



Grow Great Fruit

ESSENTIALS COURSE



[WEEK 11 – MID-WINTER]



Contents

**PLANTING YOUR FRUIT TREES WELL WILL
GIVE THEM A GOOD START IN LIFE**

SPOTLIGHT ON LEAF CURL

**KEYLINE - HOW CAN IT HELP YOUR HELP
YOUR SOIL?**

SPOTLIGHT ON PROTOZOA

MANAGING WEEDS AROUND YOUR YOUNG FRUIT TREES

**ARE DIFFERENT TYPES OF FRUIT TREES
PRUNED THE SAME WAY?**

HOW TO FOIL FROST!

**WHY ARE HEALTHY TREES LESS LIKELY TO BE
ATTACKED BY PESTS AND DISEASES?**

ESTABLISHMENT PRUNING

**BUILDING THE RIGHT WORM FARM TO
SUIT YOUR GARDEN**

**GROWING YOUR OWN FRUIT TREES -
WHIP-TONGUE GRAFTING**

PLANTING YOUR FRUIT TREES WELL WILL GIVE THEM A GOOD START IN LIFE

PLANTING YOUR YOUNG TREE

We've been talking a lot over the last few weeks about choosing the right site for your fruit trees, planning your fruit tree garden, and soil preparation, so we won't go into those topics in depth this week (but we will revisit them, never fear!).

So, let's assume you've chosen the perfect site for your tree, and done some great soil prep by planting a green manure crop, adding compost, or digging in some manure. You may even have done some deep ripping of the tree site, or used a broadfork to loosen the soil without turning it all upside down.

All of those things will make planting your fruit tree easier, but don't worry if you haven't done any soil prep at all—you can still have great success. The technique is just slightly different, and we'll come back to it at the end of this article.

FIRST, it's great if you can dip the tree's roots in an inoculant of some sort, to populate the roots with lots of good microbes that will help the tree get its nutrition as it grows. We often use compost tea, but worm castings soaked in water, or worm juice also make a great inoculant. It's also possible to buy ready-made inoculants, but we're not going to recommend any in particular, because they seem to only come in commercial quantities, which is too expensive for home use.

NEXT you need to dig a hole. If the soil has been prepared as above, you will probably only need to dig a hole just large enough to accommodate the root ball of your new tree, say 1' cm deep and 1-1/2' wide.

The hole should be deep enough that when the tree is planted it will be at the same level it was in the nursery. You can usually easily see the line that marks the soil level on the trunk of the tree, below the graft. If you can't see it, make sure the graft union is at least a couple of inches clear of the ground (see box next page).

IF DRAINAGE is an issue, mound the tree up a bit, to make sure that any heavy rainfall will be able to drain away from the roots. This is particularly important if you're planting your tree in heavy clay, when it's important to avoid planting your tree into a clay 'bowl', because it will surely drown and die if the roots are wet for too long.

It is also particularly important for cherries, which hate having 'wet feet' and for trees that are prone to phytophthora, such as peaches and nectarines.

If you do happen to be planting in clay, it's a good idea (but can be very difficult) to dig an extra 1-1/2' below the bottom of the roots to try to avoid the bowl effect. Another tip is to dig as deep as you can easily, then use a crowbar to at least loosen or create cracks in the clay below that level, to help the moisture and oxygen get down and start to create the right conditions to attract worms and soil microbes.

If you're planting a number of trees, or have access to appropriate equipment, it's really an excellent idea to deep rip (or use a keyline plough) along the tree lines as part of your soil prep.

ADD a couple of shovelfuls of compost or well-rotted animal manure (if you have any) to the loose soil at the



Dig hole, add compost...

AT A GLANCE...

Planting your fruit trees carefully will help to get them off to a good start in spring.

Being shifted from the nursery is a shock to the tree, and always involves the loss of a lot of roots. Some tender loving care, plus the right soil additives, can help them to re-establish a strong root system as quickly as possible.

Watering, weed control and pruning are all part of the picture.

bottom of the hole. This will provide nutrition and microbes to get the tree established (just make sure it's not 'hot', like fresh chicken manure or unfinished compost, because it's easy to burn the tree's roots). In the photo, Hugh's adding some complete organic fertilizer, but this is optional.



..and a handful of organic fertiliser



Firmly tamp down around the tree when backfilling.

CHECK THE ROOTS of your tree, and remove any damaged bits. Shorten any roots that are too big to fit easily in the hole. Losing roots is a shock to the tree, but you're also going to prune a lot off the top of the tree, so it will stay in balance.

POSITION THE TREE in the hole so the roots sit comfortably to hold the tree level and upright—if there's one strong root lower than the others, you might need to dig a bit deeper to accommodate it.

NOW HOLD THE TREE UPRIGHT while you backfill a few shovels of dirt over the roots, until they are well covered (but don't fill the hole completely yet). Give the tree a jiggle up and down to make sure the soil has filled the gaps between the roots—if you leave any big air gaps, the soil will collapse when you get your first rain, and your tree might end up on a tilt, or with exposed roots. Firmly tamp the soil down over the roots with your feet. It's fine to really get the heel of your boot in and press firmly; just make sure there's enough soil over the roots that you won't be damaging them.

FINISH BACKFILLING the hole with soil—the roots should be covered with at least 2" of soil. Now, firmly tamp around the tree, including up close to the trunk, to make sure the soil is very firmly packed down.

WATER THE TREE in if necessary (if you've had a decent amount of rain before you plant and the soil feels damp, this is not necessary).

PRUNE YOUR TREE (you can come back and do this step later if you want to check your pruning notes first). If you're not sure how to prune your tree you can

- check the pruning guide you received when you joined,
- post a photo on the Member's Forum and ask for feedback and suggestions from us and your fellow members, or
- book your monthly one-on-one chat with us, and send a photo of the tree through beforehand so we can give you clear advice.

THAT'S IT! The tree has now been firmly planted, and then pruned.

Haven't done any soil prep? That's absolutely fine, but you may need to dig a deeper hole, and then partially fill it in again, to make sure the tree has some loose soil beneath its roots to help it grow without restriction, and there's a couple of extra steps at the start:

- Have a tarp, or piece of plastic or cardboard ready to put the soil on as you dig your hole... otherwise the soil gets lost in the grass, and you won't have enough to fill the hole in again.
- Define the edges of the hole you're going to dig (about 1-1/2' square) by cutting through the grass with your shovel, then use the shovel to slice below the grass layer to cut the roots.
- Remove the grassy top layer and put aside, being careful to shake off any soil.
- Dig the hole (putting the soil on the tarp, plastic, or cardboard) as above...but you may need to



Prune your tree to knee height to finish the job.

make it a bit deeper, say 1-1/2' deep, to make sure there is some loose soil under the tree's roots. Replace the soil to the depth required as described above.

- Now proceed as described earlier.
- Once you've firmly packed the soil around the new tree by firmly tamping it down with your boots, you can replace the grass you removed from the top, upside down, to make a lovely mulch layer for your tree.

FINISH THE JOB by watering the tree in if the soil is extremely dry, but in a normal winter that's not usually necessary. Tune in next week for how to manage weeds around young trees.

Make sure when you plant your tree that the graft union is above the ground, by at least 2"-4", to prevent it from ending up underground if soil accumulates around the tree in later years.

If the graft union is underground, the scion (variety) can start to form its own roots in the ground, and the characteristics of the rootstock (e.g., dwarfing, disease resistance, or vigor) may be lost.

A handy tip is that the higher you plant the graft union above the ground, the greater the dwarfing effect you can create in the tree. As a rule of thumb, plant the tree at the same depth it was in the nursery (you can usually see the soil line on the bark below the graft union).

SPOTLIGHT ON...LEAF CURL

ABOUT: Leaf curl is a fungal disease caused by *Taphrina deformans*, especially during wet springs. It only occurs on peach and nectarine trees, in early spring, and is easy to identify from the deformed and misshapen leaves, which die and fall off, being replaced with a re-sprouting of new leaves. In moderate cases the tree grows completely out of the disease by summer, but the stress reduces fruit yield and predisposes the tree to pest attack. In more severe cases the fruit will also be infected and fall off, and in very severe cases the tree may die.

LIFE CYCLE: As with most fungal diseases, the spores overwinter on the tree, mainly on the buds and twigs, in a form called a conidium.

The infection period for Leaf curl is when new leaves start emerging from buds in the spring.

Spraying after the buds have opened is ineffective, because infection takes place as the young leaves emerge, and the fungus develops inside the leaf.

Wet weather and temperatures of 500–700F (i.e., quite cool temperatures) at bud swell favor germination of the conidia, particularly if followed by warm, humid conditions, which bring about rapid growth.

Once germinated, conidia penetrate the surface of the leaves, and the fungus then spreads rapidly throughout the leaf, causing the very visible deformities associated with the disease.

Above about 800F the fungus stops reproducing, and the leaves start growing out undamaged.

MONITORING: From late winter onwards, it's very important to monitor budswell, and be aware that different varieties reach budswell at different times.

Don't rely on what date a variety reached budswell last year, though recording budswell dates in your Fruit Tree Diary is certainly useful to help you know when to start monitoring (hint: begin monitoring, i.e., visiting your tree once a week, about 2 weeks before the earliest date you've ever recorded budswell for that variety).

