Growing Fruit in Suburbia

www.underthechokotree.com
Sustainable Living in the Suburbs

By Nev Sweeney

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0.0 Why Grow Your Own Fruit?

One of the cornerstones of living more sustainably is producing, using whatever capacity we have, to produce at least some of our own fruit and veg. This is generally recognised as a good thing for a whole stack of reasons, but what actually are those reasons? Ten are listed below –

1. It will save you money – you can actually save money by growing your own produce and the more of the process you do yourself, the more you save. Fruit trees can be a large investment but can pay back for many years once they are established and with the right care.

2. Growing your own provides fresher produce, improving your family's nutrition – Once a fruit has been picked the vitamin content starts to decrease so that the older they are the poorer nutrition they provide. While we like to think that we buy only the freshest produce, there is no real way to tell how old it is at the time of sale. If you pick it from your backyard or balcony, you are giving yourself and your family the best nutrition available.
3. Taste - Also, there is nothing that beats the taste of fresh, home grown produce! Fresher fruit equals sweeter fruit - it has not been harvested unripe then stored for months before getting to the retailer.

4. Lower food miles – it has been calculated that a typical Australian food basket, including fruit and veg, has travelled 70,000 miles to get to you. Each of those miles consumes fossil fuels and pumps greenhouse gases into the atmosphere (and travel by air generates 177 times more greenhouse gases than shipping). If you only have to step into your backyard or onto your balcony to gather the ingredients for a feed, the travel is measured in food feet not food miles, and no fossil fuels are consumed at all!
5. No chemical residues: you know where your fruit comes from and that it is not contaminated by pesticides – If you grow your fruit organically you can be sure that there are no residual nasties waiting for you. You know what has and what hasn't been using to grow your produce so you can eat it with confidence.

6. It shows kids where their food comes from – If you have kids, it can be a real eye opener for them to see that lemons come from a tree, not a supermarket. Also, getting them involved with growing the food they are going to eat is a great motivator for them to develop healthy eating choices.
7. It enables you to eat a greater variety of foods – If you source your fruit from retailers, you can only buy the types and varieties of fruit that they are prepared to sell you. Think of all the taste treats awaiting you out there that you don't even know about, growing your own can open up a world of taste!

8. The satisfaction which comes from growing and eating your own produce is amazing.
9. No packaging to try and recycle or send to landfill – Even organic produce can come packed in layers of plastic film, on a polystyrene foam tray, in a plastic bag and all of that packaging will wind up polluting the environment sooner or later.

A big difference I noted when we started to get serious about producing our own food was that the amount of garbage we generated reduced significantly and the amount in our worm food/compostable bucket increased significantly.

10. Reduced environmental impact of fertiliser and pesticide use – The chemicals used in industrial agriculture have a detrimental effect on the soil, ground and surface water, biodiversity and the environment in general. By opting out of that system and growing your own (as well as buying organically grown what you can't produce yourself) you don't encourage the continued use of these damaging chemicals.

1.0 How we Grow Our Fruit - An Overview

We know that sustainable living is more than just about growing fruit and veggies, but providing our own local, organically grown food using Permaculture principles is not only intensely satisfying but also makes great economic and environmental sense. We live on 600m2 in Sydney's greater west and for many years I have contributed to the family larder by growing fruit and this is an overview of how we do it.

History

I wanted to grow fruit, from the time when we first moved into the house in the late '70s. The problem was that I knew even less about fruit growing than I did about growing veggies, and I knew absolutely nothing about that! Needless to say, I made plenty of mistakes during the learning process. Some of the mistakes I made include the following –

- Planting an orange, apple and mandarine on the northern side of the then main veggie patch, causing increasing shade problems as the trees grew. Only the orange is still in place and it masquerades as the Choko Tree.
- I imported a very sickly peach tree from my fathers' place, which then acted as a fruit fly magnet every spring. When, after a couple of years I removed it, my fruit fly problem reduced considerably.

Linda, inspecting said peach, back in the day

- Planting a lemon in the chook area, long before we had the chook tractor. The chooks compacted the clay soil and the excess manure resulted in anaerobic soil where the tree was, needless to say it died. I then compounded my error by replacing the dead lemon tree with another one which, surprisingly enough, also died.
- Persistently trying to grow berry fruits like gooseberry and red and black currants that do not do well in our Western Sydney Climate.

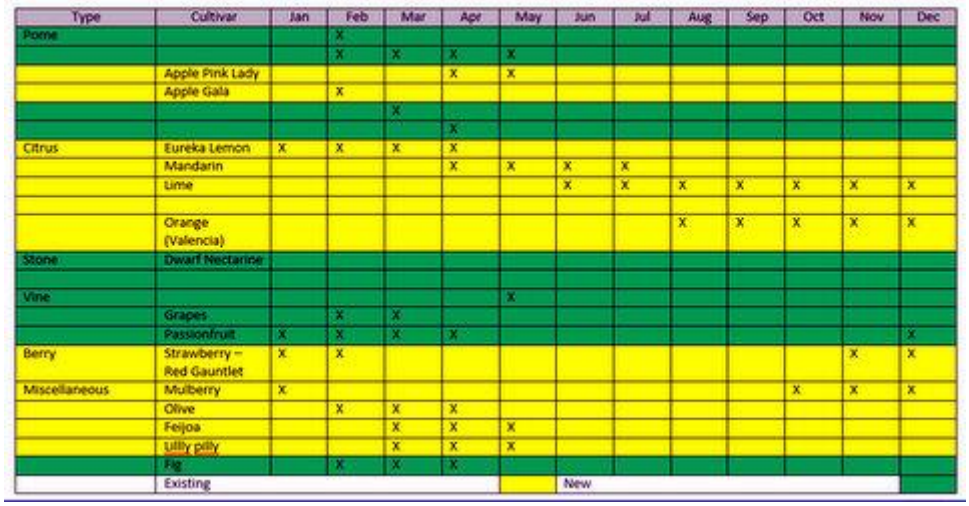
- Planting a couple of ‘Nelly Kelly’ grafted passionfruit beside the back deck. The rootstock is incredibly invasive. The productive parts are long dead but the rootstock continues to battle us for access to the house.

Nelly Kelly Passionfruit - productive passionfruit on the left, invasive rootstock on the right

Fortunately, after buying a few good books and getting some training as part of the Farm Technology Certificate I did in the early ‘80s I no longer make such rookie mistakes. My mistakes are now much more subtle and harder to correct!

Planning

There are very good things that come from planning. I unfortunately didn’t figure that out until I discovered permaculture twenty odd years ago. When I did my PDC about 15 years ago, I was introduced to the idea of a Fruit Harvest Calendar which allows you to work out when your existing (and prospective) fruiting plants will produce, so you can arrange for year ‘round fruiting by varying the species and varieties of the fruit you grow. I did one during the course and found it very educative, but I need to re-do it to reflect the fruiting plants that have come and gone in the intervening years.



Type	Cultivar	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pome			X										
			X	X	X	X							
	Apple Pink Lady				X	X							
	Apple Gala		X										
				X									
					X								
Citrus	Eureka Lemon	X	X	X	X								
	Mandarin				X	X	X	X					
	Lime						X	X	X	X	X	X	X
	Orange (Valencia)								X	X	X	X	X
Stone	Dwarf Nectarine												
Vine						X							
	Grapes		X	X									
	Passionfruit	X	X	X	X								X
Berry	Strawberry – Red Gauntlet	X	X									X	X
Miscellaneous	Mulberry	X									X	X	X
	Olive		X	X	X								
	Feijoa			X	X	X							
	Lilly pilly			X	X	X							
	Fig		X	X	X								
	Existing						New						

Fruit harvest calendar example

Fruit Growing Areas

We have a number of areas that are set aside for growing fruit, with or without other types of plants being integrated with them –

Fruit tree circle – a 3 metre, raised, wood chip mulched circle with a worm tower in the centre, topped by an insect watering station. The fruiting plants originally installed include two lime trees (Tahitian and Makrut) two apples (pink lady and gala both dwarves) and a dwarf lemon tree. There were also three red currant bushes planted in the centre of the circle between the trees and the worm tower. While not strictly fruit trees there are also a curry leaf tree and a macadamia nut tree. The gala apple has since passed on and was replaced some years ago by a multigrafted apple and the red currents also did not survive, refer mistakes above.

2012

2023

Mulberry tree – This deserves a section all to itself! It was a seedling gleaned from my father's next door neighbour about 30 years ago. It now has a canopy of 10 metre

diameter, provides lots of fruit every year with no maintenance, shades our front yard park area, provides lots of sticks for starting the fire in winter or use in the rocket stove all year round and keeps the northern end of the house cooler in summer. The leaves are edible (I have read) but we have not tried them.

Summer

Winter

LUFFA (Longitudinal Edible Food Forest Area) – This forms fence of sorts at the front (east) of the property and is made up a number of fruiting species including – feijoa, lilly pilly, thornless blackberry, midyin berry (still small and scrappy) and a coffee bush (coffee is a fruit!!!). Non fruit related plants in this area also include a large bay tree and three good sized melaleuca alternifolia trees and lots of sweet potatoes. The whole set up provides nice screening from the street and neighbours across the road.

Olive tree (LHS) and LUFFA from the south

From the north east

Small Fruit Tree Area – At almost the southeast corner of the front yard that used to house a small, scrappy and very unhappy bottlebrush, which we removed and now have a small built up area that was originally home to a blood orange and a dwarf fig (that doesn't seem very dwarf anymore) and that was recently expanded to include a dwarf lemon. It is watched over by ourselves and our lovely next door neighbours.

Miscellaneous – There are two fruit trees in the front yard that do their thing year after year. One is an olive tree, no idea what type, it had sat for a long time in a tin at a friend of my fathers' place before we got it 30 or more years ago. It sits at the front of the property almost as a southerly extension of the LUFFA, but not really. While we do not eat olives (I have passed them on to friends) it is on my 'to do' list to try extracting their oil. One day! The second is a dwarf nectarine, which is our only stone fruit, due to the issues we have with fruit fly. It seems reasonably resistant and we get a bit of fruit each year.

Dwarf Nectarine

Banana circle – This has had a chequered past. Originally in the front yard for 10 years where it was crappy soil, too dry and too shaded, the bananas never fruited or made it over two metres in height. After an attack of smarts I transferred it to the backyard where it had good soil, full sun and all the water from the spa/shower in the bathroom piped to it. They are now up to 5 metres tall and fruit when they feel like it, which will make setting up a new fruit harvest calendar interesting. The banana circle also provides welcome shade on the back of the house from the western Sydney afternoon sun.

Original position and growth 2011

New position 2023

Mandarine/passionfruit – Remember the mandarine I set up north of the veggie patch I mentioned above? It is now growing a metre from the western wall of the house and just north of the banana circle. I dug it up and moved it by hand about 15 years ago, and while it was not happy with me for 12 months, it recovered and produces lots of really nice fruit most years. It does sometimes go into biennial bearing after a particularly prolific year, but everyone deserves a rest. The passionfruit (a seedling, not grafted) sits below my office window, climbs up and provides shade, and then shows its affection for the mandarine tree, again, fruiting when it feels like it.

Passionfruit

Mandarine Tree

The back deck – It was my intention to have ago at growing some fruit on the back deck. First was a grape which I planted in a large pot which has a buried capsule to keep it watered. It has not done as well as I would like, more research required. I also got a couple of allegedly self-watering pots and put in a two blueberries. These did well for a few years but then seemed to sicken and then expire. I suspect both sets of plants of plants have not dealt well with the ferocious western Sydney summer and as they are on the edge of the western facing deck, I fear they bear the brunt of it. Again – research opportunity!

Grape, just after set up

The Strawberry tower – This was made out of a plastic 200litre drum with holes for the strawberries to grow out from. It was originally in the front yard under the mulberry tree, but I suspect it was too shaded to be truly happy. I transferred to the back yard but have not replanted it yet.

The Strawberry Tower

Watering

The mature trees such as the mulberry, olive and older citrus get watered when it rains. Simple as that.

The smaller and especially younger trees are watered using tank water and deep pipe waterers. These are 50mm diameter PVC tubes that are 500mm in length sunk into the ground near the root system with 3mm holes every 50mm down the length of the tube, facing the plant. Water directed into the deep pipe waterer goes directly underground, reducing losses due to evaporation and encouraging deep root growth.

What you see above ground

There is also a reservoir which I designed that goes on the top of the deep pipe waterer, buckets of grey water are tipped in, allowing the water to make its way into the soil without any losses.

The whole unit

The banana circle, of course is watered by greywater draining directly from the shower/spa into the centre depression of the banana circle. The mandarine is watered by greywater from the washing machine once it has passed through the constructed wetland.

Fertilising

There is some residual fertilisation from the breakdown of woodchip which most of the trees and shrubs have as mulch. Younger trees like those in the fruit tree circle and small fruit tree area have been provided with fertiliser sausages – which is a mixture of manures, wrapped up in hessian bags to form a sausage, and placed around the bottom of the trees. The sausages slowly rot down releasing nutrient for the trees. The fruit tree circle also derives some fertility from the worm tower at its centre.

Fertiliser sausage,

Fertiliser sausage, in place in the fruit tree circle

The citrus, due to their nitrogen requirements get diluted urine in spring and summer, with a tasteful white watering can in the toilet being contributed to by a donor or donors. This is then topped up with tank water at a ratio of about 1 part urine to 10 parts water. The resulting mix is then applied directly to the soil using the deep pipe waterer.

The banana circle is fertilised by adding organic matter to the central depression where the greywater goes. The damp organic matter then breaks down with nutrients being accessed directly by the bananas.

Pests and Diseases

By and large, our fruit plantation is pretty healthy with only the odd problem showing up.

In terms of pests one of the more common things we get is the scale/ants/sooty mould trifecta, where we use a vegetable oil spray to control the scale, and maybe a collar on the trunk to prevent access by the ants. This is usually on the citrus but can show up on the lilly pilly and bay tree as well. The sooty mould discolouration on the leaves is more cosmetic than anything else, caused by the scale secreting honey dew (which the ants want, so they 'farm' the scale) and encouraging the fungus sooty mould when it gets on the leaves. If the scale problem is resolved, so is the sooty mould.

Bronze Orange Bug

The main problem we tend to get is bronze orange bug on the citrus and in a bad year they can be in plague proportions and really kick the living daylights out of the citrus. I hand pick and drown them. I have found that if you get stuck into them early in the spring and keep on top of the numbers it will make life easy (for me, not them!).
Fruit fly can be an issue, and I have used paper bags around fruit to keep them out, but in recent years they seem to be less of a problem. We also get fruit bats, mainly to share the mulberry crop and occasionally some bananas but we generally let them have their share and they are happy.

Conclusion

Our fruit growing efforts have taken a while to set up, and even taking into account my previous mistakes, is quire productive. I think that given a bit time, effort and learning, anybody can do what I have done. In the end I think it is really just a willingness to give it a go and see how things turn out. Good luck!

2.0 Designing a Fruit Harvest Calendar

If you have a small space you need to plan to get the most out of it and that's what we did when we developed the veggie planting guide, we developed a plan that allowed us to harvest veggies all year round. Using a slightly different process it is possible to develop a plan that allows you to harvest fruit all year round too.

As always the thing to do first is to work out the sorts of fruit that you want to eat and while we will be talking about fruit trees, don't neglect berry fruit like strawberries or blackberries or vine fruit such as kiwis, passionfruit and grapes as well. Once you have an idea of the sort of fruit you want to grow draw up a harvest calendar by drawing up a table with 14 columns and as many rows as you want, you can always add more. The very left hand column is for the type of fruit (apple, orange, grape, mango etc) and the second column is for the variety (for apples you might want a granny smith and a red delicious, or a beurre bosc pear etc). The next twelve columns are one per month so start where you want, January is as good a place as any and then work through for a full 12 months.

