



# **Grow Great Fruit**

## **ESSENTIALS COURSE**



**[WEEK 4 – EARLY SUMMER]**



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# DIAGNOSING NUTRIENT ISSUES IN FRUIT TREES....

Nutrition is a vital part of plant health. A nutrient deficiency (or excess) can reduce the plant's ability to do what it wants to do naturally—complete a cycle of producing flowers, fruit, and seed. Most nutritional deficiencies show symptoms in the leaves—often discolouration, size, and/or shape. Others show up as overall poor health, or lack of vigour, small fruit size, and, in the worst cases, the tree gives up and dies. Nutritional excesses can also often lead to problems where an excess of one thing makes something else unavailable to the plant. So while a symptom may be a deficiency, the cause may in fact be an excess.

Diagnosing nutritional problems in trees is a tricky business. You can see that there is something not right with your tree, but is it a pest problem, disease problem, or something to do with nutrition (or even something else, like drainage!)? Usually it's a combination of these things, and there may be more than one nutritional issue!

What we are really aiming for in the long term is balance—stable soil with a good structure, pH, and levels of organic matter and microorganisms. If we are working towards improving the overall health of our soil—adding compost, other organic matter, compost tea—then we are also working at minimising nutritional problems. A well-balanced soil will contain the complete range of nutrients—both macro and micro—and in a form that is plant available.

Most nutrient problems are aggravated by the use of synthetic fertilisers—though they can act as a 'bandaid' and make it harder to

identify the real problem.

So what are the major and minor nutrients, and what happens if they are out of balance? The major ones are nitrogen, calcium, phosphorous, sulphur, and potassium. The minor ones (micro or trace elements), but still vitally important, are manganese, magnesium, copper, zinc, iron, boron, and molybdenum. This is not a comprehensive list as there are other minor ones such as silica. The really important ones for tree fruit are calcium, potassium, copper and boron.

## NUTRIENT MOBILITY

**MOBILITY.** Nutrients are generally classified as mobile or immobile, depending on how readily they move around within the plant. Symptoms of deficiency follow a pattern. If a plant is deficient in mobile nutrients (nitrogen, phosphorous, potassium, magnesium), symptoms will often show up in older leaves as the limited nutrients move to younger growth. A lack of immobile nutrients (calcium, boron, iron and zinc) will generally show symptoms in the growing tips.

**SOIL PH** is another factor that affects availability of nutrients, so while the nutrients may exist in your soil, the pH level can affect how available they are to the plant. Plants in a soil that is strongly alkaline (above about 8.0) may struggle with nitrogen, iron, manganese, copper, boron and zinc; in an acid soil (below about 5.0), all the major nutrients (nitrogen, calcium, potassium, sulphur and phosphorous) and some of the minor ones (molybdenum) may get tied up.

**SOIL STRUCTURE** is critical to nutrient mobility and availability. A soil with good structure retains water and nutrients and makes them readily available to plants. Soils with a high loam and clay content are better in this regard than sandy soils, which drain rapidly and are prone to nutrient leaching.

*'Cork spot' in apples indicates calcium deficiency*

## AT A GLANCE...

Nutrient deficiencies can be hard to diagnose, but symptoms generally follow recognisable patterns.

Luckily, the solution to almost all nutrition problems is the same - build healthy soil.

## NUTRITION SYMPTOMS

Here's a list of a few broad symptoms of nutrient excess or deficit:

- Low potassium can lead to increased production of amino acids, leading to increased insect attack
- High potassium displaces calcium, leading to weakness in cell walls, which also makes plants more vulnerable to attack
- High nitrogen levels increase most insect problems
- High nitrogen levels can kill beneficial microbes and favour disease-causing microbes
- Boron deficiency reduces the ability of plants to produce phenols and flavinoids, which repel insects and bad fungi.

## CALCIUM

Calcium is the king of the elements, and is needed more than any other for cell structure, and is the fundamental growth-inducing element. Calcium deficiencies show up more in the fruit than the leaves, with poor keeping properties due to poor fruit quality. Fruit may also be small and/or deformed.

In apples, calcium deficiency can result in 'cork spot', where you get plugs of dry cork-like material in the flesh of the apple. The skin usually has small depressions, and the affected tissue is directly beneath.



**TREATMENT:** Limestone (calcium carbonate, or agricultural lime) and dolomite (calcium carbonate with magnesium carbonate) are the most common sources of calcium. These can be applied to the soil but should be used sparingly as they do have an effect on soil pH (raising it) and can exacerbate soil compaction. Work them into the soil when planting, or simply broadcast over the soil where trees are already established. It does take time to amend calcium deficiency. Apply at a rate of 100 gm/m<sup>2</sup> broadcast around established trees in winter or worked into the soil when planting.

## POTASSIUM

Potassium is crucial for stem, fruit and root development. It is a mobile element so symptoms occur in older leaves—darkening between the leaf veins, browning of the upper surface edges, and edge rolling, especially on apples but also on stone fruit. Fruit may fail to fully colour up, and may lack good texture and flavour. Where potassium is in excess, it can result in calcium substitution and phosphate deficiency.

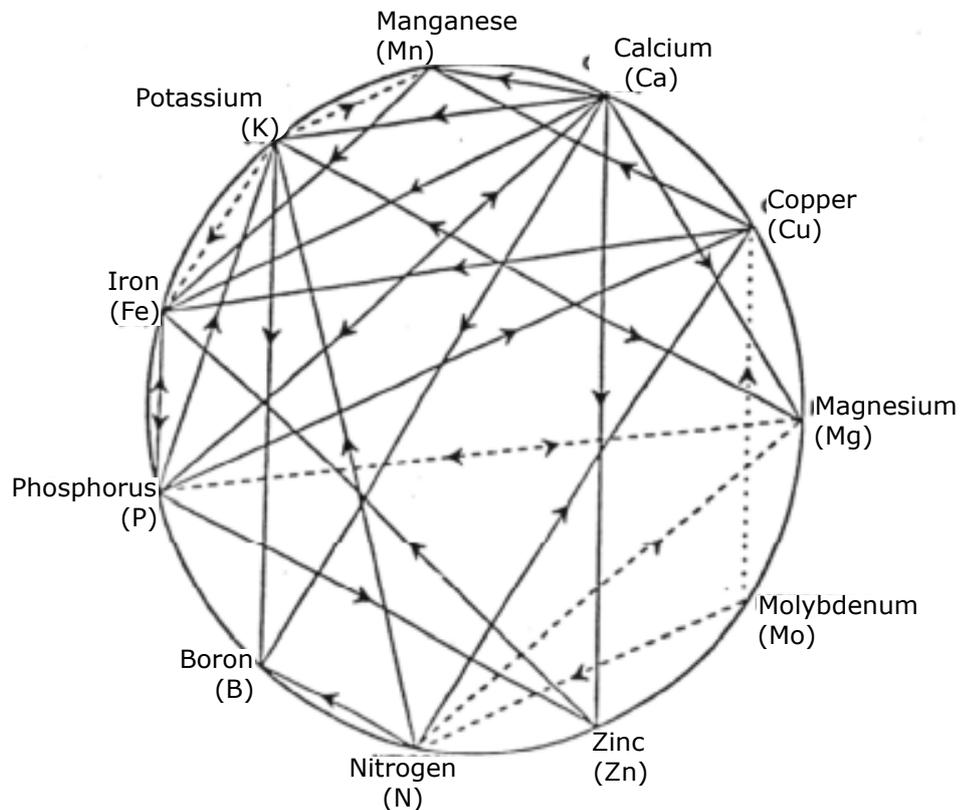
Potash is the term used for many fertilisers, and it refers to compounds that contain potassium.

**TREATMENT:** Wood ash is a great source of potassium, the only downside being the tendency to dehydrate the soil, so keep an eye on moisture levels.



*Potassium deficiency showing edge discolouration*

## MULDER'S CHART



—————> **Antagonism**, where there is a decrease in availability to the plant due to the action of another nutrient.

- - - - -> **Stimulation**, where an increase in the level of one nutrient increases demand for another.

While it may seem overly complex, Mulder's chart shows some of the main interactions between plant nutrients.

High levels of one nutrient can often have negative effects on the availability of other nutrients and are said to be antagonistic. On the other hand, some nutrients stimulate the requirement for others, and this can escalate out of control; e.g., more nitrogen creates a demand for more magnesium, which then creates a demand for more phosphorus, and so it goes on.

## COPPER

Copper deficiency shows up most commonly in apples and pears, especially in sandy soils and especially if artificial fertilisers have been used. The growing tips start out normally in spring but then wither and die back, often turning black and falling off. If your tree has a lot of dead or shrivelled tips it is a fairly sure sign of copper deficiency.

**TREATMENT:** Not an easy one to treat because there's limited ways to apply copper. Copper sulphate at the rate of 1 gm/litre applied as a foliar spray post-harvest should be effective.



*Copper deficiency on plum*

## NITROGEN

Nitrogen is the major electrolyte in the soil—it's like bottled sunshine. Trees suffering from lack of nitrogen usually show symptoms such as yellowing on new season's growth, small leaves, and short internodes (the distance between leaves). Fruit size is usually negatively affected, as is shelf life, although fruit colour can be improved.

On peaches and nectarines, stems and leaves will often have a reddish tinge, and dead spots can often appear on leaves, and these will fall out leaving a "shot hole" effect.

**TREATMENT:** Apply a generous amount of well-rotted manure in spring and autumn around the base of each tree. You could also use an organic fertiliser such as Dynamic Lifter.



*Nitrogen deficiency in peaches...*



*...and cherries*



## BORON

Boron is only required in tiny quantities in the soil (around 1 part per million) but is commonly lacking. It is vital for fruit set, stem development and calcium uptake. There are no specific symptoms and the only reliable diagnostic is through a soil test.

**TREATMENT:** If you are using compost (or chicken manure in your compost) you are probably putting out enough boron. It doesn't hurt to dissolve a bit of Borax in water and apply this to the soil from time to time.

## IRON

Iron is needed for efficient absorption of heat and energy from the sun, and is important in the way the plant metabolises chlorophyll. Iron deficiency symptoms, often referred to as lime-induced chlorosis, are yellow leaves with prominent dark green veins—this is more of a problem on acid-loving plants such as citrus (especially lemons), especially on alkaline soils, and especially if the soil is compacted. In really severe cases even the green veins go yellow and the leaves turn white.

