Soil Health and Management in Organic Farming

Practical implications for farming and growing

Assessment of the health of your soil is the very first step in farming and growing; use a combination of physical, chemical and biological assessments to really understand what sort of soil you are dealing with, to know the mineral nutrient content and availability and to get a sense of the biological activity of that soil. Perhaps the best indicator of all is the health of the plants growing in the soil and the health of the people and animals eating the plants. The real challenge comes next; what to do about your soil once you have made a thorough assessment of it. Too often recommendations from the laboratory are too vague or too expensive, and lack an understanding of the conditions of your particular farm or it is not clear what to do about the soil structure or level of biological activity found.

The principle points that will come from soil health assessment are:

- pH
- Plant available mineral levels and sometimes mineral reserves
- Soil structure and drainage
- Soil organic Matter
- Biological activity

Our aim is to ensure that these are at optimum levels to support the production of healthy plants and animals. Ultimately the availability of nutrients, air and water to the plant is what is needed; this can only be achieved by addressing all these points, not

just one, often too much emphasis is placed on one, such as soil mineral levels. In fact they are inter-related, for example nutrient availability is dependent on total mineral content, organic matter, soil structure and biological activity, including the nutrient mobilising effect of micro-organisms and plant root exudates. Some times it is possible to operate with quite low levels of total minerals by enhancing availability with good structure and high levels of biological activity.

So, as farmers and growers what can we do to improve soil health and production?

Addressing Deficiencies
Adding naturally occurring mineral fertilisers is often a first step to address underlying deficiencies, rock phosphate, potassium sulphate, magnesium and even some trace elements are all possible options. Select the less soluble forms and avoid those that may damage soil life, such as the chloride salts. Optimum levels are not well established for organic and agro-ecological conditions so some adjustment of target levels may be needed.

Most important of all is to ensure an appropriate pH for the crops that are being grown, by liming if necessary; for most soil life and crops a pH of 6.5 – 7 is ideal.

Manure and compost
The first aim of managing a farms' own manure is to maximize recycling of nutrients and to minimize waste: this means proper storage, application to the fields that need it, particularly those with low Nitrogen (N), Phosphorus (P) or Potassium (K) and at optimum application rates. Manure will stimulate soil biological activity, such as the phosphorus enhancing mycorrhiza, so a little (5-10 tonne/ha) spread over a large area is often better than high rates on a small area. Manure needs to be used strategically on the farm, often in low index situations to supply P and K rather than N, so it may be applied to conserved forage or prior to crops (extreme super market rules permitting) rather than grazed fertility building leguminous leys, where the nitrogen-fixing bacteria may actually be suppressed by the soluble N in the manure.

Composting, usually by repeated turning and aeration with a specialist turner or fore-loader, is often essential if returning green waste, to make it more readily utilizable by the soil organisms, but the process also changes the form of the organic material; well composted green waste or farm yard manure will have a more stable organic matter so is particularly appropriate for low organic matter soils, and where improved soil structure, water retention and drainage and rooting is needed. Fresh manure will not only be higher in available N but also stimulate soil biological activity.

Importing manure from another farm to increase N, P or K levels is an alternative to purchasing mineral fertilisers and in some cases may be more environmentally benign, but for organic farms if conventional manure is used it does not support the closed system that is sought.

Green manures, leys and crops
Soil health is greatly influenced by the type of fertility building leys and green manures as well as by the crops grown for sale. The use of legumes is central to any sustainable farming system: the aim is to balance the crop off-take with the nitrogen fixing legumes.

The choice of legumes is important; it has been found that growing a mixture of 3 or 4 legumes in a ley or green manure and selecting species such as red clover, white clover, lucerne and black medick fixes more N and releases it over a longer period of time, particularly when mixed with suitable non leguminous grasses and herbs.

Interestingly specific crops and green manures also affect the nutrient release and availability from some forms of tightly locked up minerals; not only will some, such as mustard prevent leaching during winter but others will release root acids that help mobilize nutrients, such as buckwheat (either as green manure or crop) which improves the availability of phosphorus and fodder beet which improves the availability of Potassium. Deep rooting plants such as cocksfoot, chicory, fodder radish, sainfoin and lucerne all help soil structure and bring up nutrients from depth. Incorporating a green manure or cover crop such as phacelia or rye will stimulate biological activity in the soil surface, improve soil structure and return nutrients, some such as caliente mustard will reduce soil pests such as eelworm.

The proportion of fertility building to cash cropping depends on the individual situation; rarely should it be less than 50% or at the very least 30% of the rotation in fertility building in a well balanced system minimizing the use of imported nutrients.

Machinery

Various forms of machinery can be used to aid soil health. Remedying soil structure with appropriate machinery is straightforward: surface slitters will aerate, drain and help break up a cap, subsoilers with fixed and winged legs will address subsoil compaction and plough pans when used just below the problem layer in the right ground conditions. There is a risk that powered cultivators will damage soil structure and soil biology but used sensibly they still have a place. There is renewed enthusiasm for non-inversion tillage, certainly less damaging to earthworms. The indications are that it may need greater use of green manure crops to achieve similar yields but may well have a place in organic farming which has become very reliant on ploughing for weed control.

The soil is such a complex organism that in many cases aspects of it will be affected by all these activities. Earthworms love to be left undisturbed in longer leys and permanent pastures, suffer from both cultivations and excessive slurry application and need constant food in the form of organic materials such as fresher manure, crop residues and green manures.

The aim should be to avoid damage to soil structure in the first place, for example caused by poaching with stock, or incorrect machinery, or using it at the wrong time and avoidance of declining nutrient levels, below what may be a critical point. The aim should be to see long term improvement in nutrient levels and availability, soil structure, organic matter and biological activity. An important use of physical, chemical and biological soil assessment is to monitor these long-term changes, so assessment of the same one or two fields every year provides a useful indication that soil health is improving.

Mark Measures
Director, Institute of Organic Training and Advice ORC mark@organicadvice.org.uk