A Dwarf Nectarine Works Well!

There is an example of our fruit harvest calendar available for download in the appendices.

As you work out what fruit and varieties you want there are several aspects of fruit growing that will modify your choices –

Family tastes – where possible actually try some fruit from your chosen type and variety and give your family a go at it too. It doesn't matter how pretty or productive the tree is, if nobody eats the fruit you have done your dough.

Climate - There are very few areas that will allow you to grow any sort of fruit that you want so you do need to be aware of the types of fruit that grow well in your area and you can do this by hitting the books or the internet but if you have access to local fruit gardeners they will be your most reliable source. Don't make the mistake of thinking that if Bunnings sell it in your area that it must grow well, they are in business to sell all

sorts of stuff and if you buy it and it doesn't grow that is your bad luck. To prevent frustration, heartache and some financial loss do your research before putting a spade anywhere near your garden.

Pollinators – some fruits like pome and stone fruits will need to have two compatible varieties that will act as pollinators for each other. Even if the variety you have chosen is regarded as self fruitful under some conditions, a pollinator tree will ensure a better harvest. Pollinators will flower about the same time and provide pollen that fertilises the target plant. More research needed.

Sexuality – no not your sexuality silly, the sexuality of the tree! Some trees have male and female flowers and so are self fertile (mostly – see pollinators above) but some have male and female trees (these are called dioecious). After spending 15 years growing up a lovely Carob tree the thing finally flowered and it turned out to be a male and at the time I bought it I had no idea that the carob species was dioecious so I would never get fruit off it. It was a happy ending though and it kept us warm during a fair chunk of last winter. Again, do your research and find out if one tree will be fruitful or if you need a male and female to get fruit. I do believe these days that self fruitful carobs are around.

So now you have a list of the species and varieties of fruit that you want, written down on the two left hand columns of your calendar. If you already have some fruit trees etc in place that is no problem, put them down on the calendar in a different colour so you can distinguish what you have from what you need to get.

Now for the fun bit, hit the books, net, local gardeners, botanic gardens or whatever and find out what months of the year each of your fruit varieties produces fruit. It is not enough to get some general idea of when oranges bear fruit, when does the variety you have selected bear fruit in your area? The more accurate your information, the better the likelihood will be of getting year 'round fruit out of your mini orchard. At the very least check out the books I have listed in the "library" section of the site and see if your library can get any of them in for you. Another book which I don't have is "The Complete Book of Growing Fruit in Australia" by Louis Glowinski which is also worth a look.

A house is not a home without a (dwarf) lemon tree

As you gather your information, from whatever source you can manage, make a mark (cross, tick, coloured square or whatever) in the columns for the months that the plant fruits along the line of each fruit/variety. Once you have completed this part of the process it will become immediately obvious if there are any blank spaces in the year when you won't have fruit available for harvest.

So now it is time to hit the books again, but this time to look for fruits that you can harvest to fill in any "hungry gaps" in your fruit calendar. Remember to make sure it is something your family will eat and if they haven't tried it see if you can get hold of a sample fruit from your local greengrocer or wherever and try it out. You never know it might be the tastiest fruit you have ever tried, but if it is gross cross it off the list and move on.

Once all the spots in your calendar are filled you can buy the fruits you don't have and complete your mini-orchard. How many you buy of each tree, bush or vine will depend on how much space you have and how much you like each fruit. If you don't have lots of space you will have to get creative and try fruit in pots, pruning to get the best yield for space such as by espaliering some trees along a fence line or the edge of one of your buildings or going for genetic dwarf trees or trees grafted onto dwarfing rootstocks. If you have friends and family around you consider putting some on their land or even put some time into developing a community orchard.

Citrus are easy to grow and lime fruit is nice

However, you manage to put it into practice, your fruit harvest calendar will help you set things up so that you and your family will have fresh, home produced, organic fruit all year round and what could be better than that?

Type	Cultivar	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pome			X										
			X	X	X	X							
	Apple Pink Lady				X	X							
	Apple Gala		X										
				X									
					X								
Citrus	Eureka Lemon	X	X	X	X								
	Mandarin				X	X	X	X					
	Lime						X	X	X	X	X	X	X
	Orange (Valencia)								X	X	X	X	X
Stone	Dwarf Nectarine												
Vine						X							
	Grapes		X	X									
	Passionfruit	X	X	X	X								X
Berry	Strawberry – Red Gauntlet	X	X									X	X
Miscellaneous	Mulberry	X									X	X	X
	Olive		X	X	X								
	Feijoa			X	X	X							
	Lilly pilly			X	X	X							
	Fig		X	X	X								
	Existing						New						

3.0 Growing

3.1 The Fruit Tree circle

Years ago we planted a carob tree in the front yard, to provide carob for us to make our own chocolate substitute because my younger daughter could not eat chocolate at the time (she has since grown out of that particular food allergy). So we bought the tree, it was a bit over a metre tall when we planted it. Unfortunately I didn't know much about carob trees; they grow slowly and my daughter had moved out before it finally flowered after fifteen years. The flowers didn't look right though and after some research I found out something else about carob trees – they are dioecious – there are male and female trees, and we had a male. No carob pods for us! It did keep us warm the next winter though and in its place I put in the fruit tree circle.

The Circle with Trees Planted (Pre-currants and chook)

To replace the carob tree I wanted a denser planting of productive trees and plants so that the area would provide more useful products that the carob would have using a combination of dwarf trees and pruning. I had cut the carob tree down as close to the ground as I could but there was still some stump sitting up and I decided to make that the exact centre of the circle. To do this I got some rope and looped it loosely around the stump, at the other end (about 1.5 metres away) I tied a stake. Then using the rope and stake dragged around the stump I scratched a circle in the lawn 3 metres in diameter which became the outer limit of my fruit tree circle.

With the circle in place I then skimmed off the grass by shallow scraping with a mattock, for later composting and put down a layer of weed mat over the whole area. To set the boundary I got some garden edging 150mm deep dug down 50mm into the ground to give it stability. I needed something reasonably fertile to form the bed so I got in some organic garden mix (basically compost) and filled in the whole of the circle to the depth of the edging, but hilled up a bit in the middle.

The Circle after 6 Months

To give the circle a bit of interest (and to completely cover the stump) I marked out an inner circle a metre in diameter and then put in some more garden edging around the edge to give the centre extra height. This circle I also filled up with organic garden mix, fully covering the stump. Over the whole lot I then put a layer of wood chips as mulch. The wood chips are a long term mulch that take years to break down but they also have another advantage in that they attract beneficial fungi that work well with the trees.

My term "Fruit Tree circle" is a bit of a misnomer, it is actually two circles and the trees are useful but they are not all fruit trees. The outer circle sports two lime trees (Tahitian and kaffir) two apples (pink lady and gala – it is important to select varieties that cross pollinate!) both dwarves, a curry leaf tree, a macadamia nut tree and a dwarf lemon tree. The inner circle is growing 3 red current bushes.

To plant the trees I had to clear away the mulch and organic mix, cut through the weed mat, then dig down into the ground to get deep enough for the trees to be happy. So far the holes in the weed mat haven't been a problem and the trees are growing well. Once the trees were planted the organic mix and mulch went back over the top and I watered them in to settle the soil and organic mix around the roots. Easy!

As it was in July 2013 from the North

The three red currant bushes went in next but because there was deeper soil build up there was no need to disturb the weed matting. The red currants are inside the outer ring of trees to provide some measure of protection from what can be fairly ferocious Western Sydney summers. My experience of berry fruits has not been good so far; they look OK after planting but look a bit sick by the middles of summer. This trick seems to work because it has been three years and they are still alive and thriving.

From the West (Look hard and you can see the chook!)

At the centre of the circle, right over where the carob stump is slowly rotting away, we have a very high class chook statue, but the trees have grown up so much it is not easy to see any more. Over the last three years the trees and bushes have spread out and created a nice shady area that the cats love to go in under and lie on. Personally, I would have thought the wood chip mulch would have been too uncomfortable but they seem happy enough.

We are yet to get macadamias (it may take a while) and it looks like we may get some apples this year, but it is great to be able to pick lemons and limes from the front yard as well as being able to pick curry and kaffir lime leaves for our curries whenever we want. We have also been able to share the leaves with family and friends. The only work required has been a once-a-year prune for the apples and occasional trimming up for the other trees to keep them open – and short!

3.2 The Longitudinal Understory Food Forest Area (LUFFA)

Along the front of our property, from the front walk to the northern boundary is a ribbon of growth which I liked to refer to as “The Hedgerow”, all very European! I called it this because the space was long and thin and I wanted some diversity of plant species in there, but didn’t know quite how to design it. I have since come across the concept of the food forest and it has sunken into my thick head that the food forest model can

work in long and narrow intensive as well as larger, 3 dimensional and extensive. The mature trees are already in place (more about that later) as well of some of the smaller tree stuff so the main design work will be on the understory(s). Hence the new name! The area is long and narrow (longitudinal) and the understory needs to go in to complete the food forest area so there you have it – LUFFA!

I originally made the bed that would become the LUFFA by getting some vertical 200mm sections of pine logs joined with wire to form raised bed borders. I used the garden watering hose to lay out the shape that I wanted, it was easier to move than the border materials. Once I had the shape, I laid out the border, using tent pegs to ensure it stayed upright, then dug out any grass underneath where the bed would be. I ordered some organic garden mix from a local supplier and used that to build up the bed, and finally mulched the bed with wood chips. Some stuff, like the large trees have been there for many years, but now it was time to design the LUFFA as a whole.

Bay Tree at the Northern End

When designing a food forest it is generally accepted that here are seven levels (some people add a water plant and fungi level to make nine, but I am sticking with the more traditional seven). These seven levels are described below –

1. **Large trees** (or Canopy) – They are generally full size fruit, nut or timber trees that will take a while to grow and may get as high as 10 metres plus.

2. **Small trees** – dwarf fruit trees, generally and mainly citrus due to the resistance to fruit fly attack and their hardy growth, although others such as dwarf fig, nectarine and elderberry are also possibilities as well as coffee and/or tea bushes. They are usually less than 4 metres tall.

3. **Shrubs** – These are lower than the fruit trees and include currants and berries such as raspberry, loganberry or black berry (thornless) as well as some of the larger herbs such as rosemary, wormwood, lavender and citronella.

4. **Herbaceous** – these plants are smaller again and include perennial vegetables such as rhubarb, globe artichoke, perennial silver been and asparagus. Other herbaceous plants include comfrey and borage to bring deep nutrients to the surface and for medicinal and compost-making purposes. Herbs which would fit into this layer include yarrow, lemon balm and calendula and perennial leeks and garlic chives round the selection out as being edible pest repellents.

5. **Root crops** - Perennial root crops such as Jerusalem artichokes and yacon produce their yield below ground although the spreading habit of Jerusalem artichokes would require them to be contained, perhaps by growing in a large buried pot or sink. Arrowroot also fits into this category. Annual root crops such as beets, carrot or parsnip can be grown in clearings which allow enough sun in.

6. **Groundcovers** – these act as a living mulch as well as providing a yield. Plants in this category include strawberries, sweet potato, warrigal greens and nasturtium. Edible weeds including fat hen, dandelion, amaranth, mallow, sow thistle, purslane, fat hen or chickweed may become volunteer species and should be encouraged if not sown/planted outright.

7. **Climbers** – these would be trained to climb the large trees already in place and could include scarlet runner beans (also called 7 year beans because they reshoot from their root for a number of years after planting), choko, passionfruit or kiwifruit although kiwifruit require both male and female plants to produce fruit.

Seeing as the area had pre-existing plants, the first part of the planning process was to write down what plants I had in each level, in this case it added up to the following –
Large trees – 3 x melaleuca Alternifolia tea trees (the type they distil tea tree oil from) and one bay tree (Lauris Nobilis)
Small trees – 1 decent sized Feijoa and one small (almost shrubby) coffee tree.
Shrubs – 1 rose bush
Herbaceous Plants – 1 pig face and some mint (came from a cutting someone gave me, I have no idea which mint it is!)
Root crops – Nil
Ground covers – Nil
Climbers – 1 thornless blackberry

Some of the area just south of the bay tree is also taken up by sweet potato tendrils which spill over from the banana circle next to it. I suppose it is somewhat of a toss-up whether the sweet potato is classed as a root crop of climber seeing as it can function as both! Since it is not planted in the LUFFA area itself I chose to ignore it.

The Map

The next trick was to draw up a map so I could locate everything and see what space I had to work with. Yes, I am sure that there are computer programs out there that would simplify things but being a card carrying Luddite, I did it the old fashioned way. The process is simplified if you pick yourself up an A4 (or even A3 if you can find it) graph book (mine call itself a "grid" book for some unknown reason). A good grid size is 5mm, or about 1/4" in imperial. For a copy of the map, see Appendix 1.

From the left - pigface, coffee bush and Tea Tree

I then measured up the length of the area I was going to work with and used a ruler to see how well it fitted onto the A4 grid. The area was almost 16 metres long, and using the ruler I found that 16 centimetres only came half way up the page, which would give a scale of two grids (or 10mm) per metre. To give me the biggest drawing on the A4 page to work with I multiplied things by 1.5 so that the scale became 3 grids (15mm) per metre and the drawing would still have room on the top end for a title etc.

Using my wonderful partner in sustainability to hold the tape measure, I was able to measure the length along the LUFFA for each of the plants already in place, I had to pick one end as the datum and chose the south end for no particular reason. I drew a line as long as the LUFFA on the scale pad and then marked off where each of the existing plants was located. By measuring the width of the LUFFA at each of the points where

there was a plant and transferring those points to the scale map, I could join the dots up on each side and approximate the size and shape of the bed to scale.

Unfortunately, when I laid out the bed originally I got a bit arty and instead of a straight sided bed, which would be easy to draw but boring, I put in a whole stack of curves. This made things a little more interesting when I tried to transfer the shape of the bed to the scale drawing, a nice regular shape would have been much easier.

I now had the shape of the bed on one side of the sheet and I could draw in where each of the plants were and some idea of the area they covered, then label them. I also wanted to retain a "clean" outline of the bed which I could use to mark in where I wanted to put the new stuff. After much thought, I figured it was easiest to photocopy the sheet, then slip the photocopied shape under the original sheet to the right of the drawing and use it like tracing paper. I just traced around the outline of the photocopied shape with a pencil, giving me two outlines on the one sheet, side by side.

Thornless Blackberry (pre-trellis)

I then marked in the existing plants on the left hand drawing. Up to this point, apart from the original measuring, the work had all been done outside so it was time to do a reality check. I took the drawing out to see if it matched what was really out there and, low and behold, I had stuffed up some measurements and a couple of the plants were actually closer together than I had drawn them. This brought home the importance of a reality check at some stage, and the good sense in using pencil rather than something more permanent!

The Plan

To be able to plan what to put in to make the LUFFA more productive I needed to get a feeling for which plants would make sense to put in for each section, I had to do some research. The product of that research, available in Appendix 2, a list of productive plants for each of the niches I was looking to fill. There were lots of plants I wanted to put in the LUFFA but when it all came down to it I could only fit in a few. So once I had extracted a list from my research, I had to prioritise them, based on how useful they would be to me, how much space they would take up and how well they would do in the protected, but partially shady environment of the LUFFA.
Taking into account all of that, I decided on the following –

1. Large trees – nil
2. Small trees – lemon myrtle (pruned to keep it small)
3. Shrubs – Nil
4. Herbaceous – calendula, comfrey,
5. Ground covers – strawberries, miner's lettuce
6. Roots – bunching onions, garlic
7. Climbers – sweet potato; basella (Malabar spinach) hops

The only thing left was then to complete the plan by drawing in the new plants and where they would go on the, as yet, clean outline of the bed on the right hand side of the plan.