Also monitor the weather, and be aware that you're much more likely to have a severe outbreak of Leaf curl if the weather is consistently wet during the period when the buds on your peach and nectarine trees are swelling and reaching budburst.

Conversely, during very dry or drought conditions in spring, you may not see any Leaf curl in your trees even if you don't spray. Check out this week's Indoor Task on page 12 for more info about when and how to monitor.

AT A GLANCE..

Leaf curl is yet another fungal disease that attacks fruit trees, and one of the most annoying.

Luckily, it only attacks peaches and nectarines, and is (mostly) preventable - as long as you notice when the buds start swelling, and get the spray on at the right time.



Once you've got leaf curl it's too late to do anything about it until next season, when early spring fungicide sprays are vital in wet weather

PREVENTION AND TREATMENT: Leaf curl is preventable by spraying copper, Bordeaux, or lime sulphur at early budswell (this can be from mid-January onwards most years, but is starting very early in some places each year). In our experience copper sprays are more effective, but it's important not to use too much copper on your trees (because copper can have a cumulative effect in the soil, where it acts as a fungicide and can kill your soil fungi) and in a year with lower rainfall, lime sulphur may be sufficient.

For best results, spray again 7–10 days later. Timing is very important, and spray should be applied when buds have swollen, within 1 week before buds opening.

Also apply fungicide in the Fall at 90% leaf fall if your tree had a severe case of the disease in spring.

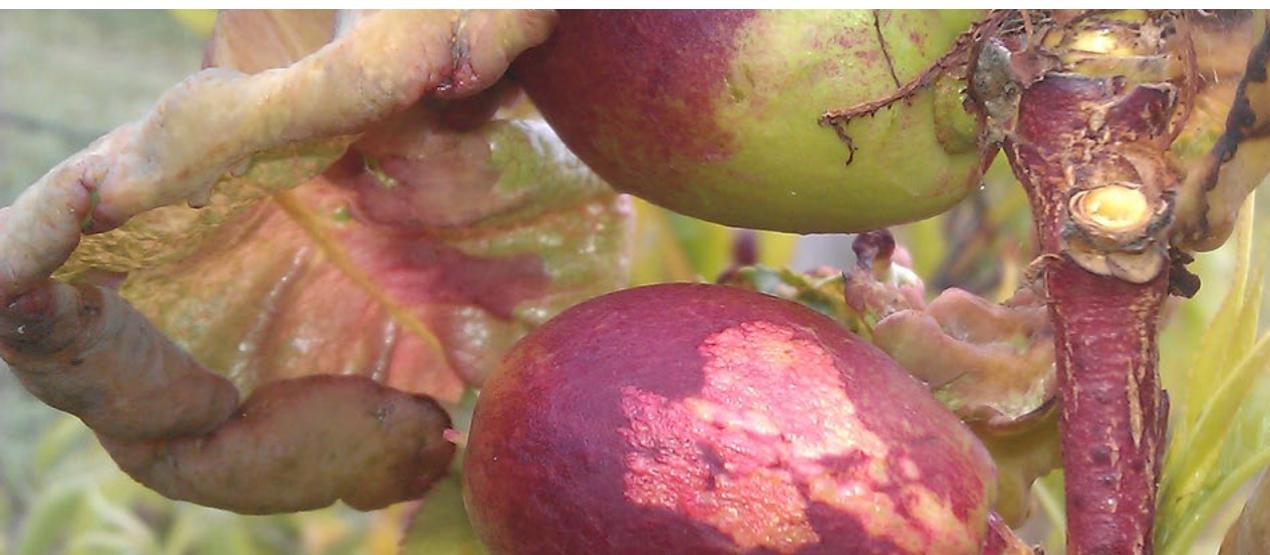
Once your tree is showing symptoms (i.e., damaged leaves), it's too late to treat the tree this season. Removing damaged leaves from the tree may help prevent some secondary infection (and will at least make you feel like you're doing something!) but most of the damage is done with the primary infection, and it's not usually worth the time taken to remove the leaves.

The tree will grow out of it as the season progresses and temperatures rise. Infected leaves then shrivel and die,

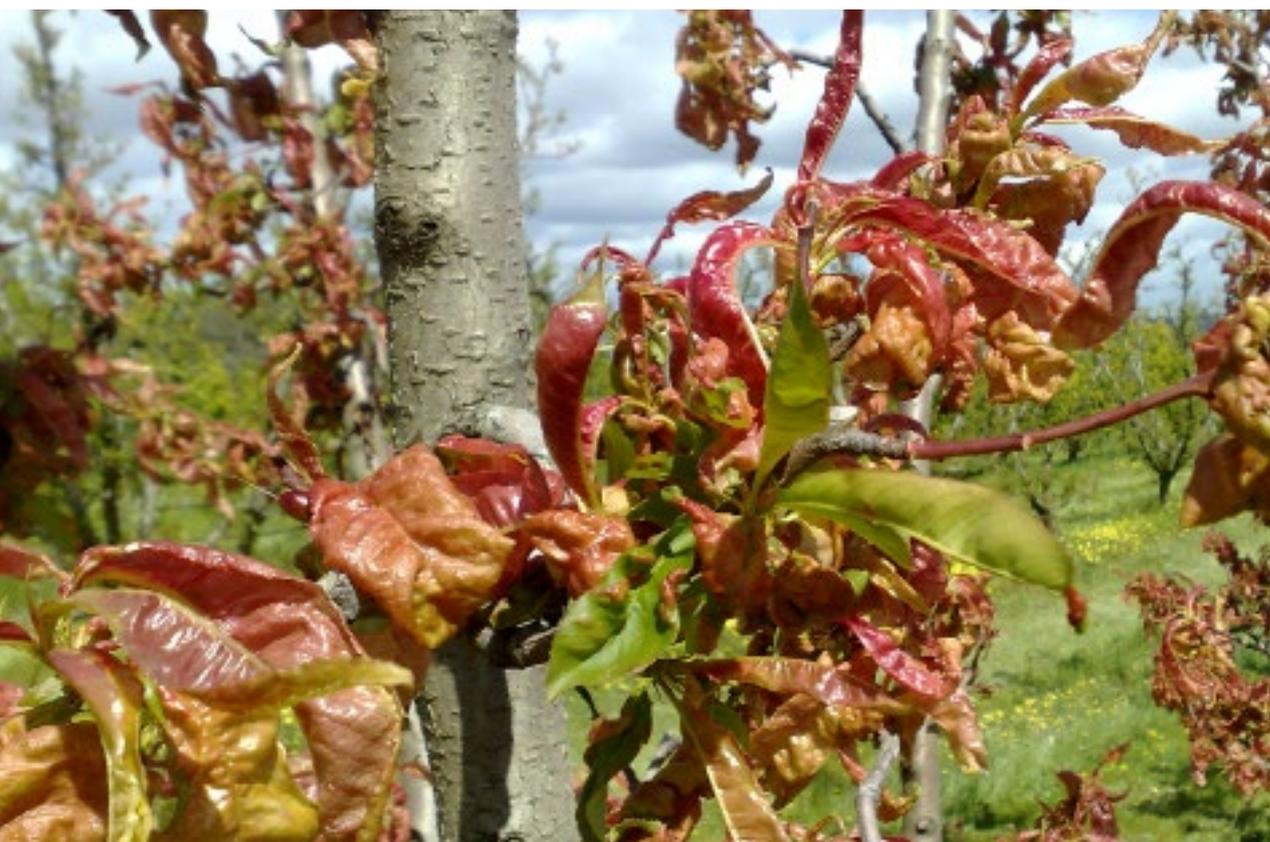
and fall from the tree. As long as they rot and disappear within a few weeks, there's not much point cleaning up the leaves, but if they persist on the ground for several months, remove them and put them in the compost pile.

On badly infected trees, the tree will be quite stressed due to losing most of its leaves. It will not grow as well as it would have otherwise, and will be more vulnerable to attack by other pests and diseases. You can help your tree by removing more fruit than usual when thinning, and particularly watch out for any fruit that has been affected by the disease. It will have patches of red, rough skin, and will often fall off by itself, but if not, it's best to remove damaged fruit to help the tree put its energy into growth rather than fruit production.

Put more effort than usual into maintaining tree vigor, so make sure the tree has enough water, and ensure the soil is well looked after with plenty of organic matter and microbes (compost or worm castings are perfect for this). You could also give the tree a boost with some organic fertilizer such as pelletized poultry manure, and for a little extra care you could spray the soil and the tree with some home-brewed compost tea (as per the instructions we'll be providing later in the program!)



A bad attack of leaf curl will affect fruit, set the tree back significantly, and can kill very young trees





KEYLINE – HOW CAN IT HELP YOUR HELP YOUR SOIL?

KEYLINE - WHAT IS IT?

Keyline planning was invented in Australia in the 1950s by an innovative farmer called P. A. Yeomans, who was looking for a way to improve the degraded soil on his farm.

It has since developed into a set of principles, techniques and systems called keyline design, which uses the natural features of a landscape to harvest and control water in a way that leads to the development of rich, fertile soil.

A key feature of keyline design is deep ripping of the soil to allow air and water to penetrate, providing ideal conditions for soil microbes to flourish. The ripping is done with a special tool called a **KEYLINE PLOUGH** which works under the soil surface, and aerates the soil without turning it over (because that would destroy soil microbes and cause compaction). This aeration is a crucial part of rapid soil improvement, because it breaks the compaction layer, allowing air and water to enter, and creates the right conditions for soil microbes to get to work.