Iron availability decreases as soil pH rises, so once your soil gets over about 7.5, iron is virtually completely locked up.

**TREATMENT:** Apply iron chelates a few times at the rate of 1 gm/litre of water, either as a soil drench or foliar spray; the symptoms should disappear quite rapidly, even in alkaline soil, although just for a short time. Lowering soil pH is the best long-term aim.

## MANGANESE

Manganese is probably the most important of the micro nutrients. It is vital for seed quality and germination, and fruit ripening. It is closely associated with the uptake of iron and copper. Deficiency symptoms are yellowing of older leaves, with the veins remaining green. In severe cases young leaves can also be affected.

Manganese availability is reduced when there are high levels of both potassium and sodium; low sulphur levels can also cause manganese lock up.

**TREATMENT:** Manganese sulphate broadcast over the soil is the best remedy, but is slow; foliar sprays (2.5 gm/litre) will give a short-term lift but are a band-aid—they will do nothing for the ongoing issue.



*Iron deficiency in peach...*

*...and plum*



*Manganese deficiency in peaches showing typical herringbone pattern*



## SULPHUR

Sulphur has a direct relation to fruit quality—sulphur deficiency results in poor fruit taste and quality (shelf life). Sulphur also promotes root development. Symptoms are similar to nitrogen deficiency (yellowing), but more pronounced. Sulphur competes with phosphorus when it comes to being absorbed into the soil, and so sulphur levels can be reduced if phosphorus levels are high.

Sulphur is also very leachable (like nitrogen), and so yearly applications may well be needed.

**TREATMENT:** Gypsum is an excellent source of sulphur, and can be broadcast but is better incorporated into the soil. It also marketed as a clay breaker, where it is used at the rate of 1 kg/m<sup>2</sup>.

## PHOSPHORUS

Phosphorus is often neglected but essential for producing good quality fruit—it is necessary for photosynthesis and metabolism to occur. Deficiency symptoms include small, dark green leaves that change colour early in autumn, and purple spots along the edges of peach and nectarine leaves, which then curl up. Cracking occurs in stone fruit.

**TREATMENT:** Organic gardeners should get adequate phosphorus through the use of green manure crops and animal manure.

Soft rock phosphates are a good source of phosphorus, as they can't get locked up by other elements. Broadcast soft rock phosphate in autumn at the rate of around 10 gm/m<sup>2</sup>. Avoid, avoid, avoid any superphosphate, but super-avoid 'triple super'.



*Phosphorus deficiency in stone fruit*



*iron deficiency in a peach leaf*



# PICKING, CARE, AND STORAGE OF APRICOTS...

One of the biggest challenges when picking any fruit, is choosing the right stage of ripeness. This will depend to some extent on what you plan to do with it and how long you want it to last off the tree, but there are a few guiding principles you can use.

## MATURITY VERSUS RIPENESS

We are often asked whether fruit will ripen off the tree, and the answer is yes, if it's picked after it has matured, even if it is not fully ripe yet. What's the difference between maturity and ripeness, we hear you ask? Read on...

Fruit is mature when it has accumulated enough starch to let it ripen, and this can only happen while the fruit is on the tree. Once the fruit has enough starch, it begins to turn into sugar, and that's the beginning of ripening.

Ripening can then continue off the tree, but your fruit will develop the best flavour if at least some of the ripening happens on the tree. Apricots are best picked before they get overripe, as they are too prone to picking injuries like small tears at the stem end (which means they will

go off faster once picked), and the texture may begin to go floury rather than juicy.

Maturity is usually indicated by a combination of factors:

### COLOUR

The surface colour is a good indication that the fruit is getting close to maturity, but the background colour is a much better indication of when the fruit is reaching ripeness. Look at the stem end, the shady side, or in the seam of the fruit to see the background colour.

For most apricot varieties, the background colour will change from green or very pale orange to a richer orange colour as the fruit approaches ripeness. However, some varieties (e.g., Goldrich, Poppicot) achieve a lovely uniform orange colour very early in the ripening process, so colour can't really be used as an indicator of when to pick these varieties.

Trevatt ripens from the inside, so will often be surprisingly sweet and juicy on the inside even when the outside is still quite a pale orange, and by the time the outside of the fruit is a darker orange, it's getting

positively squashy and overripe.

You'll gradually get familiar with what colour indicates ripeness for the varieties you're growing.

### FRUIT DROP

One of the main indications we use on the farm is looking for fruit on the ground, which has dropped because it's ripe (as opposed to having been knocked off by birds, or a passing tractor!). If some fruit is clearly ripe enough to fall off, we know most fruit on the tree will have reached maturity, and can then use colour as a guide to which fruit to pick first.

### TASTE

Taste is a crucial indicator, particularly as you're getting to know a new variety. Poppicot and Goldrich both look ripe for at least 1-2 weeks before they're ready to pick, but taste tests during that time are absolutely mouth-puckering!

### MICROCLIMATE

We have several varieties growing in more than one place on the farm (some varieties grow in three different orchard blocks), and the variation in picking dates between different



microclimates can be up to a week or 10 days. If you have the same variety growing in different parts of the property, check them all!

### KEEP A PICKING DIARY

Keep a diary of the date you start picking each variety each year (as well as the harvest weight). It's also really useful to keep a list of the earliest ever dates you've picked each variety. This makes a great master list to refer to every couple of weeks during the picking season, so you know which varieties are likely to be ripening soon, so you can start monitoring them for maturity and ripeness.

### HOW TO PICK

Don't expect to pick all the fruit off the tree at once, as most trees ripen unevenly. Picking a tree more than once is considered a great sin in the commercial orchard industry, and various methods are used to try to get the fruit to ripen at once, because it's much cheaper to get the picking done if your pickers don't have to make decisions about which fruit is ripe!

However, in a home garden, uneven ripening is a positive thing, because it extends the picking season and means you don't have to deal with a large quantity of fruit all at once.

We pick most varieties at least twice, and often three or four times, normally with about a 4–6 day gap between pickings, depending on the variety and the weather. That's because we're aiming to pick the fruit at the perfect stage of ripeness to sell at market—almost ready to eat but not ripe enough to sustain picking injuries or bruises in transit.

That makes our picking slow and full of tricky decisions, but it's worth it. At home, it's also worth putting the effort in to picking with great deliberation, to get fruit in the best possible condition.

### PICKING TECHNIQUE

Pick early in the day before the fruit has a chance to warm up.

With fruit in the palm of the hand, simultaneously pull and slightly twist the fruit, without your finger tips pressing into the flesh, so as to avoid bruising.

Avoid twisting the apricots too much, because they are prone to tear where they are attached to the branch (not having a stem), and if the skin tears, the fruit will ripen too quickly and can start to rot.

### HANDLING

Place apricots gently into your picking container, trying to stop them rolling around, to prevent bruising. If you're picking very ripe fruit, don't stack more than two layers on top of each other in the container, or they will all become bruised.

Once picked, never allow fruit to sit in the sun—if no shade is available, cover each picking container with something light to reflect the heat, after it's filled and put on the ground.

### STORAGE

Cool fruit as quickly as possible—this firms it up and prevents bruising. Ideally cool the fruit to about 2°C, but if that's not possible, put in a cool, breezy place (cellars are great, or the coolest room in the house). If you have room in the fridge, it's worth putting as much as you can in. The faster fruit is cooled, the longer it will last.

Storing apricots in cool conditions will slow the ripening process, so is a useful way to hold fruit in a condition that will last for a few weeks. It's then great to finish the ripening process in the fruit bowl—they taste much better if eaten at room temperature.



*Store in a cold place (ideally 0–2°C) and only a couple deep in each box to avoid bruising*

# IS IT TOO LATE TO THIN?

In the southern hemisphere in a temperate climate, you should aim to get all your thinning done by the end of November at the latest, though with 5,000 trees to manage on the farm, we have been known to still be thinning in December on occasion! If you are going to thin, it's important to understand that the longer you leave it, the less benefit you'll achieve for your tree, and the greater negative impact you'll cause on your fruit yield.

Let's break it down by looking at the costs and benefits for each of the four reasons for thinning.

**BREAKING BIENNIAL BEARING CYCLE.** One of the main benefits of thinning is to break the biennial bearing cycle that fruit trees naturally follow. It works by hormonally tricking the tree into thinking it is bearing a small crop, which will cause it to have a heavy crop the following year. Which means that next year, you'll need to thin again to trick the tree into thinking it had another light crop, and so on, ad infinitum... This trick works best if the fruit is removed very early in the fruit season, as close to the end of flowering as possible (after waiting for the natural 'shedding out' process to finish). The further we get from when the tree flowered when the thinning is done, the less chance you have of affecting how heavily the tree will flower next year.

**PROTECT THE TREE STRUCTURE.** The second main reason for thinning is to protect the structure of your tree, and you may already be too late, as fruit gets heavy very quickly. It's not uncommon to see laterals and side shoots break under the weight of an unthinned bunch of fruit even when the fruit is quite small. However, if you haven't thinned yet, it's definitely worth checking your tree to see whether some thinning may protect its structure.

## GROW BIGGER FRUIT.

The third reason for thinning is to make sure your fruit reaches a reasonable size.

Even if you're not aiming to grow really big fruit, fruit that is left to grow in tight bunches can end up so small as to be impractical and unpleasant to eat, and the ratio of core to flesh is unnecessarily high. The benefit you'll achieve in terms of fruit size is dependent on harvest time. It's too late to get much benefit for early season fruit that will be picked by the end of December for example, but you'll still get some benefit for fruit that will be picked in January, and considerable benefit for fruit that will be picked in February or later.

**HELP REDUCE PESTS AND DISEASES.** The fourth reason for thinning is to improve the quality of your harvest, and this remains true no matter when you do your thinning. It not only gives you the chance to remove any fruit that is already damaged by pests, diseases or limb rub (thereby directing the tree's energy into healthy, undamaged fruit), but it will also allow the fruit to dry faster after rain and reduce the chance of fungal outbreaks. If you're spraying organic fungicides, they will be more effective on thinned fruit because you'll get better coverage. You'll also remove hiding places for earwigs and other pests that will cause further damage to your fruit.