3.3 Small Fruit Growing Area

One of the problems we find (as I'm sure most urban food growers do) is to get enough land to grow the stuff we want to. We bought a dwarf fig a year or two ago and a friend gave me a blood orange tree more recently, and after much casting around both the back and front yard I had no idea where I could put them. They needed to go somewhere where they would get enough sunlight and in most unoccupied places they would either be shaded out or shade something else out.

On the southern boundary of the front yard however, the neighbours had planted a bottlebrush years and years ago, it was scraggly and not happy.....did they still want it? They said no! I could take it out and replace it with some edible species and we would share the bounty! So that is basically what happened, most of it became mulch or fire wood and only the stump remained. It seemed to be a stump which was pretty determined to remain where it was, but the neighbours had a 4 x 4 that was pretty determined that it was coming out. The 4 x 4 won.

It started with a hole!

With the stump gone it still took quite a while to dig out and chop off the remaining roots, so that I could dig the trees in. Unfortunately the soil in that area consisted of about 15mm of topsoil on top of 5 metres of clay, so I decided to build up a raised bed to ensure fertility for the plants and good drainage.

I am not one for complicated design and my original idea was for a rectangular bed with a tree at each end, but in a minor burst of unaccustomed creativity decided on a vaguely kidney shaped bed instead. I dug down a bit and loosened up the soil and made sure there was enough depth for the soil level for the trees to remain the same. Too deep and you cover up the trunk risking collar rot, too shallow and you can expose the roots, particularly on the shallow rooted citrus. If you are planting grafted trees, the graft must always be above the soil and mulch level.

The area cleared!

After some digging (and lots or sweating and cursing) it all looked pretty good so put the retaining logs in place and secured them with tent pegs then placed the fig and the blood orange into the bed and started to fill in around them. I still had some soil left over from when I put the worm tower in as well as a pile of “organic mix” and shreddings mixed so that I what I used to build up the soil level.

That left the middle bit, and I had some blueberries that I wanted to grow there. Blueberries prefer and acid soil so I got hold of some coffee grounds from a cafe and spread a good layer on the soil to keep it acid. I also wanted to ensure the blueberries had water so I had saved an unglazed terracotta pot and lid to act as an olla. I put that in and then backfilled with the organic mix and soil up to the right level, and planted the blueberries and scattered some more coffee grounds on top of the soil.

This is where I want stuff to go

It has been very dry around here and so I watered the living daylights out of the bed and filled the olla to the brim. To finish off I put on wood chip mulch to keep evaporation down and encourage beneficial fungi that will grow with the trees. It is now finished and all I have to do is wait for a bumper harvest, all from an area that was previously unproductive.

Surround up and trees in

As it was 2013

The update (2023)

Unfortunately, the blueberry (as tends to happen with me) did not survive, however the blood orange and dwarf fig have gone from strength to strength. A couple of years after the original construction I expanded the bed and added a dwarf lemon tree, and while it has been overshadowed by the fig a bit, it seems happy enough. At the time I also

added some extra timber surround so that the whole bed was enclosed, but after 10 years it had deteriorated and was looking rather sad. I have since replaced it with some repurposed pavers and bricks and added some wood chip mulch. The neighbour has also added some statuary, for a bit of fun!

3.4.1 The Original Banana Circle

The banana circle is a garden structure that has come out of the Permaculture movement and can be installed in any climate where bananas will grow (funnily enough!). Basically it is a ridge of earth around a hole, which has bananas planted into it and in common with a lot of permaculture stuff it has a number of functions –

1. It yields bananas (I knew you would be surprised!
2. The bananas can be underplanted with other food plants such as sweet potato.
3. The hole can be a receptacle for many organic materials such as lawn clippings, manure, leaves, branches, tree shreddings – all sorts of stuff, including the output from a composting toilet. But don't tell anyone that, they might not eat the bananas!
4. They add a tropical look and feel to any garden

The Banana Circle - Early Spring

I was lucky, the Permaculture group I belong to, Permaculture Sydney West, were looking for a place at which to run a workshop, so they came over one Saturday morning and in a couple of hours built the banana circle and a herb spiral (more of that in another article). This saved me some considerable hours of back breaking work. The process that we followed was this –

1. Decide where the banana circle is to go – it may sound silly to say that, but a bit of planning at this stage can prevent a whole stack of hassle later on. Banana circles are usually 2 to 3 metres across, so you need at least than much spare space and it should get plenty of sunshine. It should also be protected from strong winds and frost, if your area gets frost. I sited ours in the front yard, the back being pretty full, and next to the large mulberry tree so it gets the morning and noonday sun, but has some protection from the afternoon sun and the mulberry tree shelters it from frost.

2. Mark out the perimeter – The easiest way to do this is no get some string or rope and two sharp sticks, then tie off one stick to the other with the same length of rope as the radius of the circle you want. Push one stick into the ground at the centre of where you want your banana circle to be, then drag the other one in the dirt all the way around, forming a circle in the dirt. This will form the perimeter of the banana circle.

3. Dig the hole – If you are going to get help, this is where you will need it. If you can, wet the area thoroughly the day before to make it easier, then dig down about 500mm to 750mm so that the hole is about 750mm to 1000mm across at the top. We have good old Sydney clay here so it certainly was the fun part of the job, mattock time!

4. Make the mound - If you have not cleared away any grass, some layers of wet newspaper laid around the hole will take care of any stray green interlopers. Take the soil dug from the hole and mound it up it around the hole in the form of a ring about 60cm to 80cm across. If the soil is a bit dodgy, try mixing in some well rotted manure, compost, sand, cocopeat or some such material to improve the structure and nutritional value of the soil.

5. With the hole dug and before the bananas get in the way, fill the hole with organic matter – we used a mixture of horse poo and straw, and compost to fill the hole until it is up to the level of the top of the mound and then slightly mounded up itself. Water freely.

6. Plant the banana trees (The exciting part!) – the number of banana trees you plant depends on the size of your circle, we planted 6 and our banana circle is about 2.5 metres across. Just dig out the holes equidistant around the mound, somewhat bigger than the root ball of the banana. If you want, you can leave a position free and put in a stepping stone to give easy access to the centre hole.

7. Mulch! – Once the banana's are planted mulch them well and water them in.

8. You don't have to, but a friend who was helping had some old pavers he didn't want so he picked them up from his place and we placed them end to end around the outside of the circle to form a boundary and I think it looks pretty good.

Once the banana circle is complete, keep an eye on the mound of organic matter in the middles of the circle, as it rots down and flattens out, top it up with any excess organic matter you have floating around such as leaves, small branches, lawn clippings, compost – just about anything that is not too smelly or will attract small animals.
We let it settle down for a few months, it was done in early autumn, then when spring rolled around we put in a sweet potato suckers in the mound between each banana. They will then grow up and cover the mound in foliage – they look really good growing together, and take up no room in the veggie patch....., winner!

Banana Circle - late the following Summer

Finding Your Banana

I was given a couple of dwarf bananas from a lady over in Ryde that sat in pots and did nothing much for a couple of years (the banana circle idea had been on the boil for quite a while) but I needed four more. I did cheat and buy two from Bunnings, but the put the word out I was looking for a couple of suckers – banana suckers! I was offered a couple by a friend of ours in Richmond so I went around and collected them. One was very small and passed away early on care of the next door neighbours' lethal soccer ball. Fortunately another couple of friends had bananas and they were able to help me out with a sucker to replace it.

Every year, banana plants produce one or two suckers (one each side of the main plant) which is how they reproduce. In the commercial, tropical world they slash the parent banana once it has borne fruit and then bring on the strongest of the suckers, cutting off any other below the soil level. In a backyard situation (or front yard as it is in this

case) particularly in Sydney, it will take some years for the bananas to fruit, so when you cut off the suckers, pot them on then give them to friends. When the banana does fruit you can cut it down and put it into the centre of the circle, leaving the strongest sucker in place and away you go again.

Happy banana-ing!

Banana Circle - Showing Sweet Potatoes

3.4.2 Re-doing the banana circle

I think the idea of a banana circle is great! Dig a hole, mound up the dirt from the hole around edge of the hole and plant bananas, then add organic materials into the centre hole to rot down and feed the bananas. It makes sense to me, so when we had our local permaculture group offer to build one yonks ago, I said yes! Unfortunately, when they asked where to put it I only had a few minutes to come to that decision…….. and I got it wrong!

The banana circle, as it was

This is where planning comes in. It was the wrong place for a number of reasons –

- Fruiting plants benefit from full sun, especially the sub-tropical banana and where I had located the circle it was shaded by the mulberry tree on the west, the bay tree to the north, and the melaleuca trees to the east. It got some sun, but not as much as it needed, particularly in summer when the mulberry tree really leafed out.
- The soil was crap! The soil dug out of the hole was mostly clay with a bit of topsoil and organic matter thrown in. The rain ran off the dry clay but if the rain went on for any length of time there was a chance of waterlogging. Not the best soil in the world to plant the bananas directly into.
- Bananas need lots of water, and a great way of providing that water is with grey water. Unfortunately the banana circle was in the front yard, while all the greywater pipes exited the house around the back. To make use of this greywater I would need to catch it and pump it around the front, which required an input of energy. While I had several ideas of how to do this, there always seemed to be greater priorities so it never happened.

Needless to so say, as a result of the above, I never got one single banana of any of the banana trees in the 6 or 7 years that the circle was in operation. However, I did plant some sweet potatoes in the circle and they continue to do quite well.

Plan B

I have been thinking for some time that I should relocate the banana circle to the back yard, which is more open, has better soil and (you guessed it!) waste water outlets. I had tentatively identified an area which currently held a very sorry specimen of a lemonade tree, which wasn't happy in its current position. Also, spring was rapidly approaching and any moving of plants would need to be done in the very near future. Everything came together last weekend.

A hole in the ground! (lemonade tree removed)

We get together with permaculture friends once a month to help each other out with tasks which are quicker and easier when done by a group and we were due for our turn last weekend.

We got together and pruned the lemonade tree back pretty heavily and then dug it out by digging around the bottom of the tree then levering it over to break of any adhering roots. There was no place for it here so I gave it to one of our pod-mates who has more land than we do.

This left the area where the tree was cleared and with a hole already in place. Unfortunately I had forgotten this and although the soil was better, there wasn't enough of it to make an effective mound so I had to order in a cubic metre of organic soil mix from a local supplier. One disadvantage of the suburban block is that there is not much unused organic matter lying around.

Soil mounded up

I barrowed the mix around the back and used it to form a mount on the south side of the hole, tapering down closer to the grown on the northern side, my idea being to curve the bananas around to form a crescent shaped sun trap. The sun trap has foliage to the south and is open to the north to make the most out of the northerly winter sun. I removed the bananas from the circle in the front yard, keeping as much root material as I could manage and cut any daughter plants away to be planted separately, and leaving the sweet potatoes as undisturbed as possible. I dug a hole into the mound for each banana and tossed in some chook poo for nitrogen and wood ash for potassium, covered it with some mix, then planted each of the bananas. To make sure the bananas were able to make use of any rainwater I formed a ring of organic mix around each one. This effectively made a basin around the base of each one to retain the water and allow it to sink in, rather than running straight off the mound.

Bananas in place (note the basin around the bottom of each one)

With all of this work done I mulched the whole mound with sugar can mulch and tossed some organic matter into the hole to start decomposing. On the northern side of the mound I had intended to plant some low growing food plants and decided on a series of capsicum and chilli plants. I also intend to put some flowering edibles in to attract beneficial insects and improve biodiversity of the area. I had some nasturtium seedlings I had raised, so they were the start.

Job Done!

If you intend to put in a banana circle (or anything else for that matter) it pays to have a think about what you are trying to achieve and how you will go about it, before starting. A little planning goes along way!

2016 Update

After less than 12 months, the banana circle looks like this!

And further on, a bit less than 18 months later, we have not 1, not 2, but 3 banana plants with flowers on them! It has been amazing to watch the transformation, from weedy little banana plants to huge and vigorous ones. I am sure that the extensive amount of water they get from our spa/bath/shower area is the main reason why they are doing so well now compared to when they were in the front yard.

3.5 Making a Strawberry Tower

Unless you live on acres, there never seems to be enough room to grow everything you want to and that is particularly true in the urban/suburban setting. There are techniques, however, which help you maximise what growing space you do have. Vertical gardening is one technique, in this case by constructing a strawberry tower. I call it a strawberry tower because that is what I will be using mine for but it could just as equally be a herb tower, lettuce tower or tomato tower or a "whatever you want to grow in it" tower.

Raw materials

To make a tower like this you need a 205 litre plastic drum, preferably one that has not held anything nasty. The one I got hold of had been washed out well but even so it had only contained sorbitol, a food grade sugar alcohol sometimes used as a sweetener in sugar-free gums. To be sure I also gave it a wash out with water too!

The raw material

To keep things fertile over time I wanted to construct a worm tower in the centre so I got hold of a one metre length of 100mm plastic tubing to house the worms. I also needed something for the strawberries to grow in so I got hold of some potting mix, compost, wood ash and sulphur (more about these later). I needed some rocks to go in the bottom to ensure good drainage but had some scoria hanging around from previous projects so I decided to use that.

I also needed a lazy Susan bearing. The whole idea behind a tower of this type is that you can grow plants over its entire surface and being round most of it will get some sun at some time of the day. The trouble is that the quarter which faces south will get no

direct sun, especially in winter, which for a fruiting crop is critical. I planned to get around this by placing a large, heavy duty lazy Susan bearing under the drum to make it easier to turn, and so far it is working.

Lazy Susan bearing on the concrete block

I worked out where I wanted the tower to go so it would get sufficient sun and be reasonable accessible, which turned out to be the northern end of our front yard. Once I knew where it was going I grabbed a 600mm x 600mm concrete paver which was sitting doing nothing in the back yard. I used it to provide a stable base for the bearing to sit on, which would be where the drum would finally sit. The land slopes a bit so I had to dig out a bit of soil from the high end and check it with a spirit level to ensure it was level enough.

Constructing the Strawberry Tower

The first job was to remove the top of the drum, it was a closed head drum so it had to be cut off, but the drum being plastic made it easier. To remove the top I simply drilled a hole in the top at the edge the size of a jigsaw blade, then inserted the jigsaw and cut around the inside of the rim. Quick and easy, but it did create lots of small bits of blue plastic, which got, everywhere! I then turned the drum upside down and drilled some 12mm drainage holes around the edge of the bottom of the drum.

Lid removed

With top cut out and the drain holes in it was time to turn it back over and mark out and cut the holes where the strawberries are to go.

To mark it out, I ran some string around the circumference of the drum and then used some bits of tape to mark it off into 10 equal sections. I then used the string-and-tape to measure out 5 rows, about 200mm apart down the sides of the drum, then marked them with a dot of permanent marker. Using a small 1/8” drill I drilled a pilot hole into each of the marks.