Imagine it's raining. Unless your place is completely flat, the rain will flow from the highest parts of your

land to the lowest points – but not as one big sheet. Water flows from each ridge in the landscape into the valleys in between, and as it flows downhill, streams of water in the valleys combine to make bigger streams. This results in rapid runoff, erosion, and the loss of the rainwater into creeks and rivers.

Yeoman's brilliant observation was that in each little valley there's a spot called a keypoint, where the steep upper part of the valley starts to flatten out (in technical terms, it's where the shape of the valley switches from convex up high, to concave lower down).

In starting to make a keyline design, a contour line is first put through this point, and it's called the keyline. The land is then deep ripped, in parallel to this line. The effect is that when rainfall flows down the valleys, it's caught by these ripped lines and is diverted away from the valleys and towards the ridges, which normally never have a chance for the rain to soak in. Instead of running down the valleys, the rain spreads over the entire landscape and soaks in.

Keyline designs for farms include irrigation dams (with lockpipe systems to allow for gravity-fed irrigation), linked with graded earth channels to provide extra catchment areas and to allow the movement of water around the farm.

AT A GLANCE...

Keyline is an important farming technique being used to restore the landscape on many US farms, but believe it or not, it also has application in your garden!

Most gardens are too small to contemplate ploughing, but understanding the ideas behind Keyline helps us understand how we can reduce compaction, and increase the amount of water our soil can hold.

Keyline is a simple technique that will reduce the amount and frequency you need to water, and make your garden more drought resistant.



Keyline ploughs work under the soil, causing minimal disturbance



Keyline ploughing can be used to rehabilitate compacted soil



Broadforks are great for aerating soil

AERATING THE SOIL. For backyard gardeners there is a wonderful low-tech implement called the broadfork, which replicates the aerated soil structure that is created by keyline ploughing, but on a small scale suitable to most gardens.

BROADFORK

The broadfork is based on the European broadfork, but to suit US conditions it has straight tines (broadforks have curved tines) that have more chance of penetrating the heavy, clay soils with very low levels of organic matter that so many of us have to deal with. If you have really poor soil, you can even remove some of the tines on the first pass, to give you a better chance of being able to push the tiller into the soil.

Once you've pushed the tines deep into the soil, you just pull back on the handle to move the tines through the soil and break up the soil structure. This is a great way of loosening and aerating the soil, without turning it upside down, which would make things difficult for soil microbes and lead to compaction.

Opening the soil up with a broadfork allows air and water to penetrate the soil easily, providing the perfect conditions for your beneficial soil microbes to thrive. This gives your soil a real head start in terms of promoting good soil structure, fertility and biological activity (especially if you're also adding lots of compost, worm castings, and organic matter). You can buy them online, or you could use a sturdy garden fork if you already have one.

DO I NEED TO AERATE THE SOIL AROUND MY FRUIT TREES?

We love low-tech, low-cost solutions, and a really easy way to check whether the soil around your fruit trees is compacted is by making a penetrometer from a 2' long piece of 1/8" mild steel rod. Bend the end 6" into a loop to make a handle, and with a file, notch every 1" on the rod (from the unbent end) so you can measure how deep it pushes into the soil.

Push the penetrometer slowly into the soil until you reach resistance that is hard to push through—that's the compaction layer, which roots find it difficult to penetrate. Pull the penetrometer out and note the distance it went into the soil. If you didn't reach a compaction layer you probably don't need to aerate, but if you hit something rock solid at less than about 6", you'll be doing your fruit trees a favor.

Start your aeration just beyond the drip line of your tree (imagine where the water will hit the ground as the rain runs off the leaves—that's the dripline). Work around the tree, spiralling in towards the trunk. If you're using a broadfork, loosen the soil gently so as not to break the tree's roots.

The broadfork comes into its own when preparing fresh soil before planting, when you don't need to be gentle at all! Of course to actually plant your tree you'll still need to dig a hole, but the digging will much easier!

The best placement for roads, fences, and shelter belts is also included in the design, plus they usually highlight the best place to build houses and sheds. The plan also includes rotational grazing of pasture animals.

Putting it all into action involves ripping the soil along the correct contours, doing the earthworks for dams and ditches, and planting trees in the right place. For anybody with a large property to develop who intends to run stock or grow crops, getting a keyline plan is great start.

WHAT'S THIS GOT TO DO WITH THE FRUIT TREES IN MY GARDEN?

There are two important parts to keyline planning that are relevant no matter what size your 'farm'!

CAPTURING WATER AND PREVENTING RUNOFF BY IDENTIFYING THE CONTOURS OF YOUR LANDSCAPE.

In a garden, you wouldn't normally worry about trying to identify the keyline, but putting swales across your landscape on the contour is a similar (though slightly different) way to capture water in your garden. If you're interested in doing this, refer back to our recent article about it.

CONTOURS

I think I know what a contour line is....

Contour lines are fictional lines on a map linking points that are all the same height above sea level. You can think of them as horizontal slices through the landscape.

In the real world, in your garden, if you start at any point, and find other points that are at the same height (using a laser level or one of the low-tech methods we described recently in the Grow Great Fruit program), you're defining the contour line.

An easy way to think of it is to imagine water filling your landscape, as in a flood. As the water level rises, it is always at the same height throughout the landscape – that's a contour line!

SPOTLIGHT ON... PROTOZOA

PROTOZOA ARE A GROUP OF SINGLE-CELLED ORGANISMS THAT, LIKE PRETTY MUCH EVERYTHING ELSE THAT LIVES IN OUR SOIL, HAVE AN IMPORTANT ROLE TO PLAY.

Protozoa are single-celled organisms that form a vital link in the soil food web, and they exist in huge numbers in healthy soil. While we are only ever going to see protozoa with the aid of a microscope, it's fascinating to know what is going down under our feet every minute of every day.

Why should we care about protozoa, and why do we need to know about them? Put simply, they are an important part of the food chain within the soil. Protozoa are mostly 'consumers' (or heterotrophs), meaning they get their energy by consuming smaller organisms, mostly bacteria—of which they can eat up to 10,000 per day. In doing this they are performing two vital functions: regulating populations of smaller organisms, and releasing carbon and nutrient compounds (nitrogen, as ammonium) around plant root zones, thereby mineralizing the soil. Around 80% of the nitrogen requirements of plants are supplied via the waste products that are the result of protozoa eating bacteria and fungi! Free nutrient—what a great system!

As usual, it's dog-eat-dog down there (or bug eat bug perhaps?), and so protozoa inevitably end up as lunch for larger creatures such as worms and tiny insects (or microarthropods, such as soil mites, spiders, and springtails [those little jumping

insects often found in compost and leaf litter]).

Not all protozoa are beneficial, but even some of the 'bad' ones, which may be root eaters, have their uses in that they provide a food source for other protozoa. In a balanced soil with a high level of diversity, these bad guys never get much of a chance to become a problem. Some other protozoa are also human parasites and can be the cause of diseases such as malaria, giardia, and dysentery, but hopefully we are never likely to come across these.

CHARACTERISTICS

The three main types of protozoa that we see in healthy soil are flagellates, ciliates, and amoeba.

Flagellates move around by way of a wavy whip-like tail, or flagellum. Ciliates are much larger than flagellates, and move around through the use of hair-like filaments, or cilia, that they wave around. Amoeba are amorphous blobs that 'slide' along via the use of foot-like appendages known as pseudopods. Under a microscope amoeba can be seen to change shape as they move.

Protozoa digest their food in 'stomachs' known as vacuoles, and they have a variety of devious ways to catch their food—some absorb it through cell membranes, others surround and engulf their prey, and still others have mouth-like openings.

HABITAT

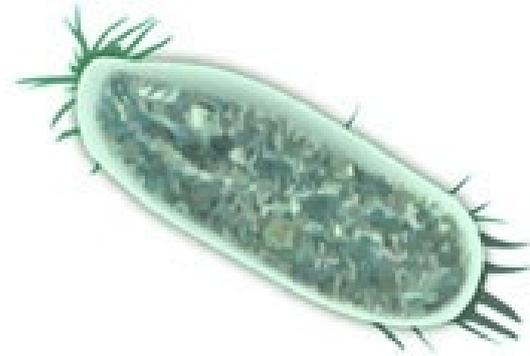
Like most soil life, protozoa need moisture to survive. They are happiest in soil with good structure, as there is room between the soil particles for them to hang out, find plenty of food (bacteria, some fungi, occasionally other protozoa), and escape from predators.

If soil conditions become too dry or too hot or cold, protozoa tend to go dormant rather than die off, encasing themselves in cysts until conditions are once again favorable, even if this takes several years.

AT A GLANCE...

Protozoa are the next step up the food chain from the single-celled bacteria and fungi. The most common ones that exist in our soils are flagellates, ciliates, and amoeba and, on the scale of these things, are quite large (around 0.005"!). Having said that, a teaspoon of healthy soil can contain several thousand protozoa, so they're not THAT big!