The situation will be different for each of you, and also for individual fruit trees. If you weigh up the pros and cons, and decide to thin, then don't delay! The sooner you get it done the better.

## AT A GLANCE...

Haven't thinned your trees yet? Can't decide whether or not it's a good idea? As with most things to do with fruit growing, deciding whether to do some late thinning is a matter of weighing up the cost-benefit ratio, so read on and we'll help you decide



# GROWING FRUIT WITH LIMITED WATER...

Your most important asset in a drought is your soil, and in particular the amount of organic matter that it holds. The more organic matter it contains, the more water it can hold and make available to your fruit trees and other plants.

## ORGANIC MATTER

Organic matter comes from anything that is, or used to be, alive. It includes living and dead organisms (microbes, worms and arthropods), dead plant material, root exudates (soluble sugars, amino acids and other goodies), and other forms such as humus and lignin.

Average soils contain 1%–3% organic matter, but over time it's even possible to get up to 20% or more if you manage your soil correctly.

One of the best things about organic matter is that it contains more than 50% carbon, and this gives the soil the ability to store much more water, as well as a pretty amazing array of other properties:

- Improved soil structure
- Increased root growth and plant biomass
- Higher crop yield
- Better soil biodiversity and nutrient reserves

After years of aiming to build the carbon levels in our soil, we had the satisfaction of receiving the results of some tests done by the Department of Primary Industry, comparing our soil with a neighbouring chemically managed orchard, and finding that our soil not only had higher levels of carbon, but we've almost doubled the amount of water our soil will hold:

- 100 gm of our soil holds 54 gm of water
- 100 gm soil from chemical orchard holds 22 gm of water

So, the first rule of growing fruit in dry conditions is to improve your soil. Which is all very well and good (and is one of our ongoing aims anyway), but is not a very immediate or responsive solution to finding yourself in the midst of a dry season or drought.

“

*While a fruit tree is under water stress, it's not growing, and neither is the fruit.*

”

## HOW DO TREES RESPOND TO DRY WEATHER?

Water stress occurs when the rate of evapotranspiration (the amount of water that is released from the tree's leaves during photosynthesis) is greater than the amount of water the tree's roots can take up from the soil. The tree responds by closing the stomata (pores) in its leaves to stop any more water loss, which also closes down the process of photosynthesis. This means that while the tree is under water stress, it's not growing, and neither is the fruit.

Trees are much more likely to experience water stress faster if they are in a light shallow soil, whereas heavy clay soils, or soils with high carbon levels, help a tree to be resilient and survive water stress much more effectively.

As the soil dries out, root growth slows, soil temperature may rise, and the tree will stop transpiring when the root temperature reaches about 34°C. Unfortunately, stomata do not react instantly to a water shortage in the soil and some water will be lost from the limbs, trunk and even the fruit before the stomata close completely for the day. If there's a reasonably good water supply in the root zone, this may not matter since the losses will tend to be made up again overnight. However, if the soil in the root zone approaches wilting point, these deficits cannot be fully made up at night and a permanent reduction in growth of fruit results.

## AT A GLANCE...

Trying to grow fruit in dry conditions presents some particular challenges, but is by no means impossible. After enduring a 10 year drought at our farm, we've learnt a few techniques that can make all the difference between watching your trees wither and die, or growing a crop of fruit!

Therefore, restoring the water supply after letting the soil dry out will improve the current growth rate but won't make up for the poor growth during the time the tree was droughted.

Depending on when water is scarce, lack of water can also strongly affect flowering, fruit set, fruit drop, fruit size, yield, fruit quality, and leaf development, but awareness and good management can lessen those impacts.

## STRATEGIES FOR MANAGING YOUR FRUIT TREES IN DRY CONDITIONS

### 1. REDUCE WATER USE BY WATERING STRATEGICALLY

There are two key times in the year to water your trees—when they are flowering, and for the few weeks before fruit ripens. If you need to scrimp on water, the periods in between, and after harvest, are when you can make the most water savings without doing too much harm to the fruit. This is called regulated deficit irrigation (RDI), and it's been shown to be able to maintain normal yields with reduced irrigation of about 30%.

Trees are kept short of water during periods of slow fruit growth, and after harvest, but given enough water at the important times—at flowering and when the fruit is growing in size. The result is a reduction in the growth of shoots, without a reduction in the size of fruit or yield.

It works because of the growth pattern of shoots and fruit. On most deciduous fruit trees, the shoots grow rapidly early in the season and their growth slows down as the fruit begins to grow rapidly. In contrast, early in the season the fruit grows slowly. Water stress at this time will reduce



the growth of shoots without markedly affecting the growth of fruit.

Think about the irrigation season as four distinct periods:

### **Period 1: flowering and immediately afterwards**

If your trees don't have enough water when they're flowering, while cell division is happening, your fruit won't contain enough cells, and can't get big later in the season no matter how much water they get! There's also a period of rapid fruit growth for approximately 4 weeks after flowering, especially for peaches.

### **Period 2: from 4 weeks after flowering until 6–8 weeks before harvest**

It's safe to give your trees less water in this period (by up to 40%), without sacrificing fruit size. Even though you're giving your trees less water, research has shown that it's better to water a small amount every day in period 2, which is a bit counterintuitive!

### **Period 3: from 6–8 weeks before harvest, until harvest**

Just before harvest, fruit is growing rapidly and needs plenty of water to reach maximum fruit size. Early maturing fruit (ie, picked before mid-January) should get normal amounts of water from 6 weeks before harvest, and later maturing fruits should be watered normally from 8 weeks **before harvest**.

### **Period 4: after harvest**

Watering can be reduced by up to 40% again once the fruit is off the trees. In early maturing varieties and species (e.g., cherries and apricots) there is usually more shoot growth after harvest, and this might be reduced by watering the trees less.

### **PARTIAL ROOT ZONE DRYING (PRD)**

is a modified form of RDI where part of the tree's roots are allowed to dry out, but other roots still have access to water. When part of the root zone dries out, the levels of abscisic acid (ABA, a plant hormone) increase in the tree. This sends a message to the plant leaves to close the stomata as a response to water stress, reducing shoot growth and evaporation from the leaf surface. However, because other roots still have access to water, the tree keeps growing and fruit development is not significantly affected.

An important aspect of RDI is alternating the wet and dry zones—ie, swapping which side of the tree you water. This means that repeated surges of ABA are delivered to the shoots, slowing shoot development without affecting flowering or fruit development.

It's possible to reduce the water use of the tree by 30%–40% using this technique, though it works best on soils that hold more water, e.g., with a high

## **THE 8 KEY WATERING PRINCIPLES**

*One of the most common questions we're asked in summer is 'how much water do my fruit trees need?' It's a hard question to answer, because it depends on a lot of variables, including the size and age of the trees, how much fruit they're carrying, the soil type and quality, how much water is already in the soil, the site where the tree is planted, the climate and the weather, just to name a few!*

*We're also facing increasing climate variability, so we all have an increasing likelihood of having to deal with drought, flood, storms, fire or heat waves in the coming months or years – and the water needs of your trees will change a lot under those different circumstances.*

*Sensible watering aims to keep the soil at "field capacity" with plenty of readily available water (RAW) that the roots of your fruit trees can easily pull out of the soil. Overwatering can create waterlogging, flush away nutrients, kill the soil biology, lead to compaction and provide the ideal conditions for diseases like phytophthora. Underwatered trees can quickly reach wilting point, at which time the fruit will stop developing or drop off, and the tree will stop growing and may ultimately die.*

*As always, we want to make this fruit growing business as easy as possible for you! We figure it's a good idea to get a grip on the principles behind the decisions you need to make, so we've come up with the 8 Key Principles for watering your fruit trees:*

1. **MONITOR SOIL MOISTURE.** Aim to make sure your tree always has access to readily available water in the soil, which means somewhere between dry and waterlogged. We go into a lot more detail about how to monitor soil moisture in the program in coming weeks, but even without any equipment to guide you, it's easy to use the tried and true 'boot' method, where you kick away the topmost soil to see how damp (or otherwise) the soil is a centimetre or two down.
2. **ADJUST YOUR MONITORING AND WATERING TO THE WEATHER CONDITIONS.** During heatwaves or windy weather, your fruit trees are likely to use much more water, particularly when they have a big crop of fruit on them. One of the main ways you can protect your fruit from heat damage is to keep the water up to them, but during heatwaves particularly, it's best to water overnight or in the cool of the morning.
3. **PAY PARTICULAR ATTENTION AT KEY TIMES DURING THE SEASON.** If your fruit trees don't have enough water when they are flowering, and in the 6–8 weeks before harvest the fruit is likely to suffer and be small, so these are the key times to really make sure they get plenty of water (if it's available). Depending on your climate and location, you may not need to actually water the trees in spring while they are flowering – in many climates there is enough water in the soil after winter, and spring rains, to provide enough water for blossoming, but in droughts, dry periods, dry climates and very sandy soils this needs attention.
4. **DECREASE THE AMOUNT OF WATER YOU GIVE YOUR TREE AFTER HARVEST.** Once the fruit is picked, your tree will need a lot less water than it was getting. Most varieties will also have finished growing for the year by this time as well (except for some of the earlier varieties like cherries and apricots), and for this reason also will need less water.
5. **GET TO KNOW YOUR SOIL TYPE.** Soil with a higher sand content drains much faster and needs more frequent, but smaller watering. Soil with a high clay content more easily becomes waterlogged.
6. **WATER SLOWLY.** Slow watering is much more effective than pouring on a bucket full at a time. It gives the water time to be absorbed into the soil, rather than it all simply running away across the surface. There's also a better chance that more of it will actually get used by the plant rather than seeping past the root zone to where the plant can't reach it.
7. **MAKE SURE THE SOIL IS NEVER BARE.** While it's true that plants under your tree will compete for water resources, they also provide lots of benefits like keeping the soil cool, preventing evaporation, increasing the organic matter in the soil and providing habitat for soil microbes to eat and live in. The cost-benefit ratio always comes down on the side of having plants there, even the humble weed! If you can't bear having weeds or grass under your fruit trees, then make sure it's always covered with mulch.
8. **CONSTANTLY INCREASE THE AMOUNT OF ORGANIC MATTER IN YOUR SOIL.** The solution to helping both sandy soil and soil with too much clay (see #5 above) hold more water without being waterlogged is to increase the amount of organic matter in your soil. Constantly adding compost, having fast growing plants under your trees (and mowing them regularly), and mulching are just a few of the ways.

clay content or high organic matter levels. If you have very poor or sandy soils, you might need to water a little more often to make sure the soil doesn't completely dry out. There can be benefits to fruit flavour by reducing the amount of water used to grow a crop.