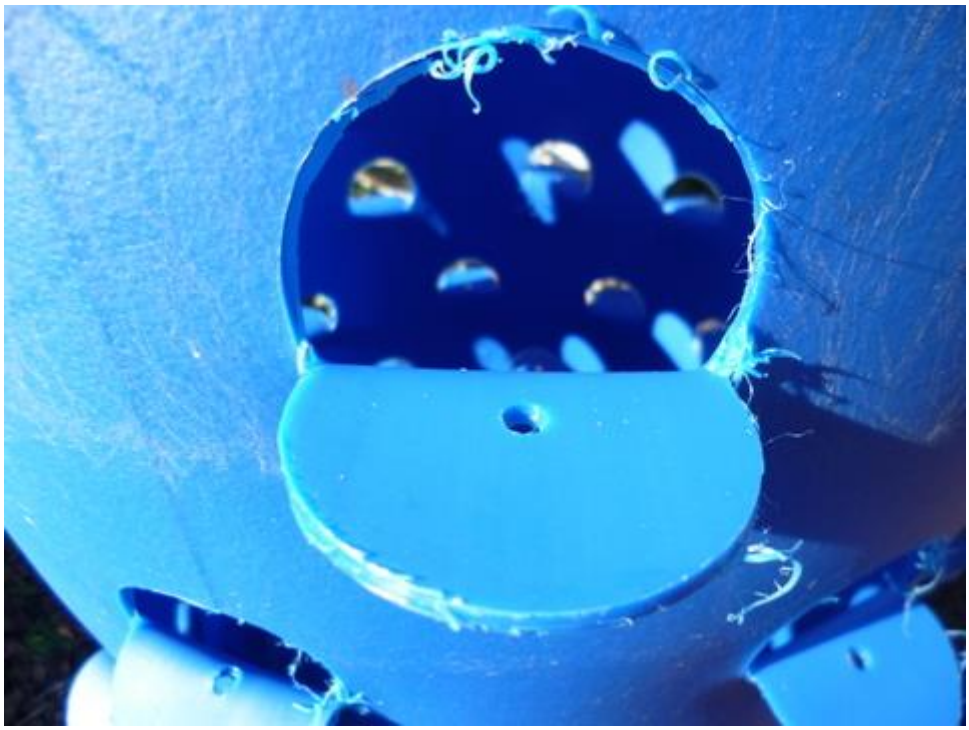
Measuring and marking

To make the holes where the strawberry plants were to go I got hold of a hole saw, which I use with my drill. You can buy sets of hole saws and the largest one in the set is usually 50mm across, but sometimes bigger can be better and this is one of those times. I had a 70mm hole saw which I had bought to assist with a previous project so I used that. After getting the central drill lined up on the pilot hole, I drilled in then tilted the drill and hole saw up so that it only cut through the top half of the circle. The bottom half was still attached because I wanted to use it as a flap for the strawberry plants to grow out onto.

The hole saw

To form the flap I used my heat gun (looks like a hair drier but runs much hotter and is used to strip paint) to run hot air back and forth over the plastic until it was soft, then pushed the flap out and held it until it cooled down, it then remained fixed in place. Doing this took a couple of hours but was made easier by the fact that I had already mounted the drum on the bearing, making it easy to sit next to it and turn it around as required.

The hole partially drilled



The plastic flap softened and turned out

With the holes in place I made the worm “tower” for the centre. It was just a case of getting hold of the metre length of 100mm plastic tubing, drilling holes in it and then holding it in place while I filled the strawberry tower with growing medium.

All the holes completed

Filling the strawberry tower

The first thing I did was to set up the worm tower in the centre of the drum so that I could fit the growing medium in around it. Then, to ensure good drainage I poured in scoria up to a level of 50mm to 75mm in the drum, then levelled it out with a hoe. With drainage assured I could put in the growing medium.

The tower for the worms

The growing medium was a mix of 50 litres of potting mix, 25 litres of compost and about 500mls of wood ash and about 150mls of elemental sulphur added in. The

potting mix provides the basis of the mix with extra fertility provided by the compost, the wood ash is to provide extra potassium for good fruiting. The wood ash will, however raise the pH of the mix, but strawberries prefer the pH to more on the acid side so the elemental sulphur was included to drop the pH back a bit.

I made the mix up in my wheelbarrow, using a shovel and hand hoe to mix everything until it seemed to be pretty homogenous to me. To completely fill the barrel I needed to make up 3 full mixes, with a bit of compost left to go on the top.

The tower in place

I filled the barrel up with growing medium until it was just level with the first row of holes for the strawberry plants. I then separated out enough plants so that I had one for each hole, then arranged them on top of the growing medium so that the roots were inside and the crown of the pant was level with where the growing medium would come to. I then shovelled in more growing medium, covering the roots of the layer below until it was just below the next level of holes. I repeated the process until the barrel was full and all of the holes were planted with a strawberry plant.

To finish of the process I filled up the last 100mm with compost and then added some sugar can mulch. To make sure that there were no spaces I watered everything in from the top until some water was coming out the bottom. The worms and veggie scraps will go in once things have had a chance to settle down.

The strawberry tower filled and planted out

Review and Lessons Learned

While it did work fairly well, it was not without its problems –
1. First off, there were too many holes/growing points. It would have been better to put in half as many and in the end I wound up using every second one.
2. While the lazy Susan was a good idea, just using the bearing meant that it filled up with dirt and rubbish and after a few months refused to turn. I wound up replacing it with a similar bearing, but this time I screwed a disk of 20mm plywood (pre-painted green) on each side of the bearing and this worked much better. It is still important to give it a turn or two every few days to keep it turning freely.
3. I installed it in the wrong place, there was not enough light for the strawberries due to the shade from the mulberry tree, plus it was not in one of the more travelled areas, so it reduced the amount of turning that it needed. So, I emptied it, transported it around the back and installed it on a plinth of sorts, right next to the back door, but now the bananas have overshadowed it. So back to the drawing board!

3.6 Experimenting with Organic Hydroponics – Strawberries

Years ago, I became interested in hydroponics but I still wanted to grow things organically. Hydroponics usually uses a specifically formulated mix of chemical fertilisers designed and maximised for each individual crop, dissolved in water and delivered directly to the roots by one of a number of techniques. But the thought occurred to me that you could use organic materials to achieve the same result…….maybe!

It was clearly worth having a go and I decided a bit of study and experimentation was in order. Unfortunately this was pre-internet and there was precious little in my books

about the organic side so what little I did find had to form the basis for my experimentation. First, I needed to make something to support the plants and distribute the nutrient solution.

The Nutrient Solution Container

As previously mentioned, there are a number of possible techniques used to get the nutrients to the plant roots, the one I was going to use consisted of a length of pipe on its side with holes cut in the top and pots placed in the holes. Simple! This is how I made it –

1. I got hold of a 2 metre length of 100mm diameter of PVC pipe, which I designed to take the ubiquitous 100mm pot. These pots can be bought new but are also fairly readily available second hand from other people's "throw out" piles because they often are used for ornamentals from plant nurseries and once the ornamentals have been planted out in the garden the plastic pots are thrown away.
2. To start the process of rendering the pipe suitable for my hydroponic activities I drew a straight pencil line down the length of the pipe and then measured out 100mm diameter circles with 150mm between them along the length of the pipe using the line as the centre. That turned out to be holes sufficient for 11 pots. I could have spaced them closer together but I wanted plenty of space for the luxurious growth I was sure I would see.
3. With the pipe marked out I got hold of one of the 100mm pots and then placed it over the line and drew around it with a pencil to transfer the circle shape to the pipe. I then drilled a hole (about 6mm diameter) on one edge of the circle and inserted my jigsaw and used it to cut out the circle.
4. The way the geometry of the round pipe surface works out, the holes are a bit over 80mm wide when measured across the hole, but the pots fit snugly anyway. If there are any jagged bits or the holes aren't quite right, a half round file will fix up any problems quickly and easily.
5. Now I needed ends! One end was just a simple pipe cap, glued in place but I wanted to be able to drain out my hydroponic nutrient solution and replace it regularly so the other end needed to be removable. Fortunately, they do make a glue-on screw on/screw off fitting for these size pipes so I got hold of one and glued it on, the pipe was now finished.

Pipe Plus Holes

Opening end plus attachment bracket

Everything in place

To mount the pipe I originally got hold of some circular pipe supports the right diameter, clipped them over the pipe and screwed them onto a bit of timber, then screwed the timber down onto some shelf brackets mounted on the fence. I used three supports, one on each end and one in the middle. For my most recent foray I just screwed the supports sideways, directly onto the supports I use for the trellis behind the veggie patches against the western fence.

The Nutrient Solution

The nutrient solution I tried first was pretty simple:

- 1 part by volume worm castings
- 1 part by volume chook poo
- 1 part by volume wood ash

The container I used to measure out the ingredients was a cup about 100ml in volume. This all went into a 20 litre bucket full of water, vigorously stirred for 5 minutes then left to settle overnight. Once the nutrient solution was ready I tipped it into a watering can and poured it into the pipe nutrient container until it was half full.

Looks disgusting and smells worse - the nutrient solution!

The neat nutrient solution seemed to work to a certain extent with the veggies but then it came to the strawberry plants I checked the pH using universal pH papers, and it appeared to be somewhat alkaline so, knowing strawberries prefer more acid conditions I used some vinegar to lower the pH to about 6.

Universal pH indicator strips

The Plants

Initially, I used veggie seedlings, the same ones I would be planting in the beds at that time. I would wash off the soil from around the roots, grab a 100mm pot and half fill it with 10mm-12mm gravel, pebbles or scoria, place the seedling in the centre and then fill around it with more gravel etc. Once the seedlings were in place the pot went into the tube and nutrient solution to grow! (hopefully).

During my more recent efforts to grow strawberries, I got hold of some bare rooted strawberries over the net and when they arrived I placed them into the pots using the technique related above. The only difference was that originally I used gravel in the pots and this time I had some scoria the right size hanging around so I used that.

Mail order strawberries

Operating the System

This part was pretty easy. On the weekend I filled up the pipe to half full with the prepared nutrient solution. During the week I kept an eye on the nutrient solution level and the condition of the plants topping up with water if too much evaporated. The following weekend I unscrewed the cap on then end and drained the spent nutrient solution into a bucket and chucked it on the lawn then flushed the pipe out with clean water. I then re-screwed on the cap and refilled the pipe with fresh nutrient solution.

100mm pots – new and recycled

How did it Work?

Veggies

I originally tried various veggies and while I always got growth, they did not grow as quickly or produce as well as I had been lead to believe they would. The best response seemed to be from the leaf veggies like lettuce so there was obviously enough nitrogen, but this raised another problem.
The nutrient solution became anaerobic pretty quickly and gave off a bit of a pong. This was unnerving enough being close to veggies that were due to be cooked, but if they were to be eaten raw (like lettuce) I became concerned that bacterial contamination would make people sick. In the end this was why the experiment ended.

Strawberries

I chose strawberries because the berries would be borne away from the nutrient solution containing pots and they would eventually grow down the side of the pipe and onto the trellis behind. The strawberries initially grew well but one of the problems was that they went in a bit late in the year and the hot weather was upon us before they had a chance to get some good growth on. The hot weather kind of cooked them, we did have some quite hot weather (40^{o}C+) this spring, but also I don't think the nutrient balance was right. As well as that I used a different capacity cup to mix up the nutrient solution and I think it was probably not dilute enough. The pH of the solution may have been a factor also.

Scoria to go into the pots

Where to from here?

For organic hydroponics to work I think it needs a far more scientific approach than I have taken up to now. I have been using the techniques of "gut instinct" and "best guess" and it ain't good enough! There needs to be better monitoring of the nutrient solution, testing for pH, NPK and conductivity so there is some understanding of nutrient ratios and overall concentration levels. Planting the stuff at the right time helps too!

3.7 Growing a Pineapple From a cut top

Pineapples are a tropical fruit but with a bit of work you can even grow them here in temperate Sydney with the right microclimate. The easiest way to do this is to buy a complete pineapple (that is to say, without the green top bit removed as is so often the fashion these days) from your local organic shop or fruit & veg merchant. Make sure the green top bit (technical term) is complete and not damaged.

Then follow these steps –

1. Cut down into the pineapple making two diagonal cuts under the green top bit, taking about 2 – 2.5 cm of fruit, so it can be removed from the pineapple.
2. Leave it to air dry for a couple of days.
3. Get hold of some potting mix (standard potting mix is OK or use my 1 part sand, 2 parts compost or worm casting, 3 parts cocopeat formulation) and a clay pot big enough to take the circumference of the fruit attached to the green top bit. Add a pinch of iron sulphate or iron chelate into the potting mix before planting.
4. Plant it into the potting mix filled pot and then cover with a plastic bag, with some ventilation holes punched into it. This will keep the humidity high and keep the plant hydrated until it can grow some roots.
5. Place the pot in a well-lit spot, but not in direct sunlight.
6. Pineapples can absorb water and nutrients through their leaves, so watering with weak liquid manure solution every week or two is worthwhile.
7. Roots should develop in 6 – 8 weeks at which point the plastic bag can be removed.
8. Leave the plant in a well-lit spot and regularly spray the leaves to water and feed it. Add some more iron sulphate or chelate to the soil when the plant is starting to flower.
9. Commercially pineapples can take 1.5 to 2.5 years to crop, so don't get too impatient because in the less-than-ideal conditions of a backyard it may take even longer. Ripening fruit in proximity to the plant (eg apples or bananas) will emit ethylene which may stimulate the pineapple to flower.
10. When the plant is flowering, move into a sunny position to assist the fruit in developing.

Here it is in a well lit area but out of direct sun

Here is a friend's productive pineapple

3.8 Setting up the Grape Vine

I have wanted to grow grapes for a while, but as usual, I found it difficult work out the right place to grow them. After some thought I decided to grow them up under the cover over the back deck, that way as well as grapes we would have shade in summer and sun in winter. There are some issues to be overcome with this approach, mainly around making sure the grape gets enough water without overflow or drainage staining the timbers of the deck. So this is how I got around it.

The Pot

The pot!

Our local shops have some black 30 litre pots with rope handles which seemed ideal for the purpose. The black plastic is very resistant to the sun – witness the self-watering pots which have been in the back yard for 7 or 8 years and still doing great service – so black it was (not that there were any other colours…….but you know what I mean!) Normally I would drill 12mm holes in the bottom for drainage, but as mentioned above I didn't want it discolouring the deck timbers so I chose a the following approach.

Fittings to make the drain

I put in a drain about 25mm up the side of the pot by drilling a 22mm hole with a spade bit and inserting a 15mm male to female irrigation adapter and screwing onto it a 19mm barb x 15mm BSP female threaded elbow. This allows any excess water to run out of the pot to the side, without making a mess of the deck. To ensure drainage, I mounded up some pebbles on the inside of the pot, around the drainage hole so the growing medium would not block the drain hole.

Drain in place

Water Reservoir

To provide a water reservoir in the pot so that the grape has a plentiful and continuous water supply I made a buried capsule to go in next to the grape when I planted it into

the pot. I got hold of a 20cm unglazed terracotta pot and similarly sized terracotta pot saucer with which to make the buried capsule.

Buried capsule - awaiting burial!

To start I installed a fitting with a 19mm thread on one end and a 15mm BSP barb fitting on the other into the drain hole of the terracotta pot. (you need two per capsule). To help secure the fitting into the capsule I butchered a Garden Rain 15mm Female to Female Rural Poly Irrigation Coupling and to join the reservoir to the capsule a length of 19mm clear vinyl tubing. One fitting is screwed into the drain hole of the pot and then the vinyl tubing is used to secure the two barbed fittings end-to-end.

To complete the buried capsule I siliconed the pot saucer to the top of the pot, creating a watertight capsule which is filled with water through the open end of the fitting secured in the drainage hole. The whole assembly is then buried upside down, so that the fitting sits above the soil surface.

I then placed some potting mix into the pot, installed the buried capsule and the grape vine, and filled the pot with potting mix ensuring that the grape was buried such that the soil surface is the same in its new position as it was in the original pot.

Something to Climb On

The idea is that the grape vine will now climb up one of the deck roofing supports and then spread out under the deck roof. It does, however, need some way of climbing up the supporting timber. I cast around to find something which would do the job effectively (but hopefully cheaply) and found some lattice which was designed to be used horizontally as a fence (it was 1800mm x 300mm border fence). All I needed to do was trim off the two spikes which would be used to secure it into the ground if it was

being used as a fence. I then screwed on a couple of supports and then screwed the supports onto the deck roof support, and there you have it!

Climbing trellis, it its fence incarnation

It is still early days and it will be interesting to see how the grape vine develops. I am assuming it will take several years to get where I want it to go, but I have the time.