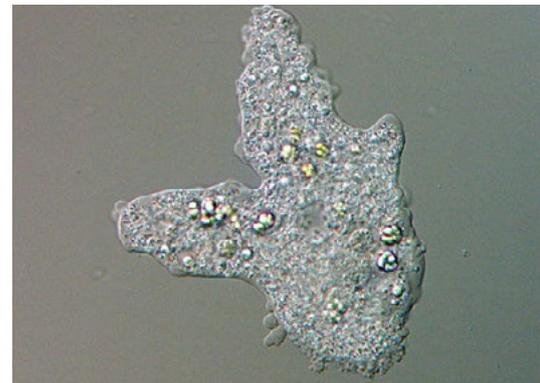
They feed on smaller single-celled organisms, and are themselves eaten by larger microbes, and so are an important part of the transfer of nutrients up the food chain. As they feed on smaller microbes, protozoa release nitrogen as ammonium, usually near or around the roots of plants.



Large numbers of ciliates can indicate anaerobic conditions



Flagellates have whip-like tails



Amoeba feed by engulfing their prey

MANAGING WEEDS AROUND YOUR YOUNG FRUIT TREES...

Bare soil is the enemy of the organic gardener, and nature will immediately fill the vacuum with any plant that will grow there, in an attempt to heal the soil—and these are the plants we often call 'weeds'. So, if you've just planted a fruit tree, which inevitably results in bare soil around the tree, there's absolutely no point trying to keep it that way, because you'll be fighting against nature at every step, and damaging your soil in the process.

However, it's also good to reduce the competition for moisture and nutrients around your young fruit trees, at least in the first year or so of life. So, what's the best strategy?

There are two main strategies you can use: cover the soil to prevent the weeds coming up, or out-compete them by sowing plants of your choice.

COVER THE SOIL

Depending on what you use, you may need to replace it several times in the first season, to be effective in keeping the weeds under control. In order to boost the microbial life in the soil under the mulch, it's a great idea to put a layer of compost or a sprinkling of worm castings down first, to inoculate the soil with microbes.

Weed mat – some excellent organic, biodegradable weed mats are available (such as [Weed Gunnel](#)), and newspaper can also be used. Use multiple layers, and weigh it down with something to prevent it blowing about the garden.

Mulch - organic mulches such as straw, leaves or bark chips are best for the soil, but they can break down quite quickly, and may need replacing.

SOW LIVE GROUND COVER

Living plants are better than bare soil or mulch because they protect the soil food web, stop the ground drying out, their roots provide habitat for microbes, they add organic matter into the soil when their roots die and they store carbon in the soil. Why wouldn't you?

Plants with deep roots, such as rye grass, and plants with taproots, help to repair disturbed soil, but can be quite competitive for water, and may be better to include in your groundcovers after the first year

Great groundcover plants include legumes (for nitrogen fixing), yellow and white flowering plants for insect attracting, edibles for eating, and companion plants.

It's important to keep your plants mowed and in the "growing phase" throughout spring and summer.



Mulch and living groundcover are both great ways to reduce competition around newly planted trees

ARE DIFFERENT TYPES OF FRUIT TREES PRUNED THE SAME WAY?

For young trees, while you're getting them established into a vase shape (which is what we recommend, unless you have a reason for growing a different shaped tree) the answer is yes. During the establishment phase (the first 1-3 years after your plant a new tree), your main concern is to establish the right structural wood (i.e. permanent limbs) in your tree; at this stage you're not concerned with fruiting wood.

However, once the shape is established it's time to switch to maintenance pruning, which is when you are more mindful of creating and protecting the fruiting wood you need. At this stage, there are some differences in how you treat different types of fruit. We'll cover pruning apricots and cherries in summer, and go more into detail about apples and pears in spring, but this week we summarise the differences in how you prune different types of fruit trees.

PEACHES AND NECTARINES

Fruit grows ONLY on 1 year old wood, therefore it is important to prune last year's growth to keep new laterals growing, and to keep fruit growing close to the limbs. Left unpruned, each year the growth would extend



from the apical bud, creating long spindly laterals extending a long way from the main limb. The best fruit is produced close to permanent main limbs as it is larger and less prone to wind damage.

- Do any limbs need removing (i.e. dead, too large and dominant, shading the bottom of the tree etc)?
- Fruit buds are fluffy; leaf buds (which will grow new shoots) are flat and pointy; peaches also often have triple buds, i.e. two fruit buds

with a leaf bud in between. Try to identify the different types of bud before you start pruning

- Define the leader, i.e. choose which growing tip you will leave at the top of the limb and prune the others off
- If laterals are getting too long and spindly, cut back to a new side shoot if there is one, or remove altogether if there is a replacement nearby. A word of warning - don't remove laterals willy nilly, or it's too easy to create stretches of bare wood on your limbs. It's good to have laterals growing along the entire length of the limb
- Remove any dead/diseased wood as you are going, and remove any fruit 'mummies' that remain in the tree from last season
- Prune for this year and next year, i.e. try to leave plenty of side shoots (or laterals) growing from each limb with plenty of fruit buds for this season's fruit, and aim to leave another lateral nearby that has been cut back to two or three (leaf or triple) buds - hopefully each of those buds will grow into new laterals covered with fruit buds in the coming season!
- If there is good growth on the tree, cut the laterals to the length of a pencil (keeping an eye on fruit buds - make sure you're not cutting them all off, some varieties have long laterals with only a few fruit buds on the ends)
- If there is plenty of space, a lateral may be allowed to branch many times and carry many pieces of fruit.



APPLES AND PEARS

- Fruit grows on nonvigorous (horizontal) wood that is at least 2 years old
- Some varieties form 'spurs' (clusters of buds) that can produce fruit for years. Old spurs have few fruit buds, and can be shortened, thinned out or removed if there are replacements nearby.
- Laterals can be shortened to encourage spurs forming, except some varieties are tip-bearing, so laterals should not be shortened for first few years until spurs develop. If not sure, wait until the tree flowers in spring to decide where to prune.
- Horizontal wood grows spurs and develops fruit buds more easily than vertical wood.
- Apple and pear trees produce vegetative buds and mixed buds. Terminal buds on apple and pear trees are usually vegetative; however, some varieties (called tip bearers) produce mixed terminal buds. Most mixed buds on apple and pear trees are the terminal buds on short shoots called spurs.

PLUMS

- Fruit grows on wood of any age (though many varieties tend to have less fruit on 1 year old wood), and on spurs, which makes pruning very easy
- Identify new growth, to assess how well the tree grew last year
- Pruning is simple: follow the vase-shaped pruning method to remove wood that is not where you want it and leave the rest

QUINCES, MEDLARS, MULBERRIES, PERSIMMONS, NUTS, AND FIGS

We don't grow any of these so don't claim any specialist knowledge, but we grow all of them in our home garden, and use the following guidelines in addition to the general maintenance pruning technique:

- Require little pruning except removing dead/diseased wood
- Remove wood that is crowding or crossing over
- Reduce height of tree if necessary to allow you to net the tree and reach the fruit.



Prune the top of each limb first



Peaches only bear fruit on new wood

HOW TO FOIL FROST!

First let's make a distinction between frost and chilling requirements. Frost happens when the temperature at ground level falls to 0°C or below, and has the potential to do damage to your fruit trees. Chilling requirement is the need for deciduous fruit trees to experience a certain number of hours below a certain temperature (usually below 12°C) over winter. While it's important to understand chill hours, it's a totally different story to frost, so we'll look at it closely in coming weeks.

WHAT IS FROST, HOW DOES IT FORM, AND HOW DOES IT MOVE?

There are two types of frost.

ADVECTION FROST is less common, and occurs under windy conditions when a large, dry, cold air mass, several thousand meters thick, moves into an area. The air temperature is often colder than the plant temperature. Under these conditions, site location and most frost protection systems are not much help.

RADIATION FROST is the more common type of frost which occurs when a dry, cold air mass settles in an area, on a still, clear night. It's usually associated with the centre of an atmospheric high pressure cell moving into an area. The good news is that clever planning can help to prevent damage from radiation frost.

During the day the sun warms the plants and soil. At night, this heat is slowly released to the atmosphere, and because there's no wind, the air settles in layers, forming an inversion layer of warmer air about 10-15 metres above the ground. Cold air is heavier, so it gets trapped under the layer of warm air. As the cool air gets colder, it settles near the ground and drains to lower areas. Plants can end up several degrees cooler than the surrounding air.

Whether the soil surface and surrounding air falls to 0°C or lower depends on the following:

- the amount of heat stored in the soil during the day
- the amount of heat lost by radiation at night—heat loss by radiation is highest on a clear still night, while clouds have a blanketing effect and wind will mix the air layers, bringing warmer air down the moisture content of the air.

The change from water vapour to water (dew) gives off heat, and as the temperature cools at night the temperature of the air in contact with soil and the plants may fall below the 'dew point', causing moisture to condense and form dew. This gives off heat, and slows the temperature drop. If the temperature keeps falling, at 0°C it freezes, and heat is again released as dew changes to frost. If the temperature keeps going down, frost occurs and the water in the plant freezes.

AT A GLANCE...

If your garden is frost prone, it may damage your fruit trees in spring, when they are vulnerable, and can lead to the loss of fruit.

Understanding how frost works, and how it affects fruit trees, can help you to plan your garden to grow bountiful crops of fruit every year, despite the frost.



Fruit trees are frost hardy when dormant





Mature trees and buildings give some frost protection

Frost forms rapidly on high plateaus, but also flows downhill (think of it moving like treacle), and forms pools in flat areas, creating a distinct frost-line on slopes. Frostiness is highly variable, even within small areas like your backyard, but slopes above 10-15 m from the bottom of a valley are generally the least frost-affected areas.

