‘Tradies’ Organic Horticulture Course

‘Learn how to build healthy soils, healthy plants & healthy people’

Notes for session presented by Peter Rutherford
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This ‘Tradies’ Organic Horticulture Course will deepen your knowledge and skills that you can then choose to apply in your work practices. You will learn how to build ‘living soils’ & understand what soil is made of. The ongoing success of organic gardening & farming depends on beneficial microbes, which act as drivers for our entire soil and plant systems.

This course will cover the following;

- Microbial nature of soil
- What is Humus?
- Understanding the microbial balance in your garden.
- Promoting bacterial or fungal dominance to suit different types of plants
- Testing & understanding pH
- Water holding capacity of soil
- The effect of synthetic fertilisers on soil
- Learning to apply the 3 ‘Keys’ to your garden:
  1. Composts & Worm Farms – How to manage & use them
  2. Mulches – different mulches for Annuals & Perennials
  3. Aerated Compost Teas -

What is soil made of?

Soil is made of two types of ‘ingredients’ – Organic Matter (OM) & Rocks (Mineral Matter). Understanding this in a practical sense will give you the skills & confidence to grow plants anywhere in the world.

> **“The soil is virtually a living organism. It is not just a collection of mineral particles with bugs walking through them. It is a mass of organic, living material in an inorganic matrix. It is dynamic. It is full of life. And it does not produce anything (healthy and vital) for human beings unless it is sustained in that living condition.”** ***EO Wilson (1993)***

Minerals

These begin as rocks which gradually break down into smaller and smaller particles (ie sand to silt to clay). Clay particles are defined as mineral particles having a diameter of <0.002mm. These minute particles are given the name ‘Clay Colloids’. Clay colloids have a very symmetrical, crystal like shape with a fairly flat, small surface area, and they are electrically charged.

Organic Matter (ANY PLANT OR ANIMAL TISSUE)
All plant and animal tissue (other than when burnt) is decomposed (ie, broken down) by soil microbes and macrobes into smaller and smaller particles. These decomposing particles of organic matter eventually become HUMUS. Humus particles are defined as organic particles having a diameter of <0.002mm. These minute particles are given the name 'Humus Colloids'. Humus colloids have a very irregular, anemone like shape with a very large surface area, and they are also electrically charged.

Colloids
Both the clay and humus colloids have special qualities. They have an electric charge (mostly negative) all over their surface. This mostly negative charge allows these colloids to attract and hold large numbers of positively charged nutrient ions, to their surface. eg, positive ions such as Calcium (Ca), Magnesium (Mg), Sodium (Na), Potassium (K) etc.
BUT - The Humus colloids are the key. Each Humus colloid has a much, much bigger surface area than each Clay Colloid, even though they are about the same size in diameter. It is estimated that each Humus Colloid can attract and hold 10 to 100 times more plant nutrients than each Clay colloid.

This means that even in periods of very heavy rainfall, soils with high levels of Humus will 'hold' onto the plant nutrient ions and they will not be 'leached' out of the soil.

"The Plant always eats at the second sitting, the plant only gets what the microbes give it. Feed the soil, Not the Plants!" ***Professor William Albrecht. (WALTERS - 1979)***

Testing & understanding pH

Acidity and Alkalinity are measured in terms of pH units. The pH scale ranges from acid (pH 0) to alkaline (pH 14) and pH 7 is neutral. pH actually means potential (p) Hydrogen (H). It is the way we measure the Acid/Alkaline balance of soil. All acids have Hydrogen molecules somewhere in their structure. So when we measure pH of soil, we are actually measuring the amount of Hydrogen that can 'potentially' turn into acid.

0	6	7	7.5	14
Pure Acid		Neutral		Pure Alkaline

Most herbs & vegies like a pH of between 6 and 7.5

We will look at two methods of measuring pH.

1. Chemical powder pH test kit available from garden centres and hardwares.
2. Electronic test meter.

pH testing is a useful thing to do, especially when starting a new garden. We can determine if it needs an initial adjustment, for example if it is too acid, an addition of dolomite lime will be needed. However, once you have created a vibrant, alive, soil system, pH testing is a lot less important because the worms and microbes work for you, to keep the pH balanced.

Water holding capacity of soil

The ability of soil to take in water, ie the infiltration rate (IR) and to hold water, ie the water holding capacity (WHC) is very important. To most efficiently capture & use either rainfall or stored water in our gardens, there are some practical things we can do .

