant growth. The soil is where plants get their nutrients, water and air, where they form symbioses with other organisms and plants and where they receive supporting stability and the flexibility to grow. The following practices focus on growing soils by supporting soil biota (microorganisms, soil animals, fungi) and improving soil functions (water infiltration and holding capacity, nutrient cycling, and soil aeration).

Mulching

Mulch is a physical layer of material on top of the soil. This can help:

- Reduce weed germination by intercepting light and inhibiting weed growth
- Moderate temperature by dampening temperature fluctuations
- Reduce evaporation, so more water and moisture remain in the soil
- Protect soil from water and wind erosion, while still allowing rainfall to intercept the soil.

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Organic mulches, as opposed to plastic ones, further improve the properties of soil. As they decompose, they add organic matter and nutrients to the soil. These additions can increase and improve the biota in the soil (all soil life), which, in turn, helps to improve soil structure. This reduces the need to water, weed, fertilise, and maintain the soil. Mulching is not the only factor, but due to the many benefits, it can help to increase your crop yield. Mulch can have significant effects on your soil, so you will need to understand its key aspects and also its limitations. Before deciding on your mulch material, depth, or maintenance procedures, consider your climate, soil type, season, and crop.

**Climate**
Mulches are excellent for conserving soil moisture in dry climates, and in drought conditions. They also reduce water erosion during heavy rainfall. Mulches may be detrimental in wet and humid climates if they are too thick, as they may exacerbate poor drainage and water logging conditions. Some mulches (for example, straw) applied thickly in a wet climate provide a perfect habitat for small rodents and slugs, both having the potential to damage crops.

**Height and colour**
The colour and thickness of your mulch will impact on its ability to moderate soil temperature. A lighter coloured mulch will be more effective at reflecting solar radiation, and protect your soil from heat extremes. The thicker the mulch, the more effective it will be. Conversely, mulches can keep your soil warmer for longer as you enter the cold season. The thicker the mulch is, the less heat will escape from your soil. Mulch applied during colder months may also prevent your soil from warming as the weather warms, which is less desirable. You may wish to have a thin mulch for this period.

**Soils and plants**
Different soil types and crops have their own considerations. Sandy soils will benefit more from a thicker mulch than a rich organic loam soil. Different mulches have different chemical compositions; some may change the pH and nutrient composition of your soil. While a thicker mulch may give you extra protection against erosion, temperature extremes, and weeds, it may also be detrimental to your soil. Thicker mulches have been known to deplete soil nitrogen and soil oxygen. As a thicker mulch inhibits weed growth, it can also inhibit the growth of the plants you want to grow.

**Maintenance**
Mulch needs to be maintained as it breaks down. Some mulching materials will break down more quickly than others and need regular maintenance (for example, fresh garden waste, or grass clippings). In warm and wet climates, mulch will need to be re-applied regularly due to high levels of soil biota breaking down the mulch.

**Source**
If you are purchasing or acquiring mulch from elsewhere (for example, straw or hay), you will need to recognise the source. Mulches may harbour unwanted weed seeds and pests that will transfer to your soil.

**How to choose a mulch**
First, choose a suitable type of organic mulch. This will depend on all the factors above, including your growing site, what you plan to grow, and what you want the mulch to do for you. Let’s take straw mulch as an example.

**Straw mulch**
Straw is great for reflecting solar radiation (keeping your soil cooler in the
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summer) and preventing weed growth, but it can harbour pests such as slugs. If you are in a climate with a pronounced cold season, ensure your soil has warmed before applying your first mulch in the spring. Remove any weeds and ensure that your soil is moist – it may be a good idea to give it a soak first. Try applying the mulch to an approximate height of roughly 7.5cm and spread it in an even layer. It is difficult to state a “perfect” mulch height as it is highly dependent on your climate, soil, mulch type, and plants so that you will learn by experience. If you feel that the thickness is unfavourable to your soil and plants, apply less mulch next time. If you feel that it is not enough, and you are still experiencing high numbers of weeds, try adding to it through the growing season. If you already have plants established, place the mulch around them leaving a small gap at the plant stem. If you plant after mulching – recommended for larger areas – create a hole in the mulch for plants, seeds, or seedlings. Lightly work the remainders into the soil after you harvest and re-apply new mulch the next year.