It's all come together!

4.0 Watering

We have a number of different strategies for watering our fruit trees which make use of greywater where possible. For the most part we use deep pipe waterers for fruit shrubs and trees, with or without the addition of the 'Deep Pipe Reservoir'. The two exceptions to this are the banana circle, which is watered from the spa/shower in the bathroom and the mandarine outside the office window which is watered from the washing machine effluent via the constructed wetland.

4.1 Deep Pipe Waterer

At the time this was originally written (2016) we had just come off a period of over 4 months with almost no rain – just a couple of showers over that time, barely enough to wet the ground. Overall, Australia is a drought country and climate change seems to be making that worse if anything so even when the rain comes we know that more dry conditions are just around the corner. It is with these gloomy thoughts that I started to research low cost, low tech irrigation techniques that were also water efficient. Ollas came up trumps, but I have also discovered other techniques which I am also in the process of building into choko tree farm. This is the first of those "others".

Deep Pipe Irrigation

The basic point of deep pipe irrigation is that it gets water where it needs to be; direct to the roots of trees and shrubs. This has a number of benefits –

1. Less water is used – because you are getting the water to where it needs to go rather than standing around watering the ground surface and hoping it percolates down to the roots (while half of it actually runs off), less water is needed to achieve the same result.

2. Less time is used – in a likewise manner, because you are not standing around with a hose waiting for water to percolate down. It is just a case of fill each pipe and move on. It can even be set up to be drip fed, reducing time required even further.

3. Deeper roots are stimulated to grow – when trees and shrubs are watered from the surface, surface roots develop to make the most of this water. Unfortunately the top of the soil is the first bit to dry out leaving your plants susceptible to drought. By using the deep pipe method water is applied down into the soil, stimulating the plants roots to grow down and out to follow the water as it moves through the soil.

So, what is deep pipe irrigation?

Deep pipe irrigation uses of a length of PVC pipe 50mm in diameter (less if drip irrigation is to be used) and between 400 mm and 600mm long, sunk vertically into the ground within the plant's root zone into which water is fed, directly irrigating the root zone.

Marking out the pipe

I use 500mm long pipe because it is in the middle of the range and gives me an even number of pipes if you by your PVC pipe in 3 metre lengths, as I do. To make the irrigator, cut the pipe to length, then drill a series of 3mm holes 50 to 75mm apart down one side of the pipe, mark at the top which side the holes are on. When installing the pipe it is crucial to have the line of holes facing the plant to be watered.

The original cap on installed deep pipe irrigator

There needs to be a cover for the open end (top) of the pipe to prevent dirt and leaves etc filling the pipe over time and to keep out wildlife. My original plan was to have a solid plastic end cap on the open end (because I like the look), but that left me with another problem. One of the reasons to put in this irrigation method is to reduce the time required for watering, but if I had to get down on my knees and take each cap off, then replace it after watering, it seemed a bit self-defeating. To get around this I used some spare shade cloth and made a clip by cutting off a 25mm length of the 50mm PVC tube and then making a vertical cut on one side so it could be opened out and fit around the irrigation pipe. This holds an 80mm square of shade cloth on, allowing the pipe to be filled with water but keeping out the wildlife.

The new permeable cover

Retrofitting Deep Pipe Irrigation

This style of irrigation is excellent for establishing new trees and shrubs and so can be put in at the time when the new plants and put in place. Deep pipes will also allow you to water existing plants but is a bit more hassle to put in, here is how I installed them to my existing plantings.

I had a 1500mm length of old imperial 48mm outside diameter galvanised pipe with a 50mm socket on one end (although an end cap would also do). To turn it into the tool I needed I used my angle grinder to cut the end without the socket on and angle from each side so that it came to two sharp points, one each side of the galvanised tube. It also helps if you make a mark on the side of the tube at the depth to which the deep tube is to be installed (in my case about 450mm-500mm).

installation bits and pieces

To use the galvanised pipe to make a hole for the deep tube waterer to go in I needed a post driver, a large stillson wrench, a 25mm square stake about 1800mm long, a pair of ear muffs and a rubber hammer. The process is as follows –

1. Decide where the pipe is to be situated and clear away any mulch and debris from the ground surface, place the galvanised pipe pointy end down onto the soil and place the post diver over the top of it.

2. Make sure you are wearing the ear muffs because it gets very noisy when you are right next to it. Lift the post driver up and ram it down onto the top of the galvanised pipe, which will sink into the ground. Do this about half a dozen times or as many times as it takes for the pipe to be driven down to about a third of the desired depth. Remove the post driver.

Close up of the cutting end of the pipe

3. Remove the galvanised pipe from the ground by using the stillson wrench to grip and turn the pipe to loosen it up for removal. While turning the pipe around, apply upward pressure to the stillson wrench so the pipe is slowly screwed out of the ground. This will be comparatively easy for the first part but will become increasing more difficult (but still doable) the further down you go.

4. With the pipe removed from the ground, place the stake in the top of the tube, invert the tube and strike it against a hard surface like a concrete path so that the stake is forced up into the tube and the plug of soil removed by the pipe is forced back out the end. You may need to clean some remaining soil out of the end if it is sticky and clayey.

5. Repeat steps 2, 3 and 4 until you get to the desired depth, cleaning out the pipe each time.

6. The galvanised pipe (48mm OD) is a bit smaller than the PVC pipe (50mm ID) so you need to put a bit of force on the PVC pipe to install it. Place the PVC pipe in the hole, ensuring that the line of holes is facing the plant to be watered and then, using a large rubber hammer, apply enough persuasion for the pipe to be installed to the bottom of the hole (ie, hit it!).

7. With the pipe installed, place the cover on by putting the square of shade cloth (or other mesh you have handy) and clip it in place.

You can now deeply irrigate as many trees and shrubs as you have deep pipes for.

4.2 Deep Pipe Reservoir

Here in Sydney, (plus most of NSW and indeed almost all of Aus) we are in drought, so I have been spending some of my time working out ways to maximise our water use. One way I have come up with allows us to use greywater from the house to deep water out perennials, working with our previously installed low tech, low cost but highly efficient deep pipe waterers. Information on how to make and install deep pipe waterers is available above.

Our problem, as I see it, is that if we gather water from the bathroom, laundry or kitchen, say if we wash and peel veg into a bucket, or use a bucket to catch the water coming from the tap before it flows hot, or whatever, to apply the water to the garden, we toss it onto the well mulched soil surface. As with any watering of the soil surface, it may or may not make it through the mulch, some will be lost to evaporation and what does make it into the soil will encourage surface root development rather than deeper roots, which makes the plants more susceptible to droughts.

What I wanted to do was to come up with a way to easily (gotta be easy or it won't happen!) pour the water deep into the soil without meaning we have to stand around for 15 minutes pouring while the water soaks slowly into the soil. If it uses (for us) existing infrastructure, is quick simple and cheap to make, from parts which are readily available, so much the better!

The answer, it turns out, is the 'deep pipe reservoir' or DPR. (if you can think of a sexier, more catchy name, please let me know).

The DPR consists of three parts mainly –

1. a 100mm x 50mm PVC taper level invert,

2. a 1 metre length of 100mm diameter PVC pipe, and

3. a 100mm PVC straight coupling to keep them both together.

Total cost for the setup is a bit over $25.

Add in a bit of blue glue to hold it together and a bit of shade cloth or equivalent mesh and a 105 – 127mm hose clamp (at $3.45). Admittedly, if you do not intend to put any water into the DPR which has solids which may clog the holes in the Deep Pipe waterer, such as veggie peelings or food residue from plates rinsed, the shade cloth and clamp and not required.

The manufacturing is easy as possible, apply some PVC pipe glue to the outside of the taper level invert and the inside of the straight coupling, then insert the taper level invert into the straight coupling and hold it in place for a few seconds, then repeat the process with the 100mm PVC pipe, inserting it into the other side of the coupling. Cut a piece of 120mm square gauze or shade cloth (if used), place it over the top open end of the 100mm PVC pipe and secure with the hose clamp.

To use just remove the mesh and C-clip securing it from the top of the deep pipe waterer and slide the open end of the DPR over the now open end of the deep pipe waterer. Now that it is installed, water can be poured from a bucket or whatever container is in use, through the top mesh, filling the inside of the DPR. Then it is just a case of allowing the water to drain into the deep pipe waterer, thereby providing irrigation for the chosen plant. The DPR may be left in place for subsequent watering of the same plant, or transferred to another plant which requires irrigation.

The DPR is light, strong, cheap to make and easy to use. If you have deep pipe waterers in place, make one today, if you don't, start making and installing them today, don't you know we are in drought?

4.3 Spa Bath Outlet and the Banana Circle

A few years ago we had our bathroom renovated, which included among other things replacing the bath with a spa, let's face it, you gotta have some luxury in your life! As part of the renovation I did ask them to put a two way valve in the drain line so that I could run the greywater either down to the sewer or into the back yard and onto the fruit trees. They did as I asked, gluing in a blocked off pipe into the line into the back yard to prevent leakage and left the valve running to sewer until I got a chance to plumb it in properly.

The valve they used - less than $5 at a local hardware

Well, life gets busy and it was a number of years before I got the chance to finish the job. To complete things I got hold of a cap the same size as the outlet pipe and drilled a 25mm hole in it, then used silicon to attach a barbed irrigation fitting suitable to fit a 25mm hose. While I considered using garden hose it is only 12mm and would not drain quickly enough when the shower was in use.

Under the house

Having done the easy stuff, I ran some of the hose through one of the under-house vents which was in roughly the right area so when the time was right I could force it onto the barbed fitting. I then crawled under the house with the fittings, glue, torch and my trusty saw to remove the blank plug and install my pre-prepared cap with the barb on it. Installing the cap proved as easy to do as it could have been, lying on my back in amongst the spiders and dirt (I'm getting too old for this crap!), anyway, job done.

All that was left to do was to turn the valve from discharge to sewer to discharge to back yard……easy! Well, maybe not so. For some reason the valve simply would not turn, regardless of what I did. I tried heating up the outside of the valve with a gas flame to break what was holding it, but no go. I even sent my son-in-law under there to try his hand at it (I told you I was getting too old for this crap) but to no avail, it was stuck solid.

The original discharge pipe, blocked by a cap

There is a lesson here! When you have stuff like this put in, try and operate it as soon as they are finished installing it. It is my belief that some of the glue they used to install it in got into the moving part and gummed it shut, but because it was now a few years down the track, any warranty period had well and truly expired.

My cap with the barbed fitting siliconed on

Due to the way it was constructed down there, and all glued together, it was not just a case of simply replacing the valve, and whole stack of pipework needed to be replaced too. In the end I broke down and got a local plumbing company in and they did a great job of crawling under the house, fixing the problem and then actually checking to make sure it worked before they left. So we now have a functioning process for reusing greywater from the spa and if we get a spate of wet weather I can crawl under the house (*sigh*) and turn the valve so the spa empties to the sewer again. Woo hoo!

4.4 The constructed Wetland and the Mandarine Tree

As you've probably guessed from the other articles on our website site, we try and live as sustainable a life as we can manage. However there is one area where our performance used to suck pretty comprehensively and that is treatment/re-use of greywater. One of the issues has been that while our banana circle (a greywater recipient) was in the front yard, all our greywater plumbing was at the back of the house. For years I fantasised about complicated tank/pump/plumbing set ups until I realised that it was not going to happen, so with the help of friends, we relocated the banana circle to the back yard. We also corrected a plumbing problem with our spa so now all shower/bath water was directed into said banana circle. We were on our way!

It is possible to put raw greywater onto lawns and fruit trees and when we had our original top loading washing machine I had a hose on the greywater outlet and did just that. The amount of water we used to wash our clothes was considerable so we upgraded to a front loader. That meant that we used less water (good!) but also meant that the concentration of pollutants in the greywater now produced by clothes washing was increased (bad!) so I didn't feel right about running it directly out to the yard. I needed some way to treat it first. Hence this section of the eBook!

My original thought was to put in a system similar to the 3 tier bathtub set up described by Scott Kellogg and Stacy Pettigrew in their book “Toolbox for Sustainable City Living”, to save horizontal space. I had problems working out where it would go even so and I would be back to needing a pump and surge tanks and the frame would need to be well engineered to suit the weight. Fortunately, with the removal of the lemonade tree to accommodate the banana circle it seemed to open the area up. There was room for two bathtubs horizontally, both below the level of the laundry sink which would act as a surge tank and I could still use gravity to move the water around.

The bathtubs

I have had two bathtubs sitting on top of the chook retirement village for some years waiting for this moment! Once I was able to manhandle them down onto the ground, it was a case of arranging them in the space that I had to see how they fit best. There is another dug-in bath acting as a water garden in that area and the other two seemed to fit best when lined up parallel with the water garden but the lower on a bit off set from the higher one. I used silicone and bath plugs to permanently block the drain holes before starting work.

Roughly positioning the tubs

The weight of the bathtub, plus gravel, plus water, plus plants means that I needed to have a stable base that could support the weight. I had some solid besser blocks, right angle ones with one long and one short side, left over from an old incinerator. So I laid one with the short side down at each end of the bath, and used a brick to support the other side. I dug them in a little bit to ensure the tub was level but also to give a more stable base. In the end it was not high enough to allow drainage into the next bathtub so I put in one besser block capping (40mm thick) under the drain end and two under the input end, when I realised the bath had a bit of fall the wrong way!

Supporting the first tub

The other bath I put in by turning two of the blocks upside down and placing one under each end of the bath. This ensured that the second bath was lower so that they would drain naturally by gravity. To improve stability of the baths and to make small adjustments to the fall, I put some offcuts of 6mm fibre cement board between the bath and the blocks to act as shims. In the end it all looked pretty good, or at least I thought so!

Supporting the second tub

The Plumbing

I needed to set the water flow up so that there was maximum contact with the bacteria which would (hopefully) grow on the gravel and the plants and plant roots so I didn't want to just dump the greywater on the top of the gravel and hope for the best! I wanted to run it so that it went in at the bottom of the batch, rose up through the gravel, then drained into the next batch and did the same thing before draining out of the second tub onto the trees.
To do what I wanted to do I got hold of three one metre lengths of 50mm PVC pipe and a series of 50mm pipe fittings which included –

- 3 x 50mm PVC end caps
- 3 x 90^{o} elbows
- 1 x Expandable Connector Waste Pvc Abey 50mm Trap Flxz22up
- 2 x Holman PVC 50mm floor flange
- 2 x 50mm mozzie proof vent cowl
- 2 x 50mm to 25mm barbed reducer
- 1 x 50mm two way valve

One of the reducers and the valve were for use on the inside part of the system (more on that later).

As it turned out a one metre length of pipe fits into the bottom of a bathtub really well so that became the basis for my horizontal part of the plumbing, which sits in the bottom of the bath. The first part of the work was to drill a whole stack of holes the length of the pipe, to let the water flow out slowly into the tub. A good size hole is 12mm or so but it can be difficult to drill into the pipe with this size twist drill and there is a tendency for the twist drill to snap out bits from the side as well as drilling the desired hole. To reduce this I used a 3mm twist drill to drill pilot holes about every 100mm down the pipe, with 4 rows at 90^{o} to each other.

With the holes in place in two of the one metre lengths I glued an end cap on one end and a 90^{o} elbow onto the other of each one, using the blue PVC plumber's glue. I then cut the third one metre length of 50mm pipe in half and slid half into the other side of the 90^{o} elbow giving two L-shaped sections. The idea was that the pipe with the holes would sit along the bottom of the tub horizontally and water would flow in through the vertical section of pipe.

I put them in place to try them out and found out that the vertical section on the one in the second tub was too tall to allow water to flow by gravity so my intention was to cut it off level with the edge of the bath. After some thought however I worked out that the drain from the upper tub could be directed down into the horizontal tube just by using the PVC expandable waste connector and ensuring it sealed by applying silicon both ends. That did work out to be the best way to do it and gave me some spare pipe.