When and How to Water

- In good quality 'loamy' deep soils, water deeply and less often. This will produce a deeper, more extensive root system and increase the plants ability to resist disease and insect attack.
- In shallow sandy soils (like many parts of Sydney), it will probably be more water 'efficient' to water more regularly and for shorter periods of time. Long deep watering on sandy soils will result in a huge waste of water.
- Try and water in the early morning. Less water is lost due to evaporation, water pressure is at its peak and risk of fungal disease will be reduced.
- Consider using a 'spike' (below surface) watering wand

Mulches

- Nature does not have 'BARE EARTH'
  Always have a mulch or a living plant, covering the soil surface. This greatly reduces the amount of water lost by evaporation and increases infiltration rate and balances soil temperature.
- Use a variety of mulches; don't get stuck on any one type. Diversity is the key.
- Newspaper is a useful mulch, although it can reduce water infiltration if too thick (use no more than 10-15 pages)

Composts/Organic Matter (OM)

- Greatly increase water holding capacity (WHC) and infiltration rate (IR)
- An increase of 1% OM (eg, from 3% to 4%) in soil will increase the water holding capacity of that soil by up to 5 or 6 times
- Greatly increase microbe activity in soil
- Greatly increase nutrient holding capacity of the soil

Planting

- Pre soak pots and tubes (add diluted worm juice or seaweed extract)
- Fill holes with water and let soak in, at least once before planting (preferably twice)
- Always water-in very well immediately after planting to remove large air pockets around roots
- Place a stone or a rock near drip line of young trees after planting, this helps retain moisture

The effect of synthetic fertilisers on soil

Organic gardening means stopping the use of any 'cides', ie Insecticides, Fungicides, Herbicides, etc. Cide = death or to kill (Latin). Organic gardening also means stopping the use of all 'synthetic, acid soluble fertilisers'. The reason is that acid soluble fertilisers gradually make your soil more acidic and there is also evidence that food plants grown using acid soluble fertilisers makes our blood more acidic, when we eat those plants (most degenerative diseases thrive in an acidic environment).

Microbial nature of soil

It's ALL ABOUT MICROBES!

This is the 'brave new world' of horticulture/agriculture. We are learning how to work with and manage, microbial populations in the soil and on the plants. Microbes are our 'friends', not our 'enemies' contrary to popular belief. Over 90% of all microbes are beneficial, 5-10% can cause harm. The 'beneficial' ones keep the 'harmful' ones under control. The higher the variety (or diversity) of microbial species in soil, the healthier our plants become.

These marvellous microbes will **increase**:

- the water-holding capacity of your soil

- the breathing capacity of your soil
- the quantity and quality of nutrients available to your plant
- the immune strength of your plants
- the nutrient levels in the food plants you grow

We are microbial creatures. Every leaf of every plant is covered with microbes. Every square centimetre of our skin has over a million living microbes on it. These microbes keep us & our plants alive and healthy!

Creating bacterial or fungal dominance to suit different types of plants
Bacteria & Fungi are the two main bodies of microbes in soil. Annual plants are happier and healthier with bacterial dominance in their root zone, Perennial plants prefer a fungal dominance in their root zone. We will learn how to manage this in our gardens.

The softer ANNUALS - ie vegies, herbs, etc - prefer a more bacterial dominated soil or a reasonable balance of bacteria and fungi.

Most PERENNIALS – ie woody shrubs and trees, prefer a fungal dominated soil.

Bacteria are concentrated forms of Nitrogen (N). No other living creature has a higher concentration of N in its body than bacteria.
Bacteria have a C:N ratio of approx 4:1 (4 parts Carbon to 1 part Nitrogen)
Fungi are concentrated forms of Carbon
Fungi have a C:N ratio of approx 15:1 (15 parts Carbon to 1 part Nitrogen)

So we begin to learn that **bacteria** will begin to 'dominate' in the soil food web if we INCREASE the amount of Nitrogen (Protein). F**ungi** will begin to 'dominate' as we increase the amount of Carbon into the soil.
It is now for us to learn how to get a 'feel' for this balance and then learn to shift this balance, in the direction preferred by the plants that we are growing.

Learning to apply the 3 'Keys' to your garden:
To manage pH, water, microbial balance, general plant production & plant health, we have the following 3 'tools' to learn to use.

1. **Compost** – we refer here to the 'black' Humus material from decomposition
2. **Mulches** – we refer here to any materials added to the surface of your soil
3. **Aerated Compost Teas** – we refer here to 'brown' liquids made from stirring mature composts in water using special recipes for spraying onto both the soil and the plants themselves. 'Worm Juice' from a worm farm is also technically a 'Compost Tea'.