It's also important to minimise evaporation of the irrigation water you apply, ie, water overnight or in the morning, never in the heat of the day.

Some work has been done in the orchard industry on the use of a kaolin-clay-based foliar spray on the leaves to reduce transpiration and cut down on water losses through the leaves, but at home it would need to be done cautiously to make sure no permanent damage was done to the leaves.

If you're so short of water that some trees are going to have to miss out, favour young trees over old ones, as they need to be kept free from water stress to keep growing, and get their structure established. Old trees are more resilient because they have large, developed root systems that are much better at extracting water from the soil.

## 2. SACRIFICE FRUIT OR LEAVES TO SAVE THE TREE

In extreme water shortages, it is sometimes worth sacrificing fruit to save the tree. Removing most or all of the fruit from your tree will give you a much better chance of keeping the tree alive with minimal water. Fruit is up to 90% water and is one of the main uses of water for your fruit tree.

Pruning the tree to reduce the canopy can massively reduce the amount of water your trees need. Tree water use is directly related to the amount of leaves it has, so reducing the tree canopy will reduce



*Trees on dwarf rootstocks require less water but need it more often*

## *Drip irrigation delivers water right where you want it*

the amount of water the tree will use. Give your tree a hard prune back; it should recover well and regrow its leaves the following spring if water supplies are plentiful again, and you've provided enough nutrition and looked after the soil.

## 3. REVIEW YOUR IRRIGATION SYSTEM AND PRACTICES

### **Can the irrigation system be put underground to save water losses due to evaporation?**

A simple way to do this is to dig a shallow trench to lay the pipe in, and cover with mulch rather than soil. This allows you to easily check drippers to make sure they're not blocked.

### **What other water sources can you access?**

One of the major underutilised sources of water for our gardens is grey water, or the water we've already used once inside the house (except toilet water, which is called black water, and should not be used untreated on the garden). You can either install a diverter outside the house to stop this water being flushed into the sewerage system, or use a range of techniques inside the house to capture the water before it goes down the drain, e.g., using a small kids' wading pool in the bottom of the shower, and then bucketing the water out onto the garden, or washing dishes in a bucket and then tipping the water onto a fruit tree. A word of warning—there were many injuries during the last drought as a result of people lugging heavy buckets of water around, so you need to take great care. It's usually possible to buy water that can be delivered by the truck load, and used to fill tanks.

If you're in a rural area you may be able to sink



a bore to access aquifer water, though you may need a licence. Your local water authority will have information about this.

A drip system is better than soaker hose, because it just delivers water to the trees, not the space in between them.

### **Is water delivered directly to your tree's roots?**

You may be able to move drippers to deliver the water exactly where it's needed.

### **Do you have soil moisture monitoring in place?**

Make sure you don't waste water by overwatering and letting it go below the root zone of your trees?

### **Do you know what soil type you have?**

Sandy soils require more frequent watering with small amounts of water to allow trees to most effectively use the water.

### **Watering from below ground**

There a couple of handy techniques for below-ground watering. Using terra-cotta pots (buy them as 'wetpots') allows slow release underground watering. The cheapest way to do it is get hold of some old terra-cotta pots, block the holes in the bottom, and bury them near your fruit tree so the top of the pot is level with the ground level. Keep the pot covered to stop dehydration and small animals falling in and drowning, and top up as often as required. You may be able to water small trees with just one pot, but larger trees will need two or more pots on different sides (this also makes it possible to use the PRD method described above by watering one side at a time). The pot needs to be left permanently in the ground, as the tree's roots will wrap themselves



### *Mulch can help to conserve water*

around the pot. Another below-ground technique is called a wicking bed, which is suitable for dwarf trees, and will be described in detail in the coming weeks.

#### **Use a timer**

If you're watering your trees with a permanent piped system, add a timer to eliminate the risk of overwatering by forgetting to turn the tap off!

#### **Divert water from nonfood plants to food plants.**

If you live in a dry climate, it can be much more satisfying in the long run replacing water-hungry exotics with a beautiful native garden with low water needs, and saving your precious water for the plants that are going to feed you!

#### **4. CHOOSE APPROPRIATE ROOTSTOCKS FOR YOUR CONDITIONS**

Large rootstocks are more resilient in dry conditions. They have deeper and more extensive root systems, and are better at pulling water from the soil. Many of the trees that survived the drought in our district were large trees on seedling or other large rootstocks.

Modern dwarfing rootstocks have correspondingly small root systems, and need much more frequent watering to prevent them drying out. They may use less water overall, but are much more dependent on irrigation water as opposed to environmental water.

As a result of our experiences in the drought, we've bucked the trend of modern orchards to use more and more dwarfing rootstocks, to return to the older and larger rootstocks. They create more work in some ways because they grow a much bigger tree, but we think the payoff is worth it if we get a more resilient tree in the long run.

#### **5. MULCH AND GROUND COVER**

Mulch can help to conserve water in the soil by preventing evaporation. Don't apply mulch until late spring, after the soil has warmed up. One of the drawbacks of using mulch is that it can prevent rainfall getting to the soil, so the choice of mulch material can be important. Chunky mulch like bark or stones will allow most of the rainfall to get



*Pebbles can shield the soil and let the rain fall through*

through to the soil, but don't offer any soil improvement characteristics because they don't break down and add organic matter to the soil.

Having live groundcover plants provides a lot of benefits to your fruit trees, and to the soil, by providing good habitat for soil microbes, providing food for worms, adding to the soil organic matter levels by shedding dead roots, helping to bring nutrients from deep in the soil up to the root zone, and keeping the soil cool. However, they also compete with your fruit trees for water, and the cost-benefit ratio may shift towards replacing groundcover plants with mulch in drought conditions.

If you decide to keep groundcover plants around your fruit trees (as we always do), you can minimise the competition for water by keeping them mown regularly.

#### **6. MAKE THE MOST OF RAINFALL**

Even in a drought, there are often rain events, though unfortunately these can be heavy and brief, rather than long and soaking, leading to runoff and very little of the rainfall soaking into the soil. You can make the most of any rainfall that occurs by creating temporary (or permanent) swales.

Swales are wide ditches built on the contours of the land, and designed to trap runoff from rainfall and allow it to soak into the soil. These can often be successfully built below existing fruit trees. It's possible to slow runoff quite a lot just by placing straw bales or even using stacked tree branches or other garden material to provide a barrier to slow the water and help it to soak into the soil. For more information there is a detailed feature about swales in the June program.

You can also create a basin around your tree with soil or other material to trap rain water and let it soak in.

#### **7. DON'T USE HIGH-NITROGEN FERTILISERS**

Giving your trees a burst of nitrogen, for example by mulching with manure (especially chicken manure), will promote lots of leaf and shoot growth in your fruit trees, and encourage excessive water use, so it's best not done in dry conditions. (In fact, artificial fertilisers can create more problems than they solve any time, so are best avoided.)

#### **8. REMOVE UNWANTED TREES-SACRIFICE UNWANTED CROP**

If you don't have enough water to water all your trees, the larger trees (and trees in heavier soil) will be the ones that are most likely to survive without watering. Be aware they may suffer some root contraction or death, and it may take them a couple of seasons to recover once sufficient water is available again.

They also won't make good fruit buds if they are short of water, so you'll also be sacrificing next year's fruit (at least) by not watering this season, but if the water can be better used to keep young trees alive, for example, then it may be worth the sacrifice.

# LOOKING AFTER YOUNG TREES IN SUMMER: CHECKLIST FOR SUCCESS...

## **WATER**

Having enough water in the soil all the time is the main key to success when growing young trees. If the roots are allowed to dry out, growth will stop, and it can be very hard to get it started again before the following spring. If you feel this might have happened, try watering your young trees every day for a week to see if this kick starts the growth again.

## **WEED CONTROL**

Maintaining a ground cover of live plants is the ideal in terms of soil microbes and carbon sequestration. But they do compete with your fruit trees for water, and while the trees are young, the cost-benefit ratio falls in favour of mulching rather than live plants, at least for the first year.

## **PRUNING**

If you want to establish your young tree as a vase or bush shape, and you're in a hurry to get the shape of your tree established, it's OK to prune during summer—but only if the tree is growing really strongly. Hopefully you will already have pruned the tree when it was planted, and it's started growing strongly in spring. Wait until the new shoots are 15-20 cm long, and then you can prune them, back to about 10 cm or at least 3 buds. This creates another branching point, on each limb, and gives you more choices of branches to select as permanent structural branches in your tree. Pruning in this way is a set-back for the tree, and will stop the tree growing for a while. Keep the water supply up, and it should start growing again. If you decide to prune in this way, it should be done as early as possible (late October is perfect, but definitely before Christmas) to give the trees a good chance to start growing again.

## **MONITORING**

Be fussy, and less tolerant of problems than for mature trees. Especially keep an eye out for aphids, pear and cherry slug, grasshoppers or any other bug that is eating the leaves of your tree. An infestation can defoliate a young tree surprisingly quickly, and either kill it or set it back severely. Visit young trees once a week so you don't get any nasty surprises!

## **SUCKER CONTROL**

To make sure the tree is directing all its energy into growing permanent limbs, remove any shoots that grow either from the trunk below the graft union, or from the roots (growing up through the soil). These shoots are usually stronger than the tree itself, and can quickly suck the energy away from your tree. You may need to remove them more than once during spring and summer.

## **PULL OFF FRUIT - DO IT!**

We recommend pulling all the fruit off your young trees until all the scaffolding branches are in place, which will usually take 1, 2, or even 3 years. It's hard to wait for a return on your hard work, but it really pays off to let the tree put all its energy into growing wood, rather than fruit.