There are several indicators of the frost line in a valley – it will often be the same as the height of dense fogs that form in the valley, and there may also be local species of trees and plants that indicate frost lines.

HOW DO I KNOW IF THERE'S GOING TO BE A FROST?

Expect a frost if the temperature is forecast to drop to 0°C or below, and the night is clear and still, especially after a cold, cloudy day, because the soil will cool quickly after sunset and has had little opportunity to heat up during the day. In Australia, the Bureau of Meteorology includes frost warnings in the forecasts issued for rural districts in South Australia and Victoria.

DOES ANYTHING ELSE MAKE A FROST MORE LIKELY?

Three other main factors can influence whether you experience a frost on your fruit trees:

1. Frost is significantly more likely to form if the soil is dry– moist soil will absorb more heat during the day for release at night.
2. Vigorous spring weed growth can add to the frost hazard by preventing the soil from heating up, so it's a good idea to mow the plants under your trees before budswell, and make sure it's short if a frost is predicted.
3. The presence of Pseudomonas syringae on the leaves (the bacterium that causes bacterial canker). Pseudomonas is an ice-nucleating bacteria, which means it can act as the trigger that makes ice start to form on a leaf or bud at low temperatures. It's been proven that leaves with no Pseudomonas bacteria can survive temperatures as low as -7°C for several hours with no damage! If only we could get our trees free of Pseudomonas, we would not only be reducing the risk of bacterial canker, but we'd also be reducing vulnerability to frost. The two main ways of getting rid of the bacteria are by out-competing it with 'good' bacteria, eg by spraying the trees with compost tea, or by coating the leaves with copper. This is a really good reason to make sure you have an early copper spray on your most frost-sensitive trees, like cherries, apricots, peaches and nectarines.

WHEN ARE FRUIT TREES VULNERABLE?

In winter while they're dormant, fruit trees are pretty frost hardy, and will even grow in climates where snow falls in winter.

However in spring, they become much more vulnerable, from the time the buds start swelling, right through to shuck-fall (when the flowers fall off), leaving the tiny green fruit unprotected. Both the flowers and the tiny fruit can be susceptible even to a light frost at this point. Varieties that flower in early spring when there are a lot of frosts, like apricots and cherries, are therefore most at risk.

A frost occurs when the temperature at ground level falls to 0°C, however most deciduous fruit trees will tolerate this, and it's not until the temperature falls below -2°C that any damage is done. The lower the temperature, and the longer it stays below the critical temperature, the worse the damage to the plant.

As the chart below shows, trees become more vulnerable to damage at later stages of flowering and fruit set, however because not all blossoms on a tree are at the same stage of flowering when a frost occurs, only a percentage of flowers will be damaged in a single frost event (this is good news!).

Stone fruit (apricots, cherries, peaches, nectarines and plums) have a slightly different type of flower to pome fruit (apples and pears), and are damaged more easily by frost. However the main reason they are more vulnerable is because they flower earlier in spring, when the risk of a heavy frost is much higher.

TEMPERATURE REQUIRED	BUD SWELL	FULL BLOOM	SHUCK FALL
To kill 10% of flowers	-11.0°C	-2.4°C	-2.1°C
To kill 90% of flowers	-17.0°C	-3.9°C	-3.6°C



Frost damage on an apple

HOW DOES FROST DAMAGE FRUIT TREES?

Frost does its damage when ice forms inside the plant tissue and injures the plant cells. In fruit trees, the worst damage is to the fruit buds, which can be killed. The lower the temperature, the more buds will be damaged. Frost damage can have a drastic effect on the whole plant in some cases (especially evergreens like citrus), but in deciduous fruit trees it's usually only the fruit buds, flowers or small fruit that are damaged.

It was previously thought that cells were killed by the water inside the cells freezing and expanding, thereby killing the cells, and this can happen at times. Curiously though, in most cases the cells actually die from dehydration, as the water inside the cells is drawn out by the ice forming on the outside of the cells.

SITE SELECTION—THE MOST IMPORTANT ANTI-FROST MEASURE

Because cold air is denser than warm air, it flows downhill and accumulates in low spots. Definitely avoid these cold holes when choosing where to plant your stone fruit. The tops of hills are also cold and should be avoided. It's best to plant on slopes where the cold air can drain away.

In the southern hemisphere we normally choose north-facing slopes for fruit trees, but in a particularly frost-affected site, consider planting stone fruit on south-facing slopes because this will slightly delay springtime bloom, and give your trees a better chance of flowering after the worst of the spring frosts, as the risk of frost decreases rapidly throughout spring.

Cold air drains downhill, so think about how vegetation, buildings etc. on a slope might be blocking the flow of this cold air. A dense barrier in the wrong place might push the cold air into the area where your fruit trees are planted, and do more damage, so prune out the lower bits of windbreaks, or cut long grass along fence lines to let air pass through.

On the other hand, vegetation, berms, fences, and buildings can also be used to control the flow of cold air and force it around your trees.

Here's a few guidelines for site selection for fruit trees (and other frost-tender plants)

- Carefully observe your block under frosty conditions, and check out low-lying areas by checking where fog patches lie.
- Choose the most frost-free sites for your stone fruit trees, especially the varieties that flower earliest in spring. Apples and pears will

tolerate frostier spots in your garden.

- If possible, plant on sites that are at least 15 m above a valley floor
- If planting in rows, lay them out parallel to the prevailing direction of the cold air drift
- Prune trees to avoid blocking air movement, especially avoid low hanging, dense branches
- Bodies of water such as dams, ponds and water tanks provide thermal mass that can offer some frost protection for fruit trees planted near them. The water absorbs and holds a lot of heat during the day, and may keep the temperature high enough to prevent freezing when it releases the heat at night.

WHAT ELSE CAN I DO TO PREVENT FROST DAMAGE?

Commercial orchards use techniques like alarm-sensitive sprinklers, frost fans (big wind turbines), and helicopters to mix the warmer air down to the crop, but unless you have a lot of fruit trees and a commercial interest in protecting your crop, you probably won't go to these lengths. An old technique is to light fires or heaters in the orchard, but this is rarely done any more (see this week's Nanna Technology, p 10).

1. Keep your soil moist in spring, especially if winter has been dry, and keep the ground cover plants under your fruit trees short
2. Improve your soil, because the more organic matter in your soil, the more moisture it will hold
3. Choose late-flowering varieties
4. Mulch reduces the amount of heat the soil can absorb during the day and release at night, so if you're planning to mulch, wait until the frost risk has passed
5. Use a clear plastic cover over the soil to increase the amount of heat your soil absorbs (this can

be quite effective, but wet the soil before putting the clear plastic down and remove it again after the danger period or you may damage your soil life.) Black plastic is not effective.

6. Plants with high Brix have a lower freezing point. Brix is a measure of the nutrient in the sap of your fruit trees, and is a good indication of the health of your soil and trees.
 7. A piece of shade-cloth or clear plastic stretched over several garden stakes driven in around a newly planted tree gives good frost protection, or an old sheet thrown over the top of a tree
- Sprinkler irrigation similar to that used in commercial orchards is possible, but carries a risk of doing more damage than the frost might otherwise do. The principle is that the water is relatively warm, and releases heat on contact with the colder air and plants. When the temperature drops below freezing, the water freezes and releases additional energy to the leaves and fruit. Low-level micro-sprinklers under trees are an effective means of using water for frost control, but should be started before the temperature drops to freezing, and run until the danger of freezing has passed.

It's interesting to note that quite apart from good site selection and appropriate choice of varieties, the other significant thing you can do to help protect your trees from frost is to improve the soil. Soil with high carbon and humus levels, lots of biological activity and heaps of organic matter will hold more moisture, have a higher Brix, and be less likely to have Pseudomonas infections, all of which help prevent frost damage. One of the really rewarding things about organic growing is that nearly every problem has the same solution—improve the soil!



WHY ARE HEALTHY TREES LESS LIKELY TO BE ATTACKED BY PESTS AND DISEASES?

It's not just a matter of luck whether or not your trees get sick—the science shows that healthy trees are much less likely to succumb to disease and insects, especially sap-sucking bugs, and have a well-organised natural defence system to protect themselves.

Anecdotal evidence and our own experience in the orchard backs this up. A tree that is obviously already struggling is much more likely to be the target for pest attack.

HOW DO PLANTS PROTECT THEMSELVES?

Plants have a secret life of which we know little! They have a highly evolved natural defence system against attack by disease (much like we humans), that includes developing thick cuticles, plant hairs, and producing a range of protective chemicals. And just like humans, the first layer of defence is the plant's skin, which means the tree's bark, the thick skin of stems and the waxy layer on leaves.

The protective chemicals that plants make have various effects on the bugs that eat them; they might stop the insects growing properly, sterilise them, repel them, or mask how delicious the plant really is. Some plants even make their own poisons - some acacias will produce hydrogen cyanide in response to insects feeding on their leaves!

Other defence mechanisms that trees use include producing gum (as seen in gummosis, which is usually the tree's response to attack by fungus or bacteria), allowing a section of the leaf around the affected area to die, causing a leaf spot, or by dropping infected leaves altogether.

Have you ever wondered why some people succumb to every cold in winter, and others never seem to get sick? Or have you had the experience of having a fruit tree mysteriously get sick and

die, while the tree over the fence is in blooming health?

