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Protected Cropping – Optimising Fertility

Compost.

Well-made compost is probably the single most important input to your greenhouse. Learning how to make or procure quality compost should be a top priority, though beyond the scope of this guide, however the following recommendations will help.

- For **green waste compost**, use a PAS100[1] certified supplier. The compost will usually arrive quite 'young'. If it is still warm it will need upwards of 6 months to mature before use. Ask the supplier how old the compost is and buy a year in advance if very fresh. Green waste compost is often delivered too dry, try adding water by coiling some dripper pipe on top of a flattened pile and watering little and often. Leaving it open to the elements can result in the top layer being leached out while the center stays dry so cover with a tarpaulin.
- If making your own compost on a **small to medium scale**, a front loader and a series of bays made from concrete, wood or straw bales can be used to ensure regular turning. Vegetable waste and fresh green material should be combined with woody and/or strawy material. Moderate additions of manure can help stimulate decomposition and is the best way to use this resource if scarce.
- Composting machinery for **large scale production** comes in all sorts of shapes and sizes but a suitable feedstock is required to earn its keep. Green waste, sawdust, straw, animal manures, crop residue, grass and clover cuttings and pack waste can all be used in the correct proportions. Large scale composting may require planning permission and environmental permits[2] (over 50 tonnes per year).
- Try to keep applied compost in the surface layers of your soil, little and often is best for most short-term crops, 3 - 4 kg per m2. For demanding summer crops double this with further top dressings once fruiting begins.

[1] http://www.wrap.org.uk/content/bsi-pas-100-compost-specification
[2] https://www.gov.uk/waste-legislation-and-regulations

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Can you use too much compost?

Certainly many crops do not grow well in pure compost but maintaining high organic matter will encourage microbial activity, improve both drainage and water retention and make for an open and workable soil.
Over-applying fresh compost, can lead to excess nitrates and continued high applications may lead to excessive phosphate levels as nitrogen and potassium tend to remain in soluble forms for longer and are rapidly utilised or lost.
Some high OM soils can become 'porridgy' and grow moss and algae where underlying drainage is poor.
Reports of deficiencies are possibly due to inferior composts containing too much un-decomposed woody material, lime or heavy metals.
The optimum in most soils is thought to be 5 – 8 % but 20% + organic matter can grow excellent crops where suitable aeration and temperatures can be achieved.

Green Manures

For long season crops time demands make it almost impossible to fit green manures into the system, and indeed even in unheated systems many growers maintain that the only way to grow a viable green manure for a greenhouse crop is to move the greenhouse over the crop rather than grow the crop in the greenhouse. While old Victoria railed glasshouses are now rare there is renewed interest in this method for polytunnels.[3]

A space efficient alternative, under-sowing taller crops, is popular though not always easy to get right, timing of sowing is important to reduce competition with the crop for light, water and fertility. Weed control may be an issue as this obviously removes the option of mulching or hoeing the crop.

Growing for a local market can open up opportunities for summer green manures as the productivity of greenhouse space coupled with the outdoor cropping season relieves the pressure to utilize every inch. Often demand for summer crops drops as customers go on holiday or grow their own.

Growing green manures is easier where weeds have been well controlled and water is plentiful.

[3] See Organic Farming Magazine Issue 114

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Green Manure Crop	Details
Summer legumes: Sweet, crimson, alsike/Persian clover	Will fix good amounts of nitrogen in the increased temperature but may need weeding or cutting to control weeds. A good choice where free water is plentiful.
Overwinter legume: Clovers sown September to October, Tares as late as Christmas.	Good spring growth will fix useful N and improve soil for summer crops. Good choice where weeds are a problem and winter leaves are not competing for the space.
Under sown legume: Trefoil, medic, white clover	Use non aggressive species and find out or experiment with timings. Best choice where space is premium and ground cover is not used.
Short term non-legume: Phacelia, buckwheat, amaranth, rye grass.	Choose as suits the season, these will outgrow most weeds. Good for filling gaps in the plan and where raw mineral fertilisers need to be incorporated.
Longer-term green manures	should be row sown to allow for hoeing if necessary.

Avoid weeding by cutting the crop with a strimmer, mower or scythe before weeds set seed.