The was one more job before they were complete, and that was to put some fly screen in place over the holes in the horizontal pipe to keep rocks and plant roots from blocking the pipes and preventing greywater from flowing into the system. I got hold of some aluminium fly screen because it is stronger than the polyester stuff and wrapped one layer around the horizontal section of pipe with the holes in it. To keep it in place I took some of the spare 50mm pipe and cut 12mm thick rings from it, then made a cut in the side of each ring so they could be opened out. These rings were then put in place over the fly screen and around the tube to hold the fly screen in place.

The next thing to organise was the drain holes in the bathtubs. Yes, I know I blocked the standard bath drain hole, but that is because I need the greywater to slowly move up through the gravel and overflow in a controlled way into the next tub then through it and out to the garden. I needed to drill a 55mm hole near the top of the tub at the opposite end to where the water flows in to fit the outside diameter of the standard

50mm (nominal) pipe. I didn't have 55mm hole saw that would cut through ceramic and metal (I tried to sort it out but failed, looooooooong story!) but I did have a 70mm one.

Cutting through the side of the bath was a pretty noisy and hard job. It requires you to keep pressure on and some water going over the cut for lubrication for up to 10 minutes. I was using a battery drill and it was about as happy with me by the end as the neighbours were with the noise. I would use a 240v drill next time I think. The hole needed to be such that the bottom was 50mm to 75mm below the estimated level of the gravel. This was to ensure that there would be no standing water at the surface of the gravel and so no issues with mozzies.

50mm floor flange

The hole I had cut was about 15mm too big (because of the larger hole saw) so I inserted a 50mm floor flange in the hole and siliconed it in (silicon is my friend, again!). This took up the difference in hole size and allowed me to provide a seal to prevent leakage. The 50mm pipe I was using to make the drain from slid in with little moving about and was also siliconed in place. To stop the drain getting clogged with gravel or whatever I glued on a 50mm mozzie proof vent cowl on the inside end of the pipe. The cowl uses strong stainless steel mesh and it resisted any funny business by the gravel quite well.

Attachment of the 50mm mozzie proof vent

With that in place I siliconed the outside end of the drain in the first bathtub to the expandable waste connector referenced above, expanded it down so it fitted into the top of the elbow bend in the second tub and also applied a bit of silicon. Now the two bathtubs were connected I needed to fit the drain to the second tub.

Expandable waste connector in place

That followed mostly the same process: cut out the hole, insert the floor flange, apply silicon, insert 100mm or so of 50mm pipe and glue on the 50mm mozzie proof vent cowl. To allow me to connect a 25mm hose I put on a 90^{o} elbow after inserting and gluing in the 50mm to 25mm reducer into it. The reducer has a barbed fitting so that the hose slips on and won't fall off again.

System for the rear drain

In place

With all of the plumbing in place all that was needed was to fill both baths to the top with 20mm blue metal gravel. This is heavy stuff! I ordered half a cubic metre which filled both baths fully with enough left over to make a bathtub wicking bed. I had to shovel the gravel into a barrow then barrow it from the front yard to the back yard then, due to the position of the bathtubs, shovel it out of the barrow, into each tub. During this process two things occurred to me –

1. It was hard work! (yes I know I am a genius!), and
2. If I had set up the baths as I originally wanted to (3 of them, one above the other) I have no idea how I would have gotten the gravel into the middle bath, let alone the top one!)

With the gravel in place I ran some tank water into the system to check flow and, believe it or not, it worked perfectly!

Gravel in place

To finish this part of the system off I needed to put in plants, preferably from a functioning constructed wetland. Fortunately two of my friends have such a beast and I was able to score irises, taro and papyrus which were then dug into the gravel far enough for any part of the plant bearing roots to be submerged. Plants in a greywater system should not be used for food but they can be periodically trimmed and cut up to make mulch or compost. Where out baths are located also means that the foliage with shade some of the back wall of the house in summer, to reduce the solar heat gain of that part of the house.

Plants in Place

The Inside Bit

The last bit of engineering required was to put something in place to get the greywater from inside house to outside the house and into the system. The easiest way to do this was to just run a flexible 25mm hose from the discharge hose of either the washing machine or the dish washer, whichever was in use directly to the input pipe of the first bathtub. I didn't want to do that for two reasons –

1. It would be effectively increasing the length of the discharge hose which would have meant the waterpump in the appliance would have to work much harder, resulting in possible early failure of the part, and
2. If the discharge from either of the appliance pumps was at a greater rate than the system could accept, it would overflow everywhere, defeating the purpose of the plumbing and reducing the effectiveness of the greywater system.

What I needed was an intermediate or surge tank, which would accept the discharge from the appliances, but then allow it to drain into the system via gravity. I worked out that I could do this using the laundry sink. I bought a 50mm two-way valve so that if the valve was in one position the greywater would go straight to waste, in the other position I could run it outside through a 25mm flexible tube into the greywater system.

Pre-valve

Valve set up

Post Valve

To fit the valve I cut the drain pipe leading out of the bottom of the sink about 220mm up from the floor using a crosscut wood saw (which made short work of it!). I unscrewed the S-bend and upper part of the pipe from the bottom of the sink and then cut off about 100mm from the free end of the pipe I had taken out. I then reassembled everything with the valve in place, just to make sure everything fitted where it should. It did! So I used the blue plumbers glue and put everything back in place and re-screwed the s-bend back onto the bottom of the sink. I also glued the other 50mm to 25mm barbed reducer into the horizontal outlet of the valve. I then left everything in place and did not use the sink for 24 hours to allow the glue to set.

The Testing

The next morning I attached some 25mm flexible tube onto the 25mm barbed fitting and ran it out the back door and into the input pipe of the first bathtub. Unfortunately the 25mm flexible tube is flexible (funny that!) so it goes well around corners but is not self-supporting, any greywater in it would cause it to sag dramatically. To get around this I ran it through a spare one metres section of 50mm pipe supported on a couple of buckets and it did the job fairly well. It is only temporary for testing purposes and I will need to develop something a little more robust for final installation. Anyway the test went perfectly, no leaks anywhere. I am somewhat impatient (alright I am very

impatient!) so I put the washing machine on and allowed one load of wash water to go through the system and again it performed flawlessly.

Once the constructed wetland is put together you are supposed to leave it for 3 months to allow the plants and beneficial bacteria to establish themselves before running any greywater. After the test I diluted the greywater in the system with more tank water and it seems to be doing OK. Just after completion we had two freakishly (for spring at least) hot days, both over 37^{o}C but the system seems to have handled it OK and we

haven’t lost any plants. The secret is to keep an eye on them and top up with clean water periodically.

Another fun project is completed we have been using it full time for the last eight years.

5.0 Fertilising

5.1 Making Fertiliser Sausages

First of all, credit where credit is due: I stole the idea from Annette McFarlane as described in her book “Organic Fruit Growing”, (check out page 43).

The idea is to find natural fibre (ie biodegradable) fabric which is no longer required, collect organic materials which will rot down to release plant nutrients then wrap the latter in the former to form long “sausages”. These sausages are draped around the drip line of fruit trees and bushes etc and act as slow-release fertilisers. They are especially good for keeping stuff together and in place if your land is sloping, which mine is not, but I liked the slow-release part!

This is how I put mine together.

The Casing

In terms of the fabric “casing” of the sausage, a friend of mine has access to the hessian coffee bags which raw coffee beans are packed in when imported into Aus for roasting, which are then discarded. So if you want to do this the way I have check out any local coffee roasters and see what they do with their excess bags. Also if you have any local purveyors of organic produce, some of it (potatoes definitely) is shipped around the country in hessian bags.

The bags are made by being folded over and then sewn down the edges, when I get them they are already opened at the top so this is not an issue. To get the most out of

each bag they need to have the sewing undone so that they can be opened out to form a piece of fabric 2 metres long. Most of the bags seem to be sewn with a hemming stitch, and you can either cut along it or unpick it from the edges. Either way takes a similar time but if you unpick it you get the twine and can use it to tie around the sausage to keep the filling in.

Casing laid out

The Filling in Place

To fill the sausage, lay it out on the ground and heap some filling along one side, then take the edge closest to the filling, pull it up over the filling and roll it tightly so that you

get the filling covered by one and a half to two turns of the material. To finish off, use biodegradable twine and tie it around both ends, with two or three intermediate ties to keep the filling from falling to one end during transport.

Rolled and tied

The Filling

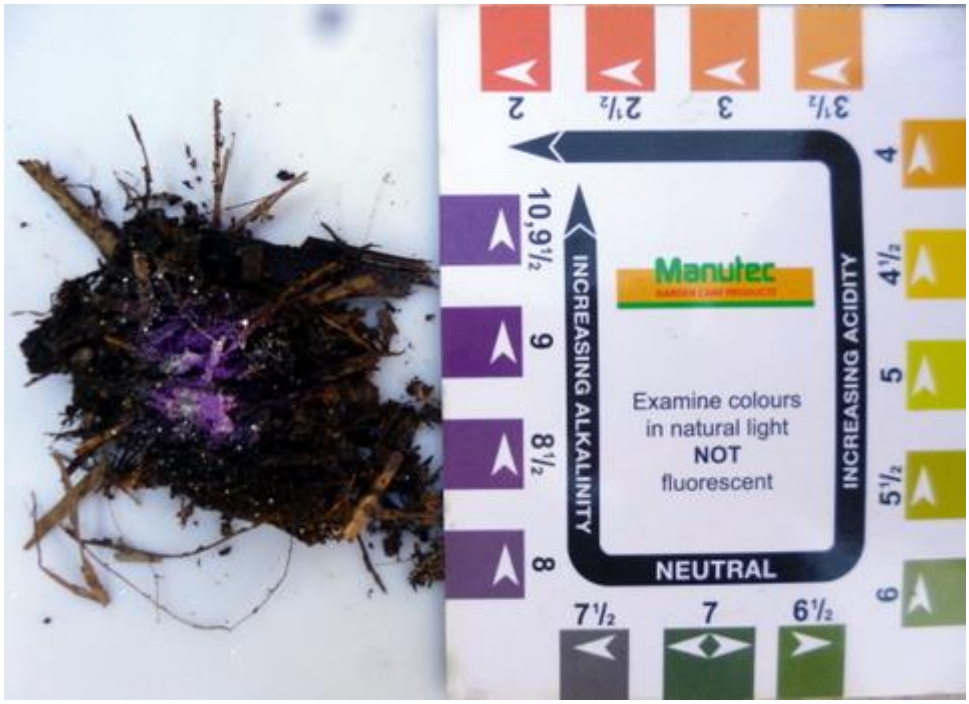
The filling can be composed of whatever organic material you have available.

There is a place near us where the kids make pocket money by selling their pony poo, so I got a bag of that, probably about 25kg worth. The chook poo we produce is applied directly to the veggie patches by the chooks themselves so I had to buy in a bag, also 25kg.

To make the filling I put half the bag of pony poo and half the bag of chook poo in my wheel barrow, followed by 2 chook-food bags of our home made compost. To top it off I threw in 500lm of rooster booster (my daughter gave me a couple of bags when they

moved), 2 x 500ml containers of wood ash for potassium from our fire and a handful of rock dust for trace nutrients.

The pony poo was pretty dry so I gave it all a thorough dowsing and then a thorough turning with my garden fork, to the point where the mix was moist but not dripping.



pH Testing

The wood ash did bring the pH up to a bit over 9 but I only took a couple of grab samples to check and it was just after mixing so I think it will settle down over time.

Installation

Once the sausage is filled and tied it is just a case of dragging it into position around the drip line of a tree or bush. I have installed a run of fertiliser sausages around the inner circle of the fruit tree circle to provide a bit of extra nutrition come spring. I have also installed them in around a couple of other fruiting plants include our coffee bush.
I have also made some smaller sausages, using the same process as above, but not opening the bag out, just using it as is to provide a double layer of casing.

Around the Fruit Tree circle

Coffee Bush

6.0 Propagation

6.1 Growing a banana from suckers

The banana circle spring 2010

A couple of years ago we put in a banana circle, (the process of putting in the banana circle is covered in Section 3.4 of this eBook) and in Sydney's climate they will take a few years to fruit, but they will fruit! However the frost at the start of last winter (2010) was the worst we have seen for a while, getting down to minus 3°C and it ripped the living daylights out of the bananas. In the end two of the smaller plants did not recover and although one sent out a sucker to replace it, the other didn't thus requiring the process I am about to describe.

Sucker as it is, growing from the base of the mother banana

Banana trees reproduce by producing two suckers of the original tree (bush, herb, whatever you want to call it!). If you can wait until the suckers are a bit over a metre high so much the better but I wanted to replace the dead banana tree soon as. Fortunately one of the larger trees had put forth a sucker that was about half a metre high, so it won the toss. The best one to get, if you have a choice, is to go for one that has small spindly leaves rather than pretty big round ones, the theory being that the sucker with the spindly leaves has been well taken care of by the mother plant and so has not needed to put out large leaves for photosynthesis. Any way that is the theory!

Machete in place

The trick is to get a sharp implement such as a sharpened spade or as in my case a machete, between the sucker and the mother plant and force it down so that is cuts the base (corm) of the sucker away from the mother plant, but still maintain as many roots as possible. Then it is just a case of digging the soil away from the sucker and removing it and replanting it where you want it to go. You can cut off the foliage to reduce transpiration of water from the banana sucker while it gets established in its new position, but I have done this a couple of times and not bothered to and things seemed to have worked out OK.

Sucker removed and ready to replant

So you see it is possible to obtain free banana plants from ones already growing in your garden or perhaps donated to your fruit growing efforts by mates. Just remember –

- Only take suckers from healthy vigorous mother plants
- The bigger the sucker, the shorter the time to flowering and fruit production
- You can cut off the foliage to help the sucker establish.

Good luck and don't go...umm.....bananas!

Sucker replanted and happily growing!

6.2 Making a Pot-in-Pot Propagator

For the annual veggies and herbs you don't need to know too much about plant propagation apart from how to grow from seed, but for the more long lived woody herbs like rosemary or bay and for fruits, nuts and berries a little propagation knowledge goes a long way. One way of propagating perennials is through cuttings and there is an art to keeping cuttings alive but this device (the pot-in-pot propagator) will give you the edge and make your chances for successful cuttings much better.

If you can acquire the skills to propagate plants well, you can increase the productivity of your land considerably for very little cost. You can expand the number of plants you have growing from your own stock or you can get plant material from friends, acquaintances or even complete strangers gardens if you are polite enough, thereby increasing the variety of plants you can grow. It could even form the basis of a business by keeping other urban food growers supplied with fresh plants, the possibilities are endless.

Installing the silicone plug

To make your pot-in pot-propagator you will need –

- 1 large outer pot, say about 200mm in diameter – this pot can be of any material but the standard terracotta looks nice.
- A pot saucer to fit the larger pot.
- 1 smaller inner pot, say about 100mm in diameter which **must** be terracotta.
- Propagating medium like coarse river sand or even a 50:50 mix of coarse sand and cocopeat.
- Some silicone sealant (remember, silicone is my friend!) and a bit of gaffer tape.
- A translucent (not transparent) plastic bag to fit over the top (I used a recycled fruit bag from the fruit and veggie shop) if you don't have a greenhouse.

To make the propagator first grab the smaller pot and plug up its drain hole by potting gaffer tape over it on the inside and then filling the hole with silicone sealer. Leave the silicone sealer overnight to set. To save time later you can also put the larger pot (if it is terracotta) into a bucket of water overnight to soak. Pull it out and let it drain the next morning.