The pathogens that cause infectious diseases (e.g., fungal spores) are commonly present in the environment, just as the microbes that cause the common cold are everywhere. So, whether or not an individual (tree or person) gets sick is more to do with the strength of their immune system, than the presence of the pathogen.

Some trees are naturally resistant to some diseases, and increasingly, as new varieties are being developed, they are often bred specifically for disease resistance. A great example of this is the Honeycrisp apple, which is very resistant to Black spot (Apple scab). Traditionally, resistance has been bred into fruit varieties using natural breeding selection methods, but there is a worrying trend towards using genetic modification, where genes are artificially spliced into fruit to add particular characteristics.

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Poor mineral nutrition is a major contributor to lack of plant resistance, or the plant's ability to regrow after insect and disease attack...

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Why are we worried? Because there is now a mountain of scientific evidence showing that artificially meddling with genetics in this way can have extremely harmful effects on the health of animals. Until we have a conclusive answer on whether GM food is safe for human consumption, we would definitely recommend staying away from GM fruit!

AT A GLANCE...

Keeping your trees healthy is your best defence against attack by pests and diseases—this month we explain why.

Unfortunately, no matter how healthy they are, trees and plants can't protect themselves against birds, locusts, or the big pests like hares and rabbits, and nor can we influence the extreme weather conditions that create favourable conditions for pests and diseases.

But there are many factors you can influence to give your fruit trees the best possible chance of defending themselves.





The healthier your trees are the more resistant they will be to attack by pests and diseases

WHERE IS MY TREE'S IMMUNE SYSTEM?

Fruit trees have a vascular system, which is made up of xylem (which takes water and dissolved nutrients up from the soil into the leaves), and phloem (which takes the sugars that are made in the leaves down into the roots, where they are used to feed the microbes in the soil, amongst other things).

If all the necessary minerals and trace elements are available in the soil (it ALWAYS comes back to the soil...), the xylem transports them from the roots into the tree, where they are rapidly made into **complete proteins**. The resulting healthy plants will have a strong vascular system, and strong, healthy stems and leaves that are much harder for insects to bite into. They can also make new tissues quickly, have harder cell walls and tougher cuticles, are able to produce chemical protection, and can rapidly recover from wounds or pest attack.

The problems arise if

- the soil is deficient in nutrients,
- the nutrients are not present in a plant-available form,
- the tree is under stress for some other reason.

This is when plants become vulnerable, because without some crucial minerals, they can't build strong cell walls or thick outer leaf layers.

As well as the devastating physical effects, mineral-deficient plants will also give off chemical signals that tell the insects that they're weak, and ripe for attack. Insect pests target weak, deformed, nutritionally deficient or unbalanced plants.

Insects love trees like this, which have lots of incomplete proteins (called amino acids) in their sap, because the insects can digest them easily, whereas they can't digest and break down complete proteins.

So, not only are the trees easier for the insects to attack because they have weaker cell walls, the trees are also sending out signals to let the insects know they're weaker, and by having lots of free amino acids in their sap, the trees provide the perfect, easily digestible food for insects. It's a lose-lose-lose situation!



Leaf discolouration and deformities are usually a sign of imbalance, and therefore vulnerability

HOW DO I KEEP MY FRUIT TREES HEALTHY AND NUTRITIONALLY BALANCED?

Avoid artificial fertilisers	One of the ways trees can end up with incomplete proteins, free or fragmented nutrients is from the supply of excess nutrient, such as nitrogen, from artificial fertilisers. For this and a whole lot of other reasons, it's best to just avoid them altogether.
Make sure your trees have a balanced supply of all the nutrients they need, especially trace elements, in a plant-available form	Build healthy soil, with a high humus content, by: <ul style="list-style-type: none"> • Adding a variety of inputs from different sources e.g., natural fertilisers, worm castings, good compost, mulch, green manures • Add diversity to your compost by adding different types of plants, herbs and manures (see box below) • Feed your worms a wide range of foods so they produce diverse worm castings, including the whole range of nutrients, to use in your garden
Manage your tree's water requirements	Don't let your tree get too wet or too dry (don't worry, we provide detailed instructions about how to figure this out in the relevant months)
Make sure the trees have adequate drainage	If it rains heavily, you don't want your trees' roots sitting in water. This can be achieved either by planting the trees on mounds or swales, putting aggie pipe in when you plant the trees, or choosing a site in your garden that has good drainage. If you're not sure, go out after it rains and check the ground. Anywhere there is still a puddle when all the other water has drained away is likely to be a spot with poor drainage
Grow your trees in conditions that suit the variety	Plants that are grown at the edge of the environment in which they are most comfortable will be more likely to get sick, because they will be under more stress (for example if the rainfall is too high, temperatures are too high or low, or you're trying to grow tropical trees in a temperate environment). Having said that, it's always fun and interesting to stretch the boundaries of where fruit is 'supposed' to grow, by creating microclimates
Encourage biodiversity in your garden - monoculture favours the pests, diversity favours the predators	The more different types of plants you have (including 'weeds'), the more habitat you are providing for beneficial insects, and the less chance the pests have to get established and do damage to your tree. <ul style="list-style-type: none"> • choose plants of different heights to create different habitats • have water sources that are easily accessible, e.g., ponds and dams, to help attract lizards, frogs and birds, which all play an important part in keeping your fruit tree healthy • include some native plants (we prefer native food plants, but whatever takes your fancy...) • make sure you have no bare ground, but good ground cover, including fallen wood, to provide extra habitat
Reduce the pressure from pathogens around your fruit trees	Good orchard hygiene, like removing 'mummies' (shrivelled rotten fruit from last season) and getting diseased wood out of your fruit trees will reduce the stress on them and help to keep them healthy.

Many plants we think of as 'weeds' are actually fantastic accumulators of minerals, especially plants with deep tap-roots such as marshmallow, horehound, wild radish and capeweed. These plants are often amongst the first to appear on disturbed or compacted soil, and their deep root gives them a unique ability to 'mine' minerals from below the top layer of soil and bring them to the surface. Adding these plants to your compost, feeding them to your chooks (and then using the manure around your trees or in the compost), or using them as a green manure are all good ways to harvest the nutrients from your soil and ensure your fruit trees have access to all the micro-nutrients they need for healthy growth.

GREAT BOOKS ON LINKS BETWEEN PLANT HEALTH AND RESISTANCE TO ATTACK:

- *Bug: the ultimate gardener's guide to organic pest control.* Tim Marshall
- *Trophobiosis.* Francis Chaboussou
- *Tuning into Nature.* Phil Callahan
- *Science in Agriculture.* Arden Andersen

Marshmallow is a great 'accumulator'



ESTABLISHMENT PRUNING...

PRUNING YOUNG TREES TO MAKE THEM USEFUL AND FRUITFUL

Many fruit trees are sold from the nursery with only one or two main limbs, and are sometimes very unbalanced, with one limb being much bigger and stronger than another. Left unpruned, these trees will usually grow very strongly, resulting in a very tall tree with the fruit growing way out of reach. It's extremely common to see this type of fruit trees in backyards.

People are often reluctant to prune young trees, either because they're not sure what to do, or because they don't want to cut the buds off because they want fruit as quickly as possible. Another common mistake people make is pruning too high in the tree, leading to branching high up in the tree. This can result in the bottom of the tree being shaded out, which means any new wood (and fruit) grows high up in the tree out of reach. Sound familiar?

It's best to use the first two or three years to prune your tree into the shape you want. Yes, you'll sacrifice fruit in those early years, but you'll end up with a tree that remains in a useful and productive shape for the rest of its life, so it's a pretty good bargain.

WHAT SHAPE DO YOU WANT YOUR TREE TO BE?

This is a very individual question, and will depend on the purpose your fruit tree is intended to serve in your garden. This might include:

- shade for animals or a particular window of your house in summer
- a beautiful view from the kitchen sink
- maximum fruit yield
- some fruit for the birds and some for you
- a food supply for your pigs or chooks

In deciding the shape of your tree, you might also want to consider whether you're willing (or able) to use a ladder, how much space is available for the tree, will you be netting it, and how much time you have for maintenance.

Tree training systems have their own pros and cons (though whether something is a pro or a con depends on your purpose for the tree) See table on following pages.

TECHNIQUE FOR CREATING A VASE SHAPED TREE

If the main purpose of your tree is to provide you with fruit, we recommend growing your fruit tree as a vase, and here's how to do it:

YEAR 1

When you plant the tree in winter, prune all limbs to an outward-facing bud at knee height. Do this for all your deciduous fruit trees, even cherries and apricots (even though we normally only prune these in summer).

Here's some tips and things to watch out for:

- If the tree is a 'whip' or 'rod', ie has no branches but just one central leader, cut it off at knee height – yes, really!
- Make sure there are at least 3 or 4 healthy buds below each cut
- If the tree being planted already has enough limbs

(i.e., 6–10), follow the technique for maintenance pruning

- Leave weaker limbs slightly longer than strong limbs
- Remove any competing buds or shoots below the graft, and remove suckers.

YEAR 2

The cuts you made last year were **heading cuts**. Heading cuts are those which remove the end of a shoot or limb, including the apical (or end) bud, and result in the growth of the buds immediately below the cut.