# USING WEEDS TO FIGHT CLIMATE CHANGE...

Soil carbon is truly amazing stuff. It dramatically increases the amount of water your soil can hold, and also provides lots of other benefits:

- Provides habitat for soil microbes
- Increases soil fertility
- Increases the nutrient levels in your produce
- Helps your plants resist pests and diseases

There are a number of organisations, scientific bodies, and websites (both in Australia and around the world) devoted to the study and promotion of soil carbon, with a focus on finding the best ways of increasing it quickly. In Australia, the Carbon Farming Initiative (Federal government) shows how recognition of the amazing benefits of soil carbon has even captured the imagination of our politicians!

Most of us are now familiar with the idea of climate change, where the rapidly increasing level of carbon dioxide (CO<sub>2</sub>) in the atmosphere is causing our climate to become warmer and more variable. As a result, the world's oceans are becoming acidified as a result of absorbing more CO<sub>2</sub> from the atmosphere, which is predicted to have a dramatic effect on the amount of ocean species that will survive.

Unfortunately climate change also goes hand in hand with another problem that a lot of people don't know about, which is soil degradation, leading to concern about a lack of "soil security" by the scientists around the world that are working on this problem. Globally, 40% of our agricultural land is already seriously degraded, with billions of tons more being lost each year.

Luckily, there's one solution that can fix all these problems—plants! Plants naturally take carbon from the air and store it in the soil as they photosynthesise, so as organic gardeners, each and every one of us is already contributing to a healthier planet.

However, there's a bit more we need to know to make sure we're gardening in a way that builds soil carbon as quickly as possible and, even more importantly, in a form that's going to stay put for a long time. To understand how, let's have a look at how carbon moves around—it's called the carbon cycle.

As you can see from the diagram,

carbon moves around a lot, cycling through many forms, and carbon in the atmosphere comes from a variety of sources. It's thought that atmospheric CO<sub>2</sub> is increasing so rapidly in this period of our history because of a variety of human activities. In fact, CO<sub>2</sub> is only one of several gases that are increasing in the atmosphere; methane is another gas which causes climate change, and is 25 times more damaging than CO<sub>2</sub>. We're focusing on carbon because it's easiest for us to influence as gardeners.

The bit of the carbon cycle we're really interested in is called carbon sequestration, or putting carbon into the soil. This is how it works in your garden:

- Through photosynthesis, plants absorb CO<sub>2</sub> into their leaves, release the oxygen back into the air and put the carbon into the soil via their roots. This is called 'liquid' carbon, and is an important food source for soil microbes
- Decaying plants and animals also return carbon to the soil, in a form that is easily released back into the air, which is called 'labile' carbon
- Microbes in the soil transform the labile carbon into a stable form (humus) that stays in the soil for a very long time.

Plants need to be managed to

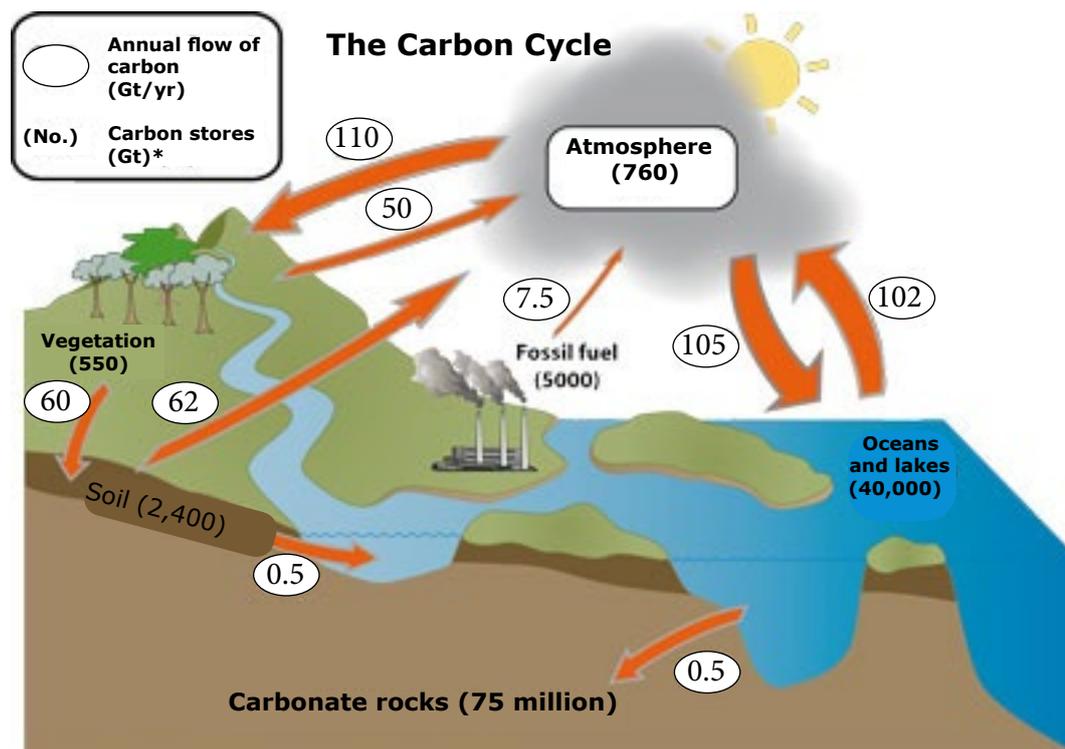
## AT A GLANCE...

Most of us want to grow fruit for the satisfaction of being self sufficient, and providing our families with affordable organic food. Saving money and having fun are the other main reasons we hear that people are passionate about fruit growing.

For many people, improving the environment is not the main thing on their minds when they start growing fruit, but in fact the most important thing you can do as a gardener is increase the amount of carbon in your soil, which can magically solve many of the world's current problems! Bet you didn't realise the future of the world was in your soil-stained hands, did you?

maximise their photosynthetic potential. Unfortunately, most conventional farming practices, including the use of artificial fertilisers and chemicals, results in loss of biodiversity, death of microbes, and a decrease in soil carbon.

However, thanks to a lot of work done by some innovative farmers and scientists, we now understand a lot more about how to manage our gardens and farms to make sure we instead increase our soil carbon, and it turns out that weeds are really



\* 1 Gt = 1 gigaton = 1 billion tons

Diagram: [www.qld.gov.au](http://www.qld.gov.au)

important!

All plants sequester carbon, and planting trees has long been recognised as good for the environment. However, trees are slow growing, and therefore slow to sequester carbon. The body of the tree also stores a lot of carbon, but that only lasts for the lifetime of the tree, and a lot of it is then released back into the atmosphere when the tree dies and decays.

Fast-growing annual plants such as grasses and weeds are much more effective at getting carbon into the soil quickly, because they grow and photosynthesise faster. So the weeds under your fruit trees are more important for improving the carbon levels of your soil than the trees themselves. But wait, there's a couple more things you need to know...

There are three stages of growth

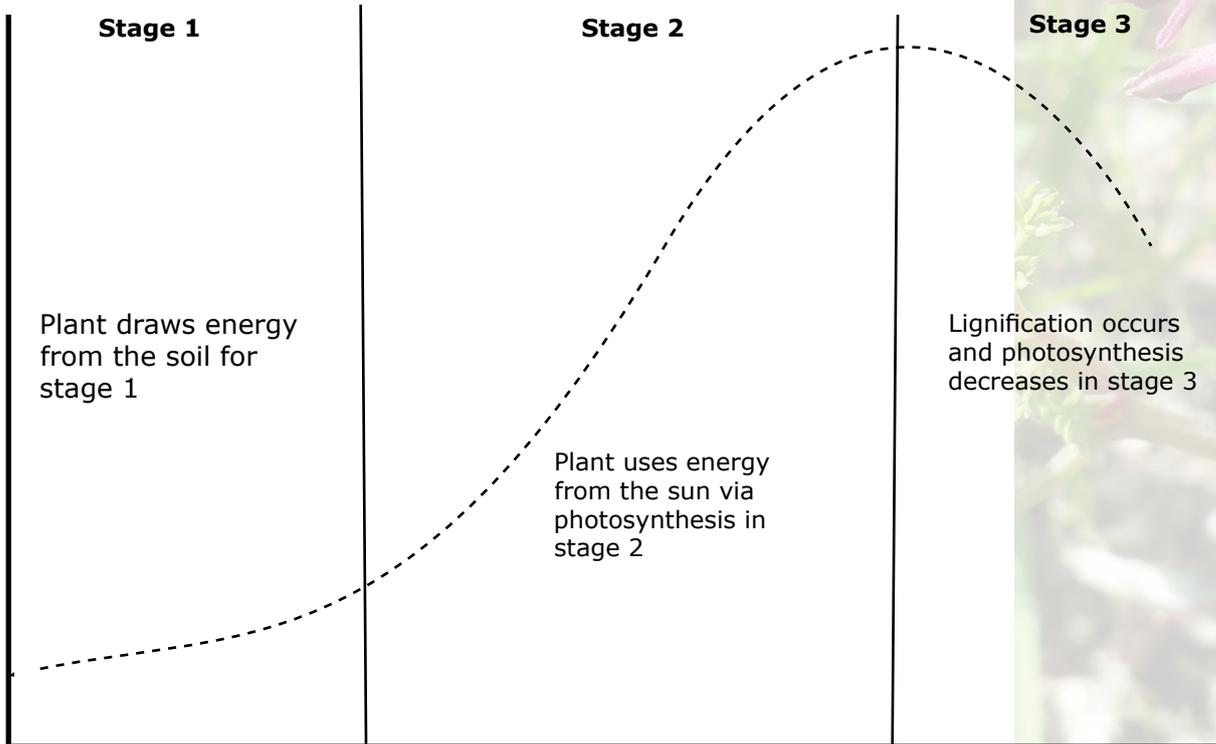
plants in their rumen and depositing the waste back on the soil with a heap of microbes and nutrients. If you're mowing instead, it's easy to mimic this process by adding compost tea or worm juice after mowing, or even just by adding microbe food, in the form of liquid seaweed, to boost the microbes already present in the soil.

Lots of interesting sustainable farming models are emerging that manage animals and crops to achieve this, and farmers are reporting that they're quickly building topsoil, increasing soil carbon, finding that unwanted weedy pasture plants are being replaced with native grasses, improving cropping rates and becoming more profitable! Organic and biological farming, holistic management, biodynamics, pasture cropping, natural sequence farming, conservation tillage and a raft of

- and maintain a ground cover of annual plants wherever possible
- Keep annual plants in stage 2 of their growing cycle for as long as possible by mowing or grazing
- Protect the soil from disturbance (no ploughing or digging), to minimise emissions of CO2 and methane from the soil
- Make sure your soil is populated with a diverse range of soil organisms and microbes, and provide the perfect habitat for them: no chemicals, enough moisture, ground cover, and a continuous supply of dead and alive plant roots

Managing our gardens and soil properly can help microbes store carbon in a form that will still be in the soil for many generations after we've become fertiliser.