Once the silicone sealer has set, place some pebbles or the classic broken terracotta pot in the bottom of the big pot to prevent the propagating mix from draining out while still allowing any excess water to drain out into the pot saucer. Half fill the pot with propagating mix and gently seat the smaller pot in the centre of the larger pot so that the top of the smaller pot is roughly 12mm taller than the outer large pot. Fill the area between the inner and outer pot with propagating mix and tamp down so it is firm, it helps if the propagating mix is pretty damp before it goes in.

The small pot sitting on propagating mix in the big one!

Fill the inner pot with water, then give the whole set up a spray with water and you are pretty much ready to start. Use a stick to poke 8 or 10 holes equidistant from each other in the propagating mix and insert your cuttings, making sure to firm them in with your fingers to ensure good contact with your propagating mix. Cover the whole shebang with your plastic bag.

Pot-in-pot part set up

Check the propagator every two days, topping up the inner pot as required and removing any cuttings that have wilted. After a month or so check your cuttings by pulling on them gently to see if roots are developing, resulting in slight resistance. If not, leave them there but if there is resistant use a fork to get under them and lift them out and pot on with a good quality potting mix.

Cuttings in place (In this case bay tree cuttings)

Once all of the cuttings are potted on or discarded, pull your set up apart and discard the propagating mix. Leave the whole set up in the hot sun for a few days to kill any nasties or wash over with disinfectant, re-assemble and you are ready to go again!

Plastic bag in place (if required)

7.0 Pests and Diseases

7.1 What's Killing Your Lemon Tree?

Healthy lemon leaves

Why is it that lemon trees are so useful, but so easily give up the ghost? Every household should have a lemon tree and it's very frustrating when your carefully planted and lovingly nurtured tree expires without producing the goods. Obviously all I have is my backyard and not a large orchard area but I have still managed to kill two lemon trees before i found out what I was doing wrong and saved the third. My other citrus trees (lime; Kaffir lime; orange; mandarine and lemonade) are OK but the lemons persisted in dying.

The manner in which leaves go yellow can tell a lot about what is wrong with the tree, but without more detailed information about your particular circumstances I can suggest theee things that may be wrong –

WET FEET

If the draining on your land is poor, there is plant of clay or marl (I'm on good old Sydney clay) or there is some other reason why water cannot get away, your lemon's roots will remain wet. This encourages the fungus phytophthora citrophthora which causes root rot. The symptoms of this are that the leaf veins yellow first, leading to general yellowing and leaf fall and the tree may eventually die. Phytophthora resistant root stocks such as *Trifoliata* may help but removal of the cause by improving drainage is the real answer. If you think this may be a problem before you plant, build the soil up and make a raised bed to improve the drainage and give yourself a chance from the beginning.

INCORRECT SOIL pH

Using a soil pH meter or chemical pH test kit is the best way to diagnose this problem. The best soil pH for lemon trees is probably 5.5 to 6.5 although this range is also favourable to phytophthora. If the pH is too low (ie the soil is acid) dolomite or agricultural lime (calcium carbonate) will raise it. If the pH is too high, which can be due to previous over-liming, a condition called lime-induced chlorosis can occur. This is cause by iron in the soil being chemically bound and unavailable to the plant at the high pH. This causes the reverse of wet feet, the leaves are yellow but the veins remain green; again leaf fall and death can result. To reduce the pH powdered sulphur, alum (aluminium sulphate), sulphate of ammonia or large doses of organic matter may be used.

NUTRIENT DEFICIENCY

Plants require a number of chemical elements to function properly and a soil which is rich and good for growing plants and trees contains all these things. If only one of these elements is in short supply or absent the whole tree may suffer in the same what a person may suffer from a vitamin deficiency. Each deficiency has its own symptoms, which can be summarised as follows –

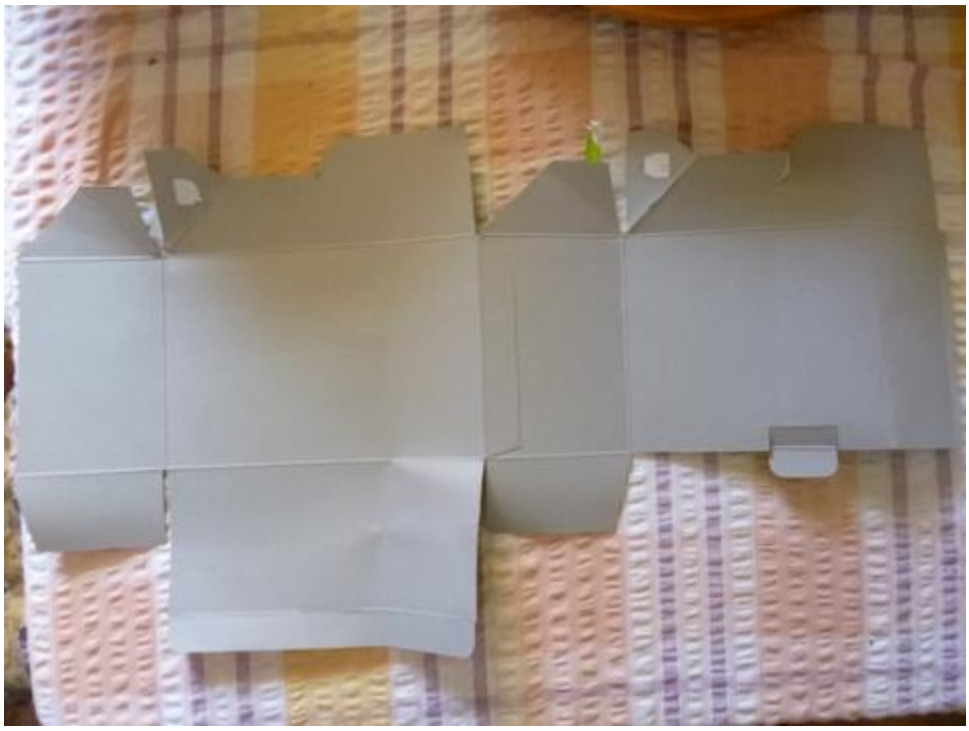
• Nitrogen – Leaves are pale green and new growth is small, old leaves fall readily.
• Phosphorous – general bronzing of the foliage
• Potassium – "burnt leaf" occurs, a banded pattern with leaves being green at the base, then yellow, then brown then dead at the tip. The old leaves fall readily.
• Magnesium – Yellow leaf and leaf drop develop as the fruit ripens.
• Zinc – mottling of the leaves and reduction in size of the new leaves ("little leaf"), worst on the sunny side of the tree.
• Manganese – mottling also occurs, worst on the shady side of the tree, leaf size is normal but if deficiency continues small, curled and beaked leaves develop.
• Boron – The fruit appears lumpy and water soaked spots occur in the leaves.
• Sulphur – similar to phosphorous or nitrogen deficiency with mid-rib yellowing.

To correct the deficiencies the element may be added by itself eg magnesium sulphate (Epsom Salts) if you suspect a magnesium deficiency, or add a trace element mix or seaweed solution for the minor elements, chook poo is high in nitrogen, potassium and phosphorous if these are what you need.
Long live your lemon tree!

Lemon tree, complete with lemons

7.2 A sticky Ant Barrier to Protect Fruit Trees

We have a number of citrus and other trees which are subject to infestation with scale. Scale are small sucking insects (2-3mm) which grow beneath a waxy cover and infest the leaves of the plants they attack. They can only move around under their own steam in their younger stages with the adults tending to remain in the one spot once they become attached. The scale is a sucking insect and enough of them can affect the plant adversely, they also pump out a sugary liquid called honeydew. Honeydew on the leaves of the plant attracts a fungus called sooty mould, due to the sooty look which the leaves take on, but is a cosmetic effect more than anything.



Scale is usually dealt with by an application of white oil (early in the morning or later in the afternoon to prevent the sun burning the host plant) which blocks the scale's breathing holes, suffocating it. Unfortunately for us, the scale's best friend is the ant. The ants can "farm" them, moving them from one plant to another or from one area of the same plant to another area. They harvest the sugary honeydew which the scales secrete and in return protect and move them around.

Cut to Size

I have recently noticed that out Tahitian lime tree was not looking happy and it was covered in ants and the scale was starting to take hold. So I needed to deal with the ants before I could sort out the scale, otherwise a re-infestation was highly likely.
To fix the ants' little red wagon I applied a homemade sticky strip to the trunk of the lime tree. I made the strip as follows –

1. I first measured the trunk circumference using Linda's sewing tape measure, and it came out at 16cm.
2. I got hold of some cardboard from the recycling, in this case it was the outer packaging of some catfood which we had bought.
3. I cut the cardboard to 19cm long (to allow overlap) and 6cm wide to allow a deep enough barrier.
4. I then smeared a goodly layer of Vaseline over the surface of the cardboard to act as the sticky layer, but I have heard of molasses or automotive grease being used instead.
5. I checked that there were no alternative routes on and off the tree like errant twigs or branches touching the ground or contact with other trees or fittings.
6. I then applied the band to the base of the trunk of the lime tree.

That was no mean feat! By the time I had the cardboard in place and wired on I was covered in Vaseline, well it was all over my hands anyway. I used two wires to ensure that the barrier was flat against the trunk and the ants couldn't sneak their way underneath and tightened them up pretty tight. To replace the Vaseline now on me I applied a liberal smear all around the cardboard to ensure a good barrier.

Vaseline applied

I then sat down to watch what happened. There were copious ants on both sides of the barrier, but the ones still on the tree (above the barrier) seemed to be more determined to get across it. I don't know if it was because the higher ants had gravity on their side or because they were not on the nest side of the barrier. I expected the little buggers to move onto the cardboard and then get stuck, slowing covering the surface of the Vaseline, but that is not what happened.

In place c/w disgruntled ants

They could walk right across the band of Vaseline without getting stuck if they wanted, but seemed to be extremely reluctant to do so. I saw a few very courageous ants above the barrier walk down across it and escape but none from below tried to climb up onto it, they seemed totally put off by the barrier. The application of the barrier did cause extreme consternation within the ranks of the ants who were, only a moment before, passing up and down the trunk unmolested. They just milled around but, with the exception of the previously mentioned hardy individuals, didn't achieve much.

If they do manage to find a way through under the barrier, wiping some more Vaseline over the breach in your defences will fix the problem.

Two Weeks Later

Two weeks after I wrote this I decided to check back and see if my handywork was still effecting, and sure enough there were no ants on either side of the barrier or anywhere near it, the mission was clearly a success! Ahhh, if that were truly so, where were all the ants on the limbs and leaves above the barrier coming from?

OK, maybe not such a success (cue frustrated screams). So I went back into surveillance mode and watched where the little buggers were coming from/going to and sure enough one of the limbs of the lime tree came very close to the leaves of the macadamia tree next door to it which I had missed on my initial survey. I removed the offending twig from the macadamia and all of a sudden there was a traffic pile-up on the leaves of the lime tree near where the twig had been. That should hold 'em!
This only emphasises the importance of my earlier comments about the initial look over to identify alternative pathways which will allow the ants to bypass your barrier. If they exist, the ants will find and exploit them.

7.3 Bronze Orange Bugs

We don’t seem to have a lot of pest issues here at the Choko Tree, but we do have a yearly battle with bronze orange bugs (AKA stink bugs). Bronze orange bugs are a wide ranging pest of citrus trees on the east coast of Australia from central NSW to SE Queensland. They are a native, feeding on native citrus like the finger lime and desert lime, and when other citrus species were imported they were pleased to move straight across to them too!

Description/lifecycle

The bronze orange bug goes through several stages of nymphs before becoming adults. First off the eggs are small spheres about 2.5mm in diameter laid on the underside of the citrus leaf. These hatch into light green circular nymphs. As they move through their life cycle, the light green nymphs get larger until they reach the fourth or fifth instar which is the last stage before adulthood. At this stage they are oval, bright orange bugs which can be easily noticed. When they reach adulthood they are black, can fly and reproduce, resulting in the next generation of bugs.

Damage/signs of infestation

Initially it can be difficult to identify an infestation when the bugs are in their small, light green stages, but they become obvious when they reach their orange stage. They are a sap sucking insect and tend to infest new growth on the trees in spring and their activities can result in this new growth turning brown/black and dying back. They can also cause flower and fruit drop. The irritating, smelly liquid the bugs produce can also result in wet patches on the leaves and fruit resulting in brown spots of dead tissue. The distinctive smell the bugs produce can also be an indicator of an infestation. A severe attack can result in a sick looking tree and reduced yields.

Prevention

Look for the eggs and squash them before they have a chance to hatch and net the trees after they have been cleared of eggs.

Controls

Manual removal – this is the one we practice here. I use pliers or gloved fingers, because the smell substance they secrete is also an irritating chemical which can cause your fingers to look like you have been smoking for the past 40 years and if it gets in your eyes, will sting like hell!! If you go the manual removal route always wear eye protection, goggles are better than glasses. This is an important point, particularly if they are above you when you are trying to remove them, their aim is good.

Once removed I place them in a container of water which has a bit of washing detergent or soap so the water wets them out and they drown quicker. If the weather is hot (39^{o}C or above), they will tend to congregate around the base of the tree, facilitating manual removal. If you want to make things a bit quicker you can use a vacuum cleaner, just make sure that this won't cause any problems with in the household, and require a replacement vacuum cleaner to be bought because the original is contaminated.

Manual removal is easiest before the bugs reach the adult (black) stage, because after that point not only are they capable of laying eggs but can also avoid you by flying away, although in most cases they don't seem to fly far.

Predators – From what I see around here, there is not much in the way of wildlife interested in snacking on bronze orange bugs with the exception, many years ago, of watching a black-faced cuckoo shrike sample some from our orange tree. My exhortations for him (or her) to come back and bring their friends unfortunately fell on deaf ears.

There is a species of wasp that parasitises the eggs and the assassin bug will predate bronze orange bugs given the chance but, again, we do not seem to see many of either around here.

Sprays – a pyrethrum based spray will work but it is broad spectrum and will also kill other beneficial insects like lady bugs and arachnids like spiders. I have read that using eco-oil in the winter to control other pests has resulted in a lower incidence of bronze orange bug in the spring, possibly due to destruction of over-wintering eggs. Spraying a solution of soft soap 2% - 2.5% in water in later winter to early spring will kill young nymphs, reducing infestations later in the season.

A friend has told me she uses a 50:50 mix of vinegar and water as a pest spray and this seems to work fairly well, driving them off or killing them.

8.0 Resources

Growing Fruit in Australia (4th Ed.) – Paul Baxter & Glenn Tankard – The Macmillan Co of Aust. Pty. Ltd (AUS) 1990 ISBN 978 0 7329 0305 X – This is a comprehensive book, divided into four sections. Section one covers planning an planting an orchard, including subjects like choosing fruit to suit your climate, soil fertility, water needs of fruit trees and buying, planting and training the young tree. Section two covers a year in the life of a fruit tree including flowering, pollination and fruit set, propagation, pruning and pests and diseases, with organic and non-organic control strategies covered. Section Three covers fruit/nut tree families talking about requirements for climate. Soil and fetilisers, rootstocks, harvesting, yields, pests and diseases for pome, stone fruits, nuts, mulberries and figs, citrus, vines, subtropical and warm climate fruit and berry fruits. Section four is a sort section on making money from fruit. The book has lots of line drawings and black and white photos as well as some colour photo sections.

The Complete Book of Fruit Growing in Australia – Louis Glowinski – Hachette Australia (AUS) 2011 (reprinted) ISBN 978 0 7336 2407 0 – This is another comprehensive (and weighty) tome! The book is broken up into 23 chapters, with each chapter covering a different nuts, fruit or berry group. This translates into over 130 separate fruit/berry/nut monographs covering varieties and history, cultivation and training, harvesting, pests and diseases and propagation. As well as the more common fruits and berries, the book covers elderberries and related fruits subtropicals like sapote and jujube, native fruits, palms, papayas and cactus fruits, guavas, monster and rose hips. There are a few line drawings and colour photos, but most of the illustrations are black and white photos.