When you go back the following year to do your pruning, you will probably find that wherever you made a cut has now grown into 2, 3 or 4 branches. It's really obvious in the photo below, because the new wood is brown and the old wood is grey. Where it changes colour is where last year's pruning cuts were made.

If possible, choose between 6 and 10 branches that are evenly spaced around the tree, and select them as the **permanent limbs** of the tree. Remove any that are growing into the centre of the tree, or crossing over each other.

You may not have enough choices to make the full shape of the tree in the 2nd year, in which case you may need to prune hard again to stimulate the tree to produce more branches.

Remember (1) wherever you make a heading cut, the tree will produce branches just below the cut, and (2) your aim is to start all the permanent branches from as close to knee height as possible, so don't make these cuts too high.

In the 2nd or 3rd year, whenever your tree has produced enough limbs to make a beautiful, well-balanced vase, you can shift into maintenance pruning, and let the tree start to produce fruit.

Don't worry if your tree doesn't behave as expected, or grows an incomplete vase, with no limbs on one side of the tree. Making pruning decisions **always** involves compromise, but if you understand the basic principles of pruning, and stick to them, you can't go far wrong! If you're really having trouble making decisions about how to prune your tree, take some photos (from several angles, in good light), and either post them on the members' forum for feedback, or book in your monthly one-on-one personal consultation with us, send us the photos beforehand, and we'll work with you to come up with a pruning plan.

AT A GLANCE...

Pruning young trees into the right shape when you plant them is super important, as it sets the tree up correctly for the rest of its life.

The shape you choose will depend on your purpose for the tree, but once you have decided what shape you would like the tree to be, and understand the principles behind pruning, the rest is easy.





SYSTEM		PROS	CONS
	<p>Vase: short trunk, 6-10 limbs start at knee height</p>	<p>Easy to establish and maintain, works with the nature of the tree, a lot of fruit grows within reach of the ground, tree dries quickly and is less vulnerable to disease, easy to maintain balance between wood and fruit</p>	<p>Animals can reach fruit</p>
	<p>Central leader</p>	<p>More natural shape for tree, less pruning</p>	<p>Can become tall vigorous tree unless on dwarfing rootstock, fruit tends to be higher in the tree</p>
	<p>Trellis: many variations, e.g., horizontal-vertical cordon, Tatura trellis</p>	<p>Two-dimensional tree, controls shape of tree for easy working</p>	<p>Fighting against the nature of the tree, requires regular attention to maintain the shape</p>
	<p>Espalier</p>	<p>Good use of flat space e.g., fence or wall, can protect against frost and help fruit ripen faster if against north-facing wall, maximises sunlight harvest</p>	<p>Requires experience, detailed pruning and attention</p>

SHOULD YOU PAINT YOUR PRUNING CUTS?

For a long time the thinking has been that yes, you should both paint all fresh cuts to disinfect the wound. However, at least one recent study has shown that there is no advantage in doing so, and in fact it may cause damage to the tree by sealing pathogen (disease causing microorganisms) into the wound. We think this is great, because if you have a quantity of trees to prune each year, the extra work of painting cuts can be enough to turn a fun, creative job (creating tree art) into a tedious, boring job!

SYSTEM		PROS	CONS
	<p>High vase: long trunk with limbs starting at waist height or higher</p>	<p>Allows grazing of large animals under tree without losing fruit, common in permaculture systems</p>	<p>All work on the tree—such as pruning, thinning, and picking—must be done up a ladder, vulnerable to birds</p>
	<p>Natural/wild shape: leave tree unpruned</p>	<p>May give some protection from birds because some fruit will grow in the tangle of branches where it's hard to reach, and fruit may ripen over a longer period</p>	<p>Tree may not grow into intended shape if it starts as a central leader, can be more prone to pests and diseases because tree takes longer to dry as air can't circulate easily, poor quality fruit</p>
	<p>Bush: similar to a vase but with more limbs (up to 20 or more)</p>	<p>Spreads the vigour over more limbs, keeps the tree small, all fruit pickable from the ground, common with cherries</p>	<p>Doesn't suit all fruit types, better for small fruit and less vigorous trees</p>



When you plant the tree in winter, prune all limbs to an outward-facing bud at knee height - don't make these cuts too high..



BUILDING THE RIGHT WORM FARM TO SUIT YOUR GARDEN

The best place for worms is in the ground, where they are fiercely efficient soil building machines. Worms do fantastic work under the ground in our gardens—including creating air passages, recycling organic matter, and depositing valuable castings (poo). They are among the most valuable and visible workers in our soils.

The purpose of a worm farm is to turn waste into useful material, and generate free fertiliser for your garden. It's also a fantastic way to generate material to make compost tea from (we'll be explaining in detail how to do this later in the program).

Last week we talked about the different types of worms, the conditions they like, and what they eat. So this week we'll look at how to set up a worm farm that suits your lifestyle and situation.

IN A NUTSHELL, worms like dark, cool, and moist (but not wet) conditions. They need regular feeding, and protection from predators, especially birds. This may sound like they are high maintenance, but in fact worm farms are easy to manage once you get the hang of it, and the end product of free fertiliser makes it all worthwhile.

TYPES OF WORM FARM

IN-GROUND FEEDING is worm farming at its most basic. You don't actually introduce compost worms, but simply bury worm food (usually kitchen scraps) at different spots in the garden, and the (earth) worms

will come and find it (just make sure there's enough moisture and shade).

You can add mulch over the spot to prevent it getting too hot and retain moisture, and so you know where you put the last lot.

If using this system in a lined garden bed (e.g. a wicking bed), you'll need to introduce some worms as well, as they have no way of getting there by themselves!

Obviously this system has no maintenance and does not rely on you doing anything. The downside is that you don't get any valuable castings to use elsewhere, though it helps to improve the soil at (and around) that site.

WORM 'TOWERS' are a step up from in-ground feeding. In this system a container or tub, sometimes with a mesh bottom (or lots of holes in the base and/or sides) is part-buried in the garden, so worms can move in and out. Food is added to the container and the worms come and go at their leisure.

Compost worms can be used in worm towers, and they will tend to stay put to do their wormy thing rather than move out into the garden bed. For this reason it's a good idea to add a few cm of damp shredded newspaper to the worm tower as worm bedding material when you install it.

Again, they are low maintenance (worms have other food sources if you are not feeding them), but a benefit is that you will get castings in and around the container, and the worms will also be taking food with

AT A GLANCE...

Worms are one of your most useful allies in the soil.

After going into detail about worms and what they like last week, this week we tell you about four different types of worm farms, their pros and cons, how to build them and how to look after them.

There's sure to be a worm farm that suits your garden and lifestyle!



Readymade worm farms are easy to manage



A simple home-made worm farm



An old bathtub makes a good worm farm

them in their gut back into the soil and depositing castings.

Worm towers are easy to make out of a short length (~50 cm) of wide (say, 150 mm or more) PVC pipe. Simply drill lots of 5 cm holes around the bottom 20-30 cm of pipe, and then dig a 20-30 cm deep hole that the pipe will snugly stand up in, and place the pipe in it. Done!

Add kitchen scraps in small amounts so that you don't get a smelly buildup of decomposing food.

It's also a good idea to place something over the top of the pipe (such as an inverted terracotta flowerpot base) to keep out unwanted scavengers and excessive rain.

READYMADE WORM FARMS, usually plastic, are widely available from garden centres and even online (eBay). There's a few different types, but the most common consists of a series of 2-4 trays that fit inside each other.

The base tray is usually solid and is where the liquid (often called 'worm juice') collects. This is simply excess moisture that occurs when keeping your worm farm damp. It's not actually a worm product but still contains nutrients and is great for plants.

The other trays have mesh bottom so the worms can move between them. Worms start off in the lowest tray (not the base) to which some bedding material (such as damp shredded newspaper, compost, or old leaves) has been added, and then as food is added and the amount of castings builds up, another tray can be added on top, and the worms will move up into it, attracted to the fresh food source.

The castings in the used tray can then be removed and put on the garden or used in compost tea.

It's a great system as there's no need to manually separate the worms from the castings.

These worm farms should be sited

somewhere out of direct sunlight and protected from temperature extremes; once it gets to 25°C your compost worms will be starting to look for new digs!

BUILD YOUR OWN WORM FARM

in any old container. The beauty of building your own is that you can do it to the scale you want and it generally costs next to nothing as you can use all manner of containers—polystyrene vegie box or boxes, old drawer, a bathtub, an old fridge, or a wheelie bin are some possibilities.

The main thing is to ensure that water can drain from your container or your worms will drown. Place a few cm of bedding material in the bottom, and a couple of handfuls of soil (the grit aids the worms' digestion). Add compost worms!

It's a good idea to put a cover over your worm farm. It helps keep it moist and cool (or warm in winter), and keeps out unwanted visitors such as rodents. Old underfelt is ideal, but old woollen blankets or woollen jumpers, or cardboard also work well. The worms will eventually eat these, but the beauty of this system is that components are cheap—or free—and easily replaceable.

FEEDING YOUR NEW WRIGGLY FRIENDS

Basically if something was once alive, worms will eat it: everything from meat to newspaper and cardboard, to manure (human and all animals), even hair and vacuum cleaner dust!

Like us, worms will benefit from variety in their diet, and there are certain foods, such as onions, garlic, and citrus, that should only be added in small amounts. If your worm farm starts to smell, chances are there is too much food and it's started decomposing. The remedy is to back off the food, and only then only add small quantities, as much as can be eaten in a few days.