Composts & Mulches

BACTERIAL DOMINATION
Knowing that soft annual plants (vegies & non woody herbs) prefer Bacterial domination in their root zone, then, they will prefer composts & mulches with higher protein/nitrogen. More Protein encourages bacterial activity and will have more Nitrogen available in the Nitrate form. (NO_3) Compost ingredients higher in Nitrogen are the fresh soft green materials, especially legumes, and

also animal manures. Mulches higher in Nitrogen are the fresh soft green materials, especially legumes, eg lucerne hay & chaff, and chick pea mulch.

FUNGAL DOMINATION

Woody shrubs and trees prefer Fungal domination in their root zone. Composts & Mulches with higher Carbon encourage Fungal activity and will have more Nitrogen available in the Ammonium form (NH4). Mulches which are higher in Carbon include the more woody brown materials such as dry leaves, and 'woody' mulches. 'Forest Fines' from Kimbriki, is an excellent fine woody mulch with high diversity of ingredients. Forest Fines is also an excellent ingredient into your home compost bin. NB: Sugar cane mulch has average levels of Nitrogen and Carbon.

Note: it is also beneficial to use a small amount of high protein mulch and some cow or pelletised poultry manure, around perennials at flowering and fruiting times of the year.

Modern 'Aerated' Compost 'Teas'

Recent biological research is showing us a BIG DIFFERENCE between:

1. the old style manure teas, made simply by soaking some manure or compost in water and getting a brown liquid and
2. the modern 'compost teas' which use more specific recipes and must be 'Actively Aerated'. Old style manure teas are often Anaerobic with low numbers of beneficial microbes and can ferment into alcohol which can be dangerous to some plants. Modern Aerated Compost Teas are very high in beneficial microbes and have no alcohol.
    i) When to Use Teas?

- At onset of flowering or fruit set
- At first sign of any stress or disease in plants
- Boost to young plants over two weeks old
- Regularly as a general 'tonic' for plants

Human Health Issues related to Organic vs Synthetic Practices

(Much of the information in this section comes from Tietze – 2003)

- The build up of organic acid waste is our main problem. Ageing is organic waste build up. The most common acid waste products in our body are acetic acid, ammonia, carbonic acid, carbon dioxide, fatty acid, lactic acid and uric acid.
- When we are born we are in the most Alkaline state of our lives. Reversing the slow but steady build up of acid waste in the body slows the ageing process
- Food is either acid or alkaline FORMING in the body. This does not relate directly to the actual pH of the food itself. For example, lime (the fruit) is extremely acid with a pH of aprox 1.9 but this fruit increases the alkalinity in the body and has an alkalising effect. If we want to influence the body's pH with food, it is not so important to know the pH of the food itself, but the reaction in the body, to the food.
- The acid or alkaline 'forming' response depends on the Calcium/Magnesium/Phosphorus/mineral ratio in the food.
- The most significant factor to mention here is that when we eat Organically grown plants, this usually increases the alkaline forming response in our blood. The same plant grown NON-Organically, using highly acidic synthetic fertilisers will have a more 'acid forming' response in our blood.

The Real Difference Between Organic & Non-Organic Food

Peter will do diagram on the whiteboard if time permits!

Learning More with Like-Minded People

Consider joining your local Permaculture Group.
Our local one is Permaculture Northern Beaches
They meet on the 4th Thursday of each month from 7pm – 9pm
In the Lakeview Hall at the Tramshed Arts & Community Centre
1395A Pittwater Road Narrabeen NSW 2101

Permaculture Sydney North is the 'mother' group & they meet on the 3rd Monday of every month (except January) at the Ku-ring-gai Centre for Seniors 259 Pacific Highway Lindfield
Doors open at 7pm for a 7:30pm start.
Phone 1300 887 145, or email info@permaculturenorth.org.au for more information.
Permaculture North can put you in touch with Permaculture groups in your local area.

Useful Information

Where to get 'Fruit Trees' other 'useful' plants.

- Local Nurseries ("New Leaf Nursery" is a great one – at 224 Powderworks Rd, Ingleside. 2101. Ask for Daniel ph. 9913 3709)
- Some Specialist Nurseries (check internet and yellow pages)
- Farmers Markets (often cheaper)
- **Daleys Fruit** Tree Nursery (Kyogle – NSW)

A wholesale and retail outlet that sells an extensive range of quality sub tropical fruit trees, nut trees, etc.\ www.daleysfruit.com.au

What to Plant & When?

Try the 'I-phone' app called **"Gardenate"**

Posters

LINDEGGER, Max (1992) - "Subtropical Fruits – A Compendium of Needs & Uses" Approx $20
A design aid for Permaculture in Town and Country.
Published by Max & Trudi Lindegger. Maleny, Australia.
max@ecologicalsolutions.com.au ph 0754944741

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