### Plant growth stages



for annual plants (diagram).

For maximum carbon sequestration, you need to keep your weeds in stage 2 for as long as possible, either by grazing with animals or by mowing, before they set seed and move into the lignification (hardening off) stage, when photosynthesis decreases. If using animals, it's important to move them quickly onto a fresh patch as soon as they've grazed, as leaving them in the one paddock for too long will lead to a loss of soil carbon.

The other part of the magic equation is to add soil biology at the same time as the plants are grazed or mowed—of course grazing animals do this naturally, by processing the

other farming systems are producing wonderful results. The wonder is that conventional farming practices are changing so slowly!

Please don't think this is not relevant to you as a gardener. As small-scale producers, we are equally as important as farmers—if you put all the gardeners together, we are responsible for a large amount of productive land, and it's much easier for us to rapidly increase soil carbon than large-scale farmers.

To recap, there are a number of things we can do in our gardens to make sure we store as much carbon in our soils as possible:

- Make sure there is no bare soil,

*The weeds under your fruit trees are more important for improving the carbon levels of your soil than the trees themselves*

# SPOTLIGHT ON... THE SOIL FOOD WEB

The soil food web is a highly complex group of organisms that develops soil structure by binding soil particles—sand, clay, silt, organic matter—while building airways. Without these critters down there doing their job, we would have no soil structure, and without that nothing would grow.

These organisms range in size from the microscopic, such as bacteria, fungi, protozoa, and nematodes, to microarthropods and larger creatures such as worms and beetles. They exist in huge numbers—up to a billion bacteria exist in a single teaspoon of soil.

At the bottom of the food web are the microscopic bacteria and fungi, which feed on the plant exudates which are the below-ground results of plants harvesting sunlight—they secrete carbohydrates.

These bacteria and fungi are in turn eaten by larger organisms—nematodes and protozoa—and it's the waste products of these organisms that are food for the plants. It's a highly efficient, complex, interdependent system that works fantastically well unless we come along and interfere, which we are very good at doing.

Protozoa and nematodes are then eaten by the next critters up the chain—arthropods (bugs, spiders)—which in the course of their foraging activities move around creating airways and passageways, giving the soil its structure. It doesn't seem logical, but soil with good structure not only holds more water but also allows water to drain more easily!

A healthy soil food web contains a huge diversity of organisms, and it's this diversity that gives protection against disease—the bad guys (pathogens or disease-causing microbes) are simply outcompeted to the point where they don't cause problems. In systems that are out of balance or have been interfered with, the pathogens can easily dominate and create havoc.

A healthy soil food web also self-regulates, so that populations of microbes stay in balance with each other.

The role of the soil food web is to cycle nutrients in ways that make them available to the plants and yet resistant to leaching.

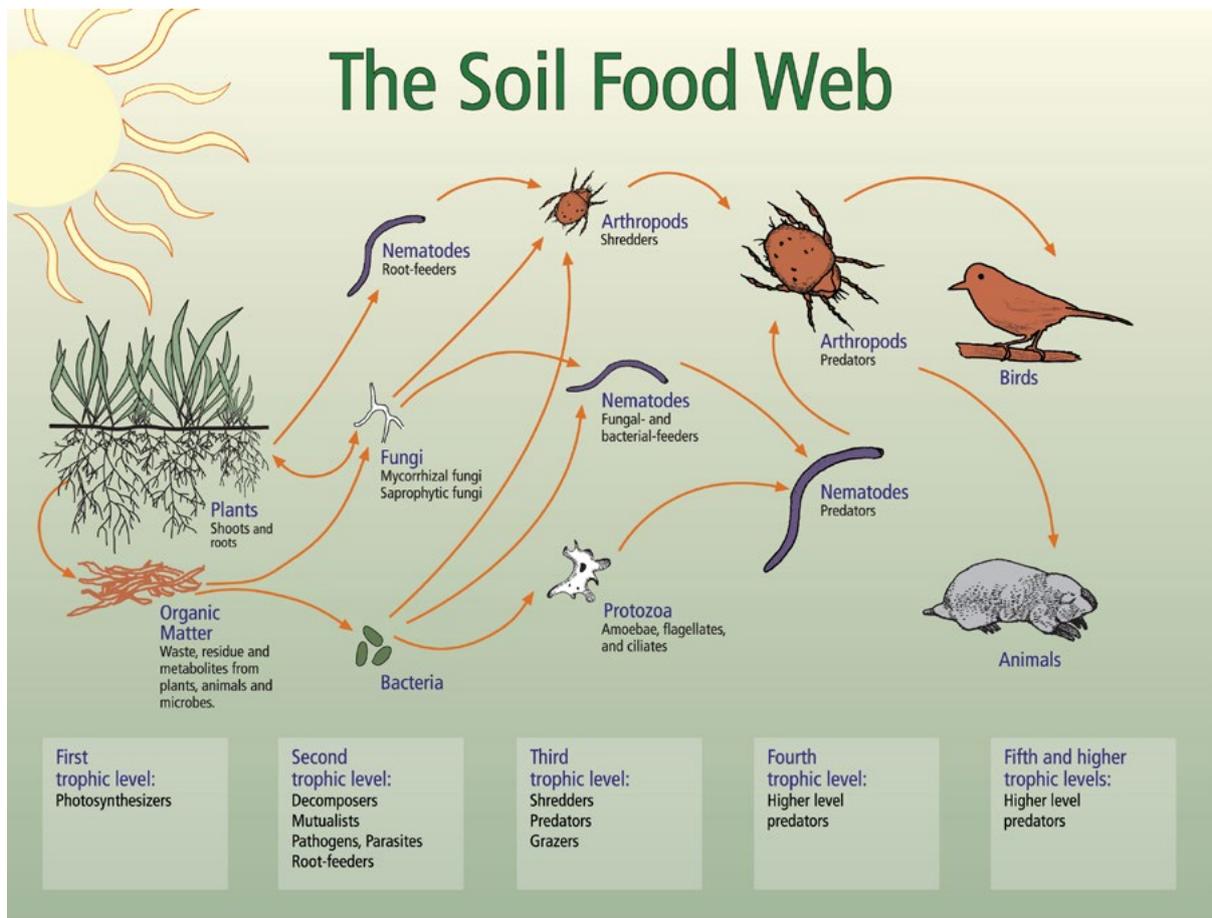
The most efficient way to damage or destroy the soil food web is to use artificial fertilisers, which are

## AT A GLANCE...

We regularly introduce you to one of your underground friends. This week we show you how they all fit together into an amazing, complex and intriguing world beneath your feet – the soil food web.

essentially salts. These salts suck the moisture out of the soil organisms, and the nutrient cycling system that nature has so brilliantly provided is wrecked. Of course, once the organisms within the soil have been destroyed, the only way to grow things is to keep adding fertiliser, thus perpetuating the cycle of damage.

Armed with even a little knowledge about what is going on beneath our feet, we can act in ways that build—rather than destroy—the amazingly complex system that ultimately feeds us. We can build healthy soil that will retain water and nutrients, and make spoiled areas productive again. And, we don't have to do all this ourselves—there's literally billions of critters per square meter down there happy to get on with it. All we have to do is give them the right conditions.

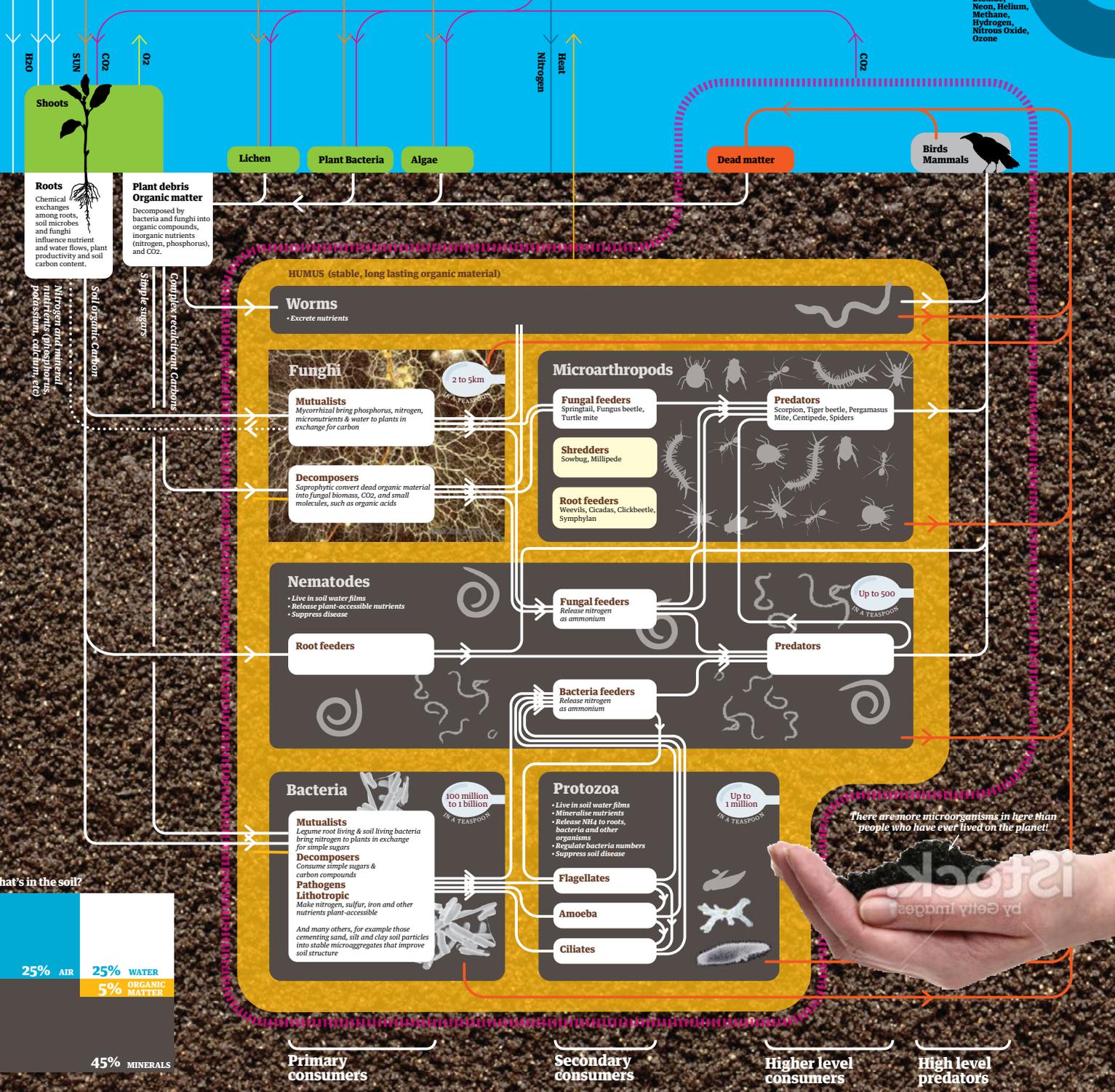


# A world underfoot

## Topsoil's web of life is, after air and water, our most vital resource

Soil is a biological habitat and gene pool and essential to food and other biomass production. It is a storage, filtering, and transforming device. Topsoil is a mix of humus, minerals, composted materials and microorganisms.