Where crops fail to grow well without repeated fertiliser inputs you could give green manure crops a try. The overall improvement in soil quality is greater than the sum of the green manures parts! Following crops are often noticeably healthier than those given compost and/or fertiliser alone.

Analysis and fertilisers

Most fertilisers verified as acceptable for use by organic producers require either justification at inspection or prior approval. Either way you need to demonstrate firstly that they are required, and secondly that you are implementing strategies to reduce these requirements through the fundamental processes of rotation, green manures and building soil organic matter.

Additional inputs should be viewed only as supplements - and not substitutes - to the system, and should only be called upon when absolutely necessary. If you do recognise a need to supplement the fertility-building process, an examination of the system, such as a nutrient budget[4] and/or full soil analysis, will normally be required.

The expense of soil analysis can be off-putting for smaller growers but, particularly in the formative years, understanding the fertility characteristics

[4] http://www.extension.org/pages/18794/nutrient-budget-basics-for-organic-farming-systems#.U7pL1ZRdUTB

of your soil and the effects of adding composts and fertilisers can be helpful. There are plenty of laboratories offering services but few specializing in organically-managed soils. It is vital that growers recognise the limitations of soil test results and cross reference the information they get from them with their own results and experience.

Which type of analysis you choose is possibly less important than how the results are interpreted and what this means to you as a grower. Use the same method / company consistently to ensure you are making a true comparison. It is usually best to start with a soil analysis but if you think you have a fertility issue based on crop performance try leaf analysis to help identify deficiencies. If this corresponds to soil analysis a fertilizer may be needed. If you are struggling with fertility despite using plenty of compost get the compost analysed as well as the soil and compare results. Agronomist advice does not come cheap but can identify problems and solutions, which for larger growers, is worth the investment. Always ask for an agronomist's portfolio and testimonials, this is not an exact science despite what you may be told!

Using nutrient specific fertilisers without sound recommendation or experience can cause more harm than good and this is reflected in the standards approach to fertilisers. Adding mineral amendments to augment your compost and green manures rather than direct to crops helps reduce this risk.

Specific issues in glasshouses can usually be related to historical soil management, salination from over fertilisation and/or under watering, contamination from poor inputs and low biological activity resulting from the above and compounded by insensitive tillage.

Due to the types of crops normally grown and the use of some compost, additional sources of nitrogen (ideally legumes) and potassium (potash) are often needed (see 'compost' section on phosphate). Other deficiencies will be more site-specific but ensuring adequate N and K for healthy fruit and leaf production will be helpful, particularly where a limited range of crops is grown and sufficient quality compost cannot be obtained. Growing a wider range of crops including varieties (such as root crops) that are less N and K demanding is part of the solution to reducing input use as well as careful soil management and minimizing leaching through irrigation or from compost heaps.

Liquid feeds

Liquid fertility is more rapidly available and should be reserved for propagation, specific treatment of unforeseen deficiency or stress-induced problems, and some long term crops.

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Seaweed[5] contains a wide ranging though low concentrations of nutrients and trace elements, cytokinins and betaines that can help alleviate crop stress and improve general health.

Homemade fertilisers and tonics
The Soil Association standards [6]allow for using plants grown on your own holding to make plant tonics and liquid feeds, which can be a cost effective and sustainable way of providing a liquid feed when needed.

For example a simple preparation for comfrey and nettle extract is to pack freshly cut leaves into a large plastic drum. Put a weight on top to keep it pressed down and collect the juice that runs out a filtered hole in the base after a few days. Bottle airtight as soon as possible and use very dilute as a root feed.

- Comfrey – Good homegrown tomato feed, Bocking 14 developed by Lawrence Hills is sterile and extra potent.
- Nettle – Wide range of trace elements – good combined with comfrey.

Inoculants

Commercially available strains of various bacteria and fungi can have beneficial qualities in poor soils. Though unlikely to be of major benefit if you are already using compost, mycorrhizal fungi can be applied to long term crops and compost teas may help to improve soil health.

Certain commercially available strains of bacteria can induce systemic resistance (improve resistance response to pathogen exposure) in addition to their bio fungicidal activity (see 'disease').

If sowing a leguminous green manure consider adding an inoculant, usually available from the seed company, to ensure the appropriate nitrogen fixing bacteria are present.

[5] Standards 4.8.5 & 4.8.6
[6] Standard 4.8.7

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Other publications in the protected cropping series

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