Adding compost

Compost is decomposed organic matter and provides nutrients for plant growth, similar to what artificial fertiliser does. Unlike artificial fertiliser, compost also helps to feed soil fauna, like earthworms and microorganisms (bacteria and fungi), which in turn, improve soil structure and fertility. With improved soil structure, roots can better penetrate the soil. This improves water drainage and infiltration as well as soil aeration. In sandy soils, compost provides a substrate to enhance water and nutrient retention. In degraded soils, compost can help mitigate the problems of reduced organic matter and fertility, erosion, or compaction. Overall, compost helps to increase the quantity and quality of plant yields while regenerating and protecting soils. Add your well-rotted compost before the start of your growing season(s). If your soil has little organic matter (light coloured), add 10-15 cm of compost to the soil surface, or add 3-7 cm of compost if your soil is rich in organic matter (dark brown or black). If your soil is loose, easy to dig and drains well, add the compost and dig to a depth of 15-30 cm in one step. If your soil is compacted and difficult to dig with poor drainage, loosen your soil to a depth of 30cm, then layer your compost on the surface and turn it under to a depth of 15-30 cm.

You can also use compost as a mulching layer on top of your soil. It is fantastic mulch for enriching your soil quickly, but it may not be very effective at smothering weeds. Compost mulch breaks down faster and will require re-applying more regularly. Re-apply halfway through the growing season, and again after harvest.

Planting cover crops

Cover crops have been used for thousands of years to increase soil productivity and provide ecosystem benefits. They can also help to sequester carbon in the soil. They are planted mainly to regenerate and protect soils during periods of low production. Planting cover crops is like giving soils a regenerating break. They can be planted as winter cover, or during the regular growing season to protect otherwise bare or “non-productive” soil from erosion and sediment run-off, while at the same time improving the soil’s overall water and nutrient-holding capacity. When used as green manure, cover crops can improve the available nutrients in soils leading to increased growth and yield of plants that are grown afterwards. Planting cover crops can also break pest and disease cycles, which occur naturally and often can’t be avoided completely. Leaving cut cover crops on the soil surface, or planting as “living mulch” with a tall main crop, can help reduce weeds. Although, careful plant selection and management are needed to ensure the cover crops do not themselves become competitors to the main plants.
The right choice of a suitable cover crop species (or mixes) and the timing of planting and removal depend on the aims and reasons for using them.

To protect soil from erosion and related nutrient loss
Any cover crop is better than bare soil. Species with fine-branched roots like rye (*Secale cereale*), oats (*Avena sativa*) and white mustard (*Sinapis alba*) can best improve water infiltration and hence reduce soil erosion due to water run-off.

To increase soil fertility and quality
When worked into the soil, cover crops improve the amount of organic matter in the soil. Legumes like vetch (*Vicia* species), clover (*Trifolium* species), beans (*Vicia faba*), peas (*Pisum sativum*) and alfalfa (*Medicago sativa*) can provide both soil nitrogen (for plants) and carbon (for soil organisms). Alfalfa is deep-rooted and can improve soil aeration and drainage. Non-legumes can also increase soil organic matter and, instead of providing nitrogen to soils, can take up surplus nitrogen.

To reduce weeds
Winter-grown cover crops can be cut and left on the soil surface to block weed germination before planting the food crop. Overall, this can make bed preparation easier. Living mulches, including perennials like white clover (*Trifolium repens*) or birdsfoot trefoil (*Lotus corniculatus*), may be grown alongside the main plant. The time spent hand weeding and the use of herbicides can be reduced. Also, if using perennials, there is no need to resow each year. Still, careful observation and management are needed to ensure that the germination and growth of the main plants are not affected.

Other benefits
Many cover crops have additional benefits. E.g. *Phaeceila* (*Phacelia tanacetifolia*) is effective green manure and, if left to flower, attractive to bees and other pollinators.

### Planting legumes – a special case
A legume is a plant from the family Fabaceae, also known as the pea, or bean family often used in intercropping, crop rotations, and as mentioned above, as cover crops. Their speciality lies at their roots. Most legumes have root nodules containing a bacterium called Rhizobium. Rhizobia fix atmospheric nitrogen and turn it into soil nitrogen, which can be readily available to plants. It is estimated that legumes contribute approximately half of the yearly biologically fixed nitrogen to the world’s soils. The potential increase in soil nitrogen caused by legumes can increase the protein levels of other plants alongside, or after the legumes. Legumes can help regenerate nitrogen deficient soils as well as help substitute nitrogen fertilisers. Nitrogen fertilisers, if applied broadly, intensively and not buffered properly, often harm fresh water sources by runoff. Legumes include edible crops (for example, beans, lentils, and peas), or forage crops (for example, alfalfa and clover).

### Other in this GROW Regenerative Practice series:

- **Key practices for growing ecosystems**
- **Key practices for growing polycultures**
- **Key practices for growing soils**