And it's these microorganisms – the life beneath our feet – that get the water, carbon, nitrogen, and mineral nutrients to the plants... so they grow, provide habitat, sequester carbon, perform photosynthesis, and feed us.



Topsoil is only an average 16 centimetres deep... and eroding fast!



Deforestation, poor agricultural practices and overgrazing are the main culprits, all involve the removal of vegetation, exposing the topsoil, drying it out, compacting it, reducing its fertility and allowing the wind and rain to blow and wash it away.

Diagram by Mark Carter

# FRUIT TREES FOR FREE...

If you know what to look for, and you're lucky, you might be able to glean some free fruit trees, either from your garden or somebody else's. Volunteer trees (ie, trees that come up by themselves) may have grown from seed, or can be suckers from existing trees, and will usually only be useful as a rootstock. However, once grafted, they will make a perfectly good—and often tough and resilient—fruit tree. But before we get into that, let's remind ourselves of the basics.

## SOME DEFINITIONS

Fruit trees that you buy from a nursery will have been grafted—the graft union is often visible on the trunk about 20 cm from the soil, and the bottom of the tree (the part with the roots, below the graft union) is called the rootstock. Rootstocks are usually specific varieties (e.g., many plums and apricots are grown on a plum rootstock called Myrobylan), and don't usually produce good quality fruit, but have been chosen as rootstocks because of other characteristics they give the tree—size, resistance to disease, or drought tolerance. Developing new rootstocks is a major area of research and development within the commercial

orchard industry.

Suckers are shoots that grow from the rootstock, and are therefore genetically identical to the rootstock, and therefore will also not usually produce usable fruit. For example, cherries are often grown on a rootstock called Mahaleb, which commonly produces suckers. If these suckers are allowed to grow and produce fruit, it is tiny, black and incredibly sour!

The main part of the tree, above the graft union, is called the variety or cultivar, and is chosen for the qualities of the fruit it produces, including all the varieties we're familiar with, like Jonathan apples, or Golden Queen peaches.

Seedlings are fruit trees that have grown from seed. Because fruit trees produce sexually, ie, flowers are fertilised with pollen from a different tree, the offspring (ie, the seeds in the resulting fruit) are an unknown genetic mix of the two parents and, if planted, will not produce fruit that is "true to type", but they will often grow a large and resilient tree that makes a great rootstock.

Random seedlings will sometimes bear decent fruit (particularly peaches and nectarines), but if you wait a couple of years for them to bear, and

*Did you try grafting last winter? Did you have some failures? Welcome to the wonderful world of grafting, where failure is just an opportunity to practice some more grafting skills!*

*Failed grafts can be redeemed by budding in February. As soon as you're positive the graft has failed—and it should be obvious by now—use your secateurs to cut back into healthy wood and remove the graft. Hopefully the rootstock you grafted on to is still alive and vigorous, and will probably have put out some strong new shoots below the failed graft. Select shoots at a good height and placement around the tree that you can use for budding, and remove the rest. Even one healthy shoot is worth nurturing, you can create a whole new tree by grafting on just one bud!*



*Removing limbs prior to budding*



it turns out they're no good and you still need to graft the tree, it's a waste of time. Better to graft it in the first year with a variety you want.

An exception is peach and nectarine seedlings, which have a much better chance of producing satisfactory fruit that might even be quite like its parent, because peaches and nectarines are self-fertile, so the seed has a good chance of having been pollinised by the same variety.

The only reliable way to propagate fruit varieties (and the way they have been preserved for hundreds of years) is by grafting, or joining wood from the variety onto a rootstock.

So, where to find our free rootstocks? Fruit seeds are great survivors, and can germinate in random and unusual places if the conditions are right. Here's a few places to look:

## THE COMPOST PILE

If you have a cold compost pile, ie, a pile to which you consistently add garden or food waste, it never heats up and reaches a temperature that kills seeds. This is actually one of the drawbacks of making compost in this way, because it doesn't kill weed seeds or pathogens, but one of the benefits is that it can provide the perfect environment for fruit seeds to germinate. Apples and peaches are one of the most common types of fruit trees found in cold compost piles, and they can usually be easily dug out, roots and all, and transplanted into the garden.

## SUCKERS

Suckers from existing fruit trees, or where old fruit trees have died or been removed

Many grafted fruit trees consistently sucker, which means they send shoots up from the rootstock. If these shoots are from above the soil level they are nothing but a nuisance, and should be removed by cutting back flat to the trunk. However, if they come up from below the soil, they may form their own roots. Carefully remove the soil from around the sucker to see if there are any roots growing from it and, if there are, cut the sucker away from the parent tree, preserving as many roots as possible, before transplanting it into the garden.

If the original tree has died back, you may be able to leave the sucker where it is, and remove the dead tree instead.

## THE VEGIE GARDEN

A few years ago we fertilised the vegie garden with some litter from the chook yard, which included a lot of old peach seeds, and the following spring a whole batch of peach trees come up—and they still pop up occasionally! They are easy to dig up and transplant, and make a great rootstock.

## WHAT TO DO NEXT

If you're lucky enough to find some randomly growing rootstocks, it's best to leave them and look after them wherever they are growing until

next winter, if possible. If they're in a difficult spot where you need to move them, like the vegie garden, you can try transplanting them now while they are actively growing, but there's a risk the tree will die.

If the tree can stay where it is until winter, mark it and make a note on your calendar (say 1st June) to remind yourself of where it is, and that you plan to move it! As soon as the leaves fall off in autumn or winter, you can transplant the seedling or sucker to its new home, and graft it late winter or early spring.

If the tree has cleverly managed to grow in the right place, you will be able to graft on your preferred variety by budding in February, rather than waiting until next winter to graft it. If it is growing strongly and has put out several side shoots, it's a good idea to cut the centre out of the rootstock so it puts its energy into the side shoots, which will be big enough to bud in February, rather than waiting until next winter to graft it.

If you've identified an older seedling or sucker (that grew last year or even earlier), you can still bud it in February, but it's a good idea to cut most of the branches off now to stimulate new shoots to grow, as it's best to bud into new season's shoots that are about pencil diameter. This is best done in late winter or early spring, but if the tree is quite vigorous, you will most likely still get strong enough growth in the new shoots if you remove the branches now. Make sure you leave at least one 'nurse' limb so you don't kill the tree.



*New shoots ready for budding*

# MAKE YOUR OWN ORGANIC SPRAYS

These days there are lots of certified organic insecticides available to buy off the shelf, and they do have some advantages because they must comply with the law, they may have additives that make them 'stick' and therefore work more effectively, and they usually come with good instructions and safety information on the label.

However, they're expensive, and you may have to buy much more than you need to do a particular job. It makes sense to learn how to make your own insecticides, as organic gardeners have done for hundreds of years before us.

Many of the sprays we describe here recommend adding a bit of soft soap to help the sprays stick. Don't use commercial dish washing soap, but rather make your own solution by grating some pure soap into hot water.

## BUG JUICE

This remedy works well for plant-sucking bugs like harlequin bugs, by repelling the live bugs, helping to attract predators, and possibly spreading disease within the bug population. Collect a handful of the problem bugs, and put them in the blender with 2 cups of water or milk. Let the brew sit for a few hours, dilute with water, filter the mixture, add a bit of soft soap to help it stick, and spray on your plants.

## FLOUR AND OTHER DRY STUFF

Ash, flour, clay, lime, chalk or rock dust can all be sprinkled on pear and cherry slugs, and may also be useful on aphid infestations. Use a dust applicator or shaker, or stockings. It can be easier to mix the powder with water to make a very loose slurry, and apply with a watering can over the affected area during the hottest part of the day so the water evaporates quickly. Any of these products will wash off in rain, and may need to be re-used several times.

Caution: Use a face mask when using any dry product, stand upwind, and don't overuse products like ash, to prevent affecting the soil chemistry.



## CHILLI

A strong chilli solution can kill or deter small soft-bodied insects like slugs, snails and caterpillars, especially if you use hot chillies. Grind up the chilli and mix with water, leave it

to sit for a couple of hours, then strain, dilute and add soft soap.

Caution: Wear gloves, and don't touch your skin or eyes, don't let your pets get near the stuff!

## ELDER LEAF SPRAY

This concoction can be used for aphids and small caterpillars. Boil a couple of big handfuls of leaves and twigs in a couple of litres of water for half an hour. When it's cold, strain it and use straight away, though it will keep for ages if you bottle it hot.

## GARLIC

Garlic is known to effectively kill phytophthora root rot in the laboratory; trials are currently being done at our farm to see if it works on fruit trees. A strong garlic solution will also kill larvae (e.g., pear and cherry slug), aphids, and any soft-bodied insect.