WORMS ON A LARGE SCALE

One person doing some really interesting and innovative things with worms on a large scale is David Davidson at Creswick, in central Vic.

David's main worm beds are largely undefined spaces piled with feedlot manure and straw, and covered with straw. Just below the surface there are masses of worms. This sort of free-range worm farming looks risky—what's to stop the worms from just moving elsewhere?—but if conditions are right and there's plenty of food, there's no reason why the worms would go anywhere.

David processes large quantities of commercial food waste, and so has moved onto quite a large scale.

On a recent visit David took us into his paddocks (where he agists horses) and dug a shovelful of soil to demonstrate the difference between where he's been applying worm tea and vermicast. In both samples there were an impressive amount of worms, but the soil was much deeper in the paddock where he'd spread vermicast. Both samples were friable, but more so in the vermicast paddock.

Always looking for new ways to apply vermicast, David has recently started trialling inoculating cow pats in the paddock with worms, to see how they go.

David makes and sells pine worm farms. He demonstrated the one they have outside their house for ease of use, which they feed with all their scrap food and paper, loosely torn up. It was absolutely thick with worms, and also still had lots of undigested food (and a couple of mice). The finished vermicast is taken out of the bottom by removing a board.

Really interesting, and food for thought—another potential, and fairly simple, way to make money from a farm. And it's so integrated. As David said, worms will turn anything that was once alive into a fantastic additive for the garden—they're the perfect scavengers.

An old fridge is another possibility





Bedding material is the first thing when building a worm farm

HARVESTING THE CASTINGS

Worms will convert the food into lovely, dark, rich, crumbly castings (vermicast, worm poo) that is chock-full of plant-available nutrients and is very biologically active and diverse—it's a fabulous fertiliser.

In home-made systems chances are you'll have to separate the worms from the castings yourself. There's a couple of ways to do this. The easy way is to stop adding food and water to one side of the bed and uncover that side; the worms will gradually move to the side with the fresh food, water and protection from light.

The other way to take about half a bucket full of material, complete with worms, and place it in a mound, preferably in bright or direct light. The worms will immediately head for the centre of this mound, away from the light. Scrape away the outside few cm of castings, and then wait a few minutes for the worms to head still deeper, then repeat the process until you are left with just a mass of worms surrounded by a small amount of castings—these can be returned to the worm farm.

Ways to use the finished castings:

- 🍏 Apply direct to garden
- 🍏 Dilute to make compost extract (the microbes are diluted but it goes further)
- 🍏 Basis for compost tea (a brewed product where the microbes are fed and multiplied).



Worm farm workshop held at the farm



GROWING YOUR OWN FRUIT TREES...

WHIP-TONGUE GRAFTING

There are many different types of grafting. We stick to teaching the four main types of grafting we do often in the orchard, because they're the ones we know about!

Before we get into detail, let's remind ourselves of a couple of definitions. The **rootstock** refers either to an existing, mature tree in your garden that you are grafting to change varieties (or add a polliniser), or to a new rootstock tree that you've grown from seed or rootstock.

The rootstock may also be a mature tree you previously planted that died back, then shot up again from the roots, or it could be a tree that came up unbidden in your compost pile.

The **scion wood** is wood you cut off an existing, known variety of fruit tree, and then attach to the rootstock. (See the outbox for how to do this).

Three types of grafting can be done in winter, and the method you choose in any particular situation will depend on the size of the rootstock, and the size of the scion wood. These sizes are approximate only, and if in doubt, it's always worth trying your graft and seeing what happens!

1. **Whip-tongue grafting** is used when the rootstock is less than 20mm diameter, and works well when the scion and rootstock are about the same diameter.
2. **Cleft grafting** works for rootstocks between 20-40 mm, and is also a useful technique when the scion wood is much smaller than the rootstock.
3. **Bark grafting** is used for rootstocks with a diameter greater than 30mm, and is a good way to graft a mature tree that has big branches.

The fourth common type of grafting is **budding**, which is done in summer, so we'll come back to that at the right time.

This week we'll look at whip-tongue grafting.

HOW DOES GRAFTING WORK?

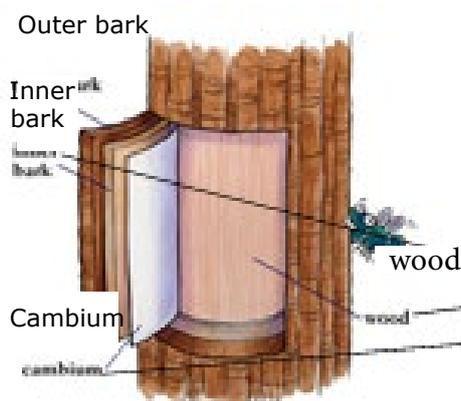
The cambium layer of your tree is the active growth layer between the bark and the wood. This is where a lot of the transport of sap and water take place, and where all growth of

the tree is initiated—the bark grows outwards, and the wood grows inwards.

For any graft to work, the cambium layers of the scion and the rootstock **MUST** be touching.

CHOOSING WHERE TO PUT THE GRAFT

This will depend on the type of rootstock you are grafting onto. If you're using a small rootstock you have grown from seed or cutting, or a sucker that has come up, the graft should be done at about 15-20 cm from the ground. If you are replacing a limb on a mature tree, you should cut the limb back to a stump of about 15-20 cm.



AT A GLANCE...

Grafting your own fruit trees is a great way to change varieties in your garden, preserve a heritage variety, or add a polliniser to a tree that flowers well, but doesn't produce much fruit.

We've already shown you how to grow your own rootstock from seed, grow rootstock from cuttings, and collecting scion wood to do your grafting in early spring.

This week we get down to nitty gritty with the first, and most useful, grafting technique you need to learn. It's called **whip-tongue grafting**.



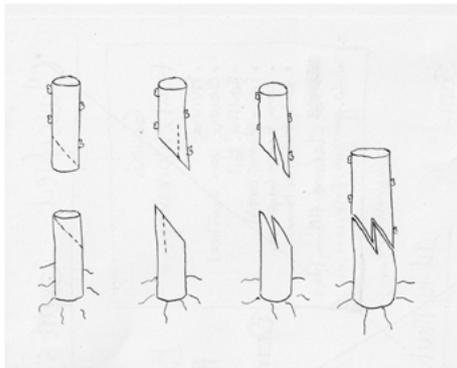
*It's not too late to be collecting scion wood if you plan to do any grafting this year. The **scion** should be one year old wood (i.e. wood that grew last summer). It might be wood you've already pruned, that's lying on the ground or you might cut it from your own or somebody else's trees. The most important thing is to **LABEL IT** with the correct variety name. Wrap it up in a plastic bag and put it in a nice cool dark place (a coolroom, the fridge or a cellar is ideal).*

*Grafting involves attaching **dormant** scion wood to a tree in which the sap has started flowing in spring, so it's important to collect the scion early and keep it dormant.*

WHEN WOULD I CHOOSE TO USE A WHIP-TONGUE GRAFT?

The limitations that determine whether you would choose to use whip-tongue grafting are:

- The size of the rootstock – as you'll see when we describe the technique, it's very tricky to do the right cut on a rootstock that is more than about 20 mm diameter, but it's possible!
- The size of the scion wood – if you are using really small scion wood (say less than 8-10 mm diameter), the mismatch in size can be too great, and you won't get a really good union between the rootstock and scion.



TECHNIQUE

This is how we do it:

1. Hold the scion (stick of grafting wood) in your left hand (if you're right-handed), with the fat end closest to your thumb.



2. Put your thumb on a bud.
3. Use your knife to make a long sloping cut above the bud. The cut should be flat, slightly concave, and have a bud on the back. Make sure the cut is not twisted (as it is in the photo below). If it is, have another go.



4. Now cut the tongue. Place your knife blade about 1/3 of the way from the end of the sloping cut, and make a cut parallel to the bark (not to the sloping cut) as you can see in the photo below, finishing about 1/3 of the way from the other end of the sloping cut.



5. Shorten the piece of grafting wood, leaving at least 3 buds (other than the bud on the back of the sloping cut), and no more than 5 or 6.
6. Next make a matching flat cut and tongue on the rootstock.
7. Fit the two cuts together



TROUBLESHOOTING

It's fine to have a mismatch at the back of the graft. As long as the cambium layers of the two pieces of wood are touching, and it is tightly sealed, it should heal.

It's also ok to have a slight mismatch in diameters between the scion and rootstock, as long as the cambium layers are touching.

Before you cut the piece of grafting wood off the scion stick, check the buds are present and healthy—they often get knocked off during collection and storage.

You can graft with a piece of scion wood with only two buds, but you may create a tree with a wide-angle fork at its base, which can be vulnerable to splitting later in life. It's even possible to use a piece of grafting wood with only one bud, but it's risky. If it 'takes', prune it in spring back to 3 or 4 buds as soon as it has grown enough, and these should then all shoot.

SEALING THE GRAFT

All grafts need sealing so they are watertight, and held firmly in place. Whip-tongue grafts are usually sealed by wrapping them tightly with budding tape and tying it off.

A type of budding tape called 'buddy' tape is available, and has the advantage of being biodegradable, so you don't have to remember to remove it in spring (but don't worry, we'll remind you anyway.)

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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