Make a solution by crushing 8 gm of peeled garlic cloves in 50 ml water, and mixing for at least 5 minutes to extract as much of the active ingredients as possible. Strain, and then dilute with water. Use a very strong mixture if spraying directly on larvae to kill them, a weaker solution sprayed over a wider area will act as an insect deterrent. Mixing in a little bit of soft soap will help the mixture to stick better. Garlic breaks down very quickly (within 2 or 3 days) so spray when the bugs are active, and you may need to respray several times.

## MELIA

Melia (aka Queensland white cedar and Persian lilac) is a native Australian deciduous tree that has the same active ingredient—Azadirachtin—as that Indian wonder tree, neem. Oil extracted from melia seeds makes an effective spray against aphids. Melias are commonly used as street trees, and seeds can be collected in late winter when they are dry and shrivelled.

*Melia seeds*



## AT A GLANCE...

Most pest issues resolve by themselves over time as you increase the biodiversity in your garden, and insecticides should always be the instrument of last resort when it comes to pest control. There are times when you need to use them, for example to save young trees from infestations that would kill them, and it's cheaper and often as effective to make your own sprays at home.

Seeds have a soft outer skin and pulp. Ideally these should be removed but actually you can just chuck a load of whole seeds in a cloth bag and crush them with a hammer, making sure you crush the kernel (which contains the oil) as well. Steep the crushed seeds in water for a few hours, and then strain and spray. You can add a bit of soap to help it stick.

## OIL – MINERAL OR VEGETABLE

Oils are very useful hygiene sprays, used in winter to smother aphid or earwig eggs. If using vegetable oil use canola or linseed (though any vegetable oil can be used); mineral oil can be bought as 'white oil' or 'winter dormant oil'. The drawback is that you'll also smother the eggs or overwintering adults of any predator species.

To spray, dilute the oil to water at 1:15. You can also add a few ml of citrus oil to make this spray more effective.

**Caution: Do not spray on very hot days or you may burn leaves.**

## NETTLE

The common nettle makes a great general purpose insect spray and plant tonic, and is often used in biodynamic growing. It can be particularly useful for controlling aphids and leaf miners, and nettles can also be used as an activator in compost heaps.

Soak the nettle leaves in water for a few days, then strain the water and use it straight away (or within a couple of days) undiluted.

## PEPPER

Pepper can work well for some beetles and weevils, as well as caterpillars. Grind the peppercorns then cover with alcohol and soak overnight. Filter and dilute with water at 1:10, then spray. This spray keeps well for months (keep in the dark).

## QUASSIA

This is a great spray to make because it's effective against aphids, caterpillars, leaf miners and sawfly (pear and cherry slug), but doesn't hurt ladybirds or bees! It's made using quassia bark chips, if you happen to know where there's a quassia tree (though you can buy the chips online – see the Resources section).

Put a handful of chips in a saucepan, cover with water and boil for 10 minutes. Strain when it's cool, and dilute at 1:10 with water before spraying. Add a little soft soap to help the spray stick. Once made, it can be stored for months in a dark place. It can also be used to drench the soil around your fruit trees where it will be soaked up by the tree roots and then kill sucking bugs that eat your trees.

**Caution: Don't spray on fruit—it's really bitter!**

## WORMWOOD

If you've got wormwood growing in your garden, harvest a bucketful of leaves, cover with boiling water and leave to soak while cooling. Strain, and use to kill soft-bodied insects or aphids.

*Wormwood spray kills soft-bodied insects*



*Ground peppercorns are effective against weevils and caterpillars*



*Spray made from quassia chips also deters possums*



*Nettles grow in high-nitrate areas (e.g., in chook runs) and make a great aphid and leaf miner spray*



# NOTICE THE FEEDBACK FROM YOUR GARDEN...

A few weeks ago we asked you to notice whether your trees had flowered, what happened to the flowers, whether the flowers developed into fruit, and what happened to the fruit. All going well, your fruit trees should now be laden with small fruit that will be slowly growing through the summer, or you may already have harvested some varieties.

However, if it hasn't all gone according to plan, it's worth trying to figure out what's happened. One of the things we recommend you record in your Fruit Tree Diary is extreme or unusual weather events, for example late frosts, excessive rain, or windy storms, as they can all have a dramatic impact on the outcome for your fruit trees. It's also useful to make a note of any particular pest or disease issues you had for particular trees. It's worth noting pests or diseases, even if you don't know what they are or what's causing them.

Whether you know it or not, your garden is probably full of microclimates. In winter, some areas will get more frost than others, but at this time of year, there's a whole lot of other things to look out for.

- **SUN**—where does sunshine fall at different times of the day? Fruit trees like lots of sunlight hours, so will thrive better growing in a part of the garden where they get the long summer hours of afternoon sun, rather than the short hours of morning sun.

- **FRUIT QUALITY AND QUANTITY**—do you have a crop? If not, then the probable reasons are that the tree didn't flower, there was too big a crop last year, disease, or frost. Did you notice any of these?
- **SHADE**—notice where the shade falls in your garden, or where you might like more shade that could be provided by a productive fruit tree. Being deciduous, fruit trees offer great solutions for those parts of your garden where you want shade in summer, but not in winter. Fruit trees can even be espaliered on trellis or over a pergola to provide summer shade over windows or outdoor eating areas.
- **WIND**—how quickly do your fruit trees dry after rain? This can make a big difference to their chances of succumbing to fungal diseases, many of which are triggered by the number of hours your trees stay wet. The sooner they dry the better. The downside is that being exposed to hot northerly summer winds can quickly dry out fruit trees during a heat wave. Are the trees being shaped by the prevailing wind? This may influence the way you need to prune them.
- **PESTS AND DISEASES**—has the growth or production on a tree been severely affected by any particular issues? If so, do some detective work and try and figure out what's going on (or book a

## AT A GLANCE...

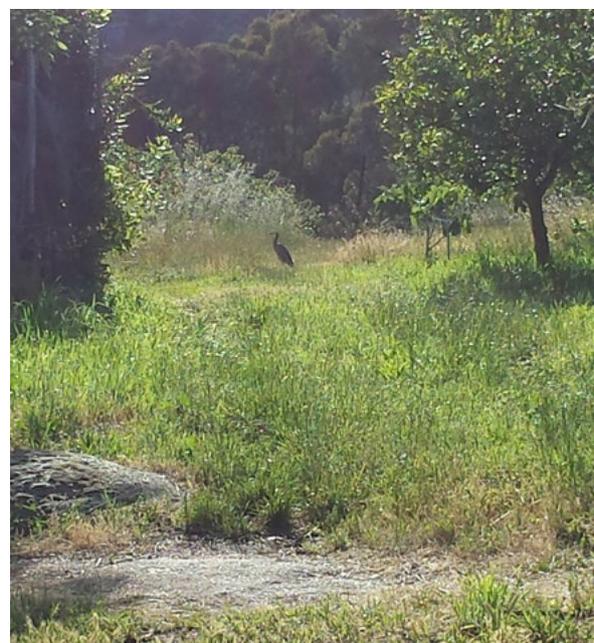
Hopefully this fruit season, you'll achieve the satisfaction of being able to pick a successful, and delicious, crop of organic fruit from your own healthy trees.

But for various reasons, that might not happen, or there might be some glitches. It's a long process, getting better at growing fruit, and a big part of the journey is getting to know your garden better.

call!).

- **RAIN AND DRAINAGE**—which parts of your garden dry out and need watering first? Summer rainfall is often short and heavy, so look for how well the soil drains in different parts of the garden. Particularly notice if puddles remain on the ground for long after rain.
- **KEEP A FRUIT TREE DIARY** to help with your orchard planning, and particularly note the date you start picking each variety. This will help identify gaps in your production that you can fill when choosing which trees you'll plant next winter, or which varieties you'd like to add by grafting.

In different seasons your garden can tell you different things. By quietly watching, you'll learn a lot about your fruit trees, and how to increase your chances of success. It's not hard, you just need to know what to look for.



# ABOUT US

We—Katie and Hugh Finlay—run Grow Great Fruit from our farm in central Victoria, Australia. Teaching organic fruit growing was a natural progression from growing fruit commercially for years, and being asked thousands of fruit tree questions as we were selling fruit at markets.

We've always used organic, biological and regenerative farming methods, relying on building healthy soil to grow healthy trees and fruit—so that's what we teach. The trees get their nutrients from a diversity of microbes in the soil and plant tissues and from their relationships with other plants, rather than from artificial fertilisers.

We've been orchardists since 1998, both coming to it from non-farming careers, though Katie grew up on the orchard and Hugh worked on farms in Western Australia and the Middle East before roaming the globe for many years as a travel writer for Lonely Planet.

Training in organic farming, permaculture, soil biology, compost and holistic farming (as well as years of practical, hands-on experience) has all been important in developing our growing practices, the sustainable development of the farm, the establishment of the Harcourt Organic Farming Co-op, and the ethics of what we bring to you in Grow Great Fruit.

Diverse plantings rather than monoculture, spreading risk with biodiversity, and learning how to grow your own food successfully all contribute to food security—and we're on a mission to help build a secure food future for all!

**DISCLAIMER: We make every effort to ensure the information given in this program is accurate. However, as conditions and methods vary, we cannot guarantee the results, and take no responsibility for any damage or injury that may occur, no matter how caused. But relax—you'll probably grow twice as much fruit as we predict...without incident!**

## Staying in touch

Part of what we love about the Grow Great Fruit Program is that we're building a community of like-minded fruit growers—something we wish we'd had when we were learning how to grow fruit.

There's lots of ways to join in, ask questions, share information, swap stories, make connections, and get to know us, and other GGF members.

### *On the socials...*

See daily photos and updates from the farm, post comments, and share your own news on our social platforms:

Visit our [Facebook](#) page.



Instagram: [GrowGreatFruit](#)



### *For our exclusive community...*

**Grow Great Fruit Forum:** Post your photos and questions online to get answers and feedback about fruit growing issues. Also a great place to brag about your success! Click [here](#).

**Monthly Q&A Sessions:** Join the community for a face-to-face friendly group chat once a month. Bring your questions and send photos in beforehand for us to share with the group. Register from the Members Home Page [here](#).

**Blog.** Our blog is another way we share what's happening on the farm, and go into more detail about various aspects of organic fruit-growing. Click [here](#) to view the blog.

**All the material in the Grow Great Fruit program is the property of Hugh and Katie Finlay. It is provided to you as a member of the Grow Great Fruit program, and is not to be shared or distributed in any form without written permission.**

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