Better Fruit Growing (for Australian Gardeners) – Duncan Brown – Landsowne Press (AUS) 1963 ISBN 978 0 7018 0131 1 – The book is broken up into 56 sections of four to five pages in length. The first twenty five sections cover setting and maintaining a small orchard, covering such subjects as frost, purchasing and planting trees, fruit thinning, cordon and espalier, pruning and shaping, pollination, budding and grafting, pests and diseases, soil management, watering and hormone use. Spray charts are old school and definitely not organic! The following sections are monographs on fruits berries and nuts, and each monograph covers history, varieties, harvesting, manuring, diseases and pruning. The book has two sections of black and white photos and no other illustrations.

Organic Fruit Growing – Annette McFarlane – ABC Books (AUS) 2011 ISBN 978 0 7333 2913 5 – The book is broken up into two parts – Part one is techniques and methods for growing organic fruit trees. It gives an introduction to organics, how to get started, preparing to plant, pruning and training, tree nutrition, pest and disease prevention and control, pollination, propagation and weeds. Part two is an A to Z of fruit, providing monographs on 58 fruits and berries. Each monograph provides an introduction to the species, a description (including colour photo), location and climate where they grow, cultivation, pruning and training, pot culture, varieties, potential problems (pests, diseases etc.), Harvesting and storage, and propagation. There is a section at the end detailing 23 recipes with various fruits. The book has lots of colour photos.

Home Fruit Growing – Dept. of Agriculture NSW (AUS) 1984 ISBN 978 0 7240 8689 7 – Chapter one of the book covers planning and preparation including soils and soil preparation, drainage, nutrition, growing, pruning and propagation, harvesting and storing fruit. The next eight chapters provide monographs on various fruit broken down by type such as – Citrus, stone fruits, pome fruits, grapes, berries, tropical fruit, nuts, and miscellaneous fruit such as figs, olives, kiwifruit and feijoas. Each monograph covers varieties, propagation where they can be grown, planting and caring, nutrition, pruning, harvesting and pests and diseases. Chapter ten talks what varieties of each fruit can be grow where (in NSW). Chapter eleven goes into more detail around pest and disease control for the more common fruit but is not organic. There is a supplement provided with the book detailing pest and disease chemical control sprays which is also not organic! The book has quite a lot of line drawings.

The Complete Guide to Fruit Growing – Peter Blackburne-Maze – The Crowood Press (UK) 2010 ISBN 978 1 84797 173 9 – This also a small book, not as comprehensive or detailed as books mentioned above, and it reflects the UK experience. Chapter one talks about the history of fruit growing (in UK) and chapter two covers different ways of growing fruit meaning the various ways fruit trees can be pruned. Chapter three covers the kinds and varieties of fruit, talking about soils, varieties, effects of the site, rootstocks and propagation. Chapter four covers planning, planting and aftercare including soil preparation, marking out, planting, soil management and watering. Chapter five covers pest diseas and weed control, not organic and not much detail. Chapter six covers pruning and growth control, chapter seven covers fruit picking and storage, Chapter eight is interesting covering the growing of various fruits in a greenhouse including citrus and pineapples. The rest of the book is a 'Fruit Reference Section' giving some detail on growing various fruit including varieties, some pests and diseases and some pruning. The book has a centre section of colour photos with the rest of the book being taken up with line drawings.

The Easy Fruit Garden – Clare Matthews – Hobble Creek Press (US) 2012 ISBN 978 1 4621 1291 3 – This book is broken up into three parts, part one is planning and design including how and what to grow, putting design together, soil prep and where to grow fruit. Part two covers what to grow including monographs on tree fruit (13), soft fruit (14), nuts (4), 'other fruits' (5) including rhubarb, melon and passionfruit, and 'almost wild' (3) sloes, rowan and elder. Part three addresses how to grow, including sections on planting, pruning, mulch, compost, watering, weeding, natural defences, companion planting (the US experience), pests and diseases including organic controls, the fruit garden timetable, storing fruit and tools required. The book has lots of colour photos.

Citrus – Allen Gilbert – Hyland House Publishing (AUS) 2007 ISBN 978 1 86447 103 8 – This comprehensive book is broken up into seven chapters. Chapter one covers the origin and spread of citrus trees, chapter two discusses species and cultivars including, sweet citrus, sour citrus, large citrus, citrus grown for their leaves and Australian native citrus. Chapter three covers propagation including seed, cuttings, budding and grafting. Chapter four covers citrus tree management in the open orchard and in pots and there is a small section on the organic citrus grove. Chapter five covers pruning and training

of citrus trees including training young trees, espalier, pruning established trees and equipment required. Chapter six covers pest and disease control of citrus with an organic approach. Chapter seven provides a couple of pages on harvesting and storage of citrus fruit. The book has lots of colour photos.

All About Apples – Allen Gilbert – Hyland House Publishing (AUS) 2001 ISBN 978 1 86447 046 1 – This book covers all you would want to know for apple growing in Australia. It starts off in chapter one with some apple history, myths and customs, moving on I nchapter two to comprehensive lists of early and heritage apples, cultivars available here in the 1930s, heritage cultivars available today and modern Australian cultivars with a description of the fruit and some photos. Chapter three covers caring for apple trees and chapter four covers pruning, including a new approach to summer pruning apple trees. Chapter five covers pests and diseases of apples, referring to organic treatments where they exist. Treatments may have moved on since the book was written over 20 years ago. Chapter six covers growing your own apple trees, including your own rootstock from seed, budding and grafting and planting young apple trees. Chapter seven covers apple flowering and maturity and apple storage. Chapter covers setting up your own orchard with reference to permaculture principles. The book has lots of colour photos and some line drawings.

Citrus: A Gardener's Guide – Bruce Morphett & Ian Tolley – Government of South Australia (AUS) 2011 (reprint) ISBN 978 0 7308 6225 9 – This is a small book, A5 size and 76 pages. There is an introduction that summarises the key steps for success in growing citrus, then the first chapter talks about citrus varieties and the rootstocks available. Chapter two covers growing citrus including establishing young trees, maturity and harvesting and growing it pots. The third chapter, taking up the remainder of the book, covers citrus pests and diseases, control is organic in nature. For a small book, it covers its chosen subjects well; it has lots of colour photos and some line drawings.

The Olive Book – Gareth Renowden – Canterbury University Press (NZ) 1999 ISBN 978 0 908812 80 9 – The book is a good overview but no great depth in the chapters. Chapter one is an introduction to olives and the reality of managing an olive grove, chapter two talks about olive botany, history and olive oil chemistry. Chapter three talks about where olives are grown throughout the world and chapter four discusses olives from tree to table. Chapter five discusses olive oil uses, chapter six covers getting a olive grove started including climate, water, wind, aspect, access and bureaucracy. Chapter seven goes into the financial side of starting your olive grove and chapter eight discusses the aspects associated with choosing the right cultivars. Chapter nine covers planting the grove and chapter ten covers managing it, including pruning, irrigation and coping with frost. Chapter eleven lists pests, diseases and other problems but does not offer much in the way of solutions. Chapter twelve talks about options for oil production, chapter thirteen talks about how to treat olives for eating. Chapter fourteen talks about olive cuisine and how they are prepared and used. The book has lots of colour photos.

Fruit Trees in Small Spaces – Colby Eierman – Timber Press (US) 2012 ISBN 978 1 60469 190 0 – This book focusses on stone fruits, pome fruits and citrus. The book is broken

up into four parts. Part one is planning the orchard and starts out detailing all the takes which need to be done throughout the year and then looks at the issues associated with orchard design including understanding your site, design elements and design ideas. Part two is a guide to choosing the right fruit trees and covers rootstocks as well as monographs detailing each type of fruit tree, including varieties (in the US), how to grow, pruning, pests and diseases including organic controls and cultural problems. Part three covers setting up and maintaining a small scale orchard including planting, irrigation, pruning and training. Part four provides sixteen fruit based recipes for your harvest. The book has lots of colour photos.

What's Wrong with my Fruit Garden – David Deardorff & Kathryn Wadsworth – Timber Press (US) 2013 ISBN 978 1 60469 358 4 – This incredibly detailed and handy book is written in three parts, the first part is an introduction and covers problems fruit trees have that are associated with environmental problems including temperature, soil, light and water that includes a series of photos of examples of problems caused by each one. Part two 'plant portraits' is a series of monographs covering 37 fruits and nuts starting with a plant description then covering temperature, soil, light, water, garden uses, pollination, pruning and problem solving. Part three is the meat of the book and is a problem solving guide for 21 fruit, with the entry being for a single fruit like figs or a fruit family like pome, stone or citrus fruit. Each guide provides a series of entries, each one starting with a colour photo of the issue, followed by a description of symptoms, diagnosis of the cause and a series of solutions. The solutions are referenced to a page in the part of the book called 'Organic solutions to common problems' which gives detail on each solution and how it is carried out. The book has lots of colour photos.

Community Orchards Handbook – Angela King and Sue Clifford (Common Ground) – Green Books (UK) 2011 ISBN 978 1 900322 92 8 – This is a great little book with lots of information but in terms of legalities and processes it reflects the UK experience. Chapter one is a short introduction to local orchards in the UK, Chapter two covers what a community orchard is, chapter three talks about the place of orchards in landscape and (UK) culture, chapter four details previous community orchard success stories. Chapter five details getting a community orchards started, from getting support, access, insurance and even writing a constitution. Chapter six talks about getting more information through wildlife mapping, an apple survey or parish fruit map. Chapter seven covers the issues associated with planning the orchard, and chapter 8 talks about adopting an older existing orchard. Chapter nine covers attracting and conserving wildlife in the orchard area, and chapter ten discusses options for sharing and processing the harvest. Chapter eleven talks about ways to celebrate the orchard such as wassailing and apple day (UK) and chapter twelve covers how to safeguard the orchard and preventing local and historic orchards being 'developed'. The book has lots of colour photos.

Backyard Self Sufficiency – Jackie French – Aird Books (AUS) 2009 ISBN 9780947214586 – This is THE book on living more sustainably in a small area. Jackie devotes 35 pages of this book to backyard fruit growing, covering the standard pome fruit, stone fruit and

citrus but also some weirdo stuff you may never have thought of growing. This book is a must in your library for many, many reasons.

Fabulous Food From every Small Garden – Mary Horsfall – CSIRO Publishing (AUS) 2009 ISBN 978 0 643 09597 7 – A great book that really covers everything you need to know to get the best out of your urban/suburban space. She covers the basics well and has a specific area on fruits cover the standard and tropical fruits well. Mary is the co-editor of Grass Roots magazine, how can it get better than that?

Grow Your Own Fruit and Veg in Pots, Plots or Growbags – Steve Ott, Emma Rawlings & Roxanne Warwick – Foulsham Books (UK) 2008 ISBN 978 0 572 03494 8 – This is set out as an A to Z guide to growing vegetables, fruit and herbs with 1 or 2 pages per plant including varieties, growing tips and recipes. Good for what it is bearing in mind it is written for the UK experience.

Fruit for the Home and Garden – Leslie Johns and violet Stevenson – Angus & Robertson Publishers (AUS) 1985 ISBN 0 207 15068 0 – A comprehensive book giving a monograph covering the origin, the fruit itself, the plant, how it is cultivated and culinary uses for the fruit for almost 200 fruits. No recommendations for varieties.

Growing fruit in Australia – Paul Baxter – Thomas Nelson (AUS) 1981 ISBN 0 17 006317 8 – This book covers the planning and planting of an orchard, a year in the life of a fruit tree and information on more than 50 fruits, nuts and berries. While information on varieties and cultivars is provided this book is a little out of date and will not cover the most recent ones. A later edition was released in 1990 with Glenn Tankard by Macmillan and co with an ISBN 0 7329 0305 X.

Tropical Fruit – Glenn Tankard – Viking O'Neil (AUS) 1987 ISBN 0 670 90205 5 – this book covers what fruits to grow, selecting the best growing site in your garden and modifying the home garden microclimate followed by information on almost 50 tropical fruits. There is also a section on recipes.

The Australian Home Orchard – Colin Hutchinson – Simon & Schuster (AUS) 1993 ISBN 0 7318 0406 6 – This is a good beginners book covering climate and cultural needs, pests and diseases, cultivation and landscape uses. This is followed by monographs on pip (pome) fruit, stone fruit, Nut fruit, Berry fruit, citrus and exotic, subtropical and tropical fruit covering almost 50 of the more common varieties. Various cultivars are discussed for each one.

Fruit for Australian Gardens – Paul Baxter – Sun Publishers (AUS) 1991 ISBN 0 7521 0634 4 – This book is a mine of information covering details on climate, soils, organic fruit, propagation, pests and diseases as well as monographs on 50 common fruits, nuts, vies and berries. This one is a gem!

Growing Citrus Trees – Geoff Godden – Lothian Publishing co (AUS) 1988 ISBN 0 85091 286 5 – This book gives details on the different citrus varieties, physiology of the tree, factors influencing success or failure, planting, soils and soil management, irrigation,

nutrition, pruning and propagation. While not being strictly organic it is still a good book if citrus is your interest.

Citrus Growing in Australia – F.T.Bowman – Angus and Robertson Publishers (AUS) 1956 ISBN (couldn't find one!) This is an old book and certainly not from the organic camp but it is the "bible" and most detailed book i have ever seen on growing citrus in Aus. It is worth the price if you can find it second hand.

Fruit Growing in South Eastern Australia – The Caxton Press (AUS) 1983 ISBN 0 908563 09 4 – This is not a huge book but good sections on Soils, watering, propagating, pruning, weed, pest and disease control as well as monographs on almost 50 fruit trees and berries.

Grow Fruit – Alan Buckingham – Dorling Kindersley (UK) 2010 ISBN976 1 74033 763 2 – Chock full of colour photos this could be a coffee table book. It has a section on growing fruit in general then a series of monographs on deciduous tree fruits including nuts (13); berries (12); vine fruits (4) and evergreen tree fruits(31) which includes six native fruits. There is also a section called the fruit doctor covering soils, pests and diseases. A bit expensive but a good book!

Landscaping with Fruit – Lee Reich – Storey Publishing (US) 2009 ISBN 978 1 60342 091 4 – This book is a bit different in that it covers landscape design basics first before moving on to assessing climate, soil and yourself and general issues around growing fruit like plant selection, pollination, pests, pruning and soil care. The next section is also a departure from more traditional fruit growing books, it covers home landscaping plans including a patio fruitscape, a modular backyard and a children's garden. There are also almost 50 monographs on common and uncommon fruits and berries including some I've never heard of so they may only be available in the US.

Tropical Tree Fruits for Australia – Compiled by P.E. Page – Queensland Department of Primary Industries (AUS) 1983 IBSN 0 7242 2200 6 – This is more a book for the professional rather than the home grower but it does give quite a bit of technical information and covers some obscure fruit. The monographs are broken up into plant families and each monograph covers botany, climate and soil requirements, genetic diversity, cropping season, yield, market acceptability and export potential, how to grow the fruit, harvesting, storage and transport. This is one for those who are heavily into tropical fruit.

Success with Organic Fruit – Yvonne Cuthbertson – Guild of Master Craftsmen Publications (UK) 2006 ISBN 1 86108 483 8 – A lot of the fruit growing books, particularly the older ones, are anything but organic so it is good to have a book that covers things from an organic perpective. This book covers where and how to grow fruit outdoors, cultivating fruit under cover, buying fruit trees, bushes and canes and includes an A-Z directory of fruits, nuts and berries.

The Australian Berry Book – Clive Stone – Pioneer Design Studios (AUS) 1992 ISBN 0 909674 18 3 – This book covers soils, fertilisers, manures and soil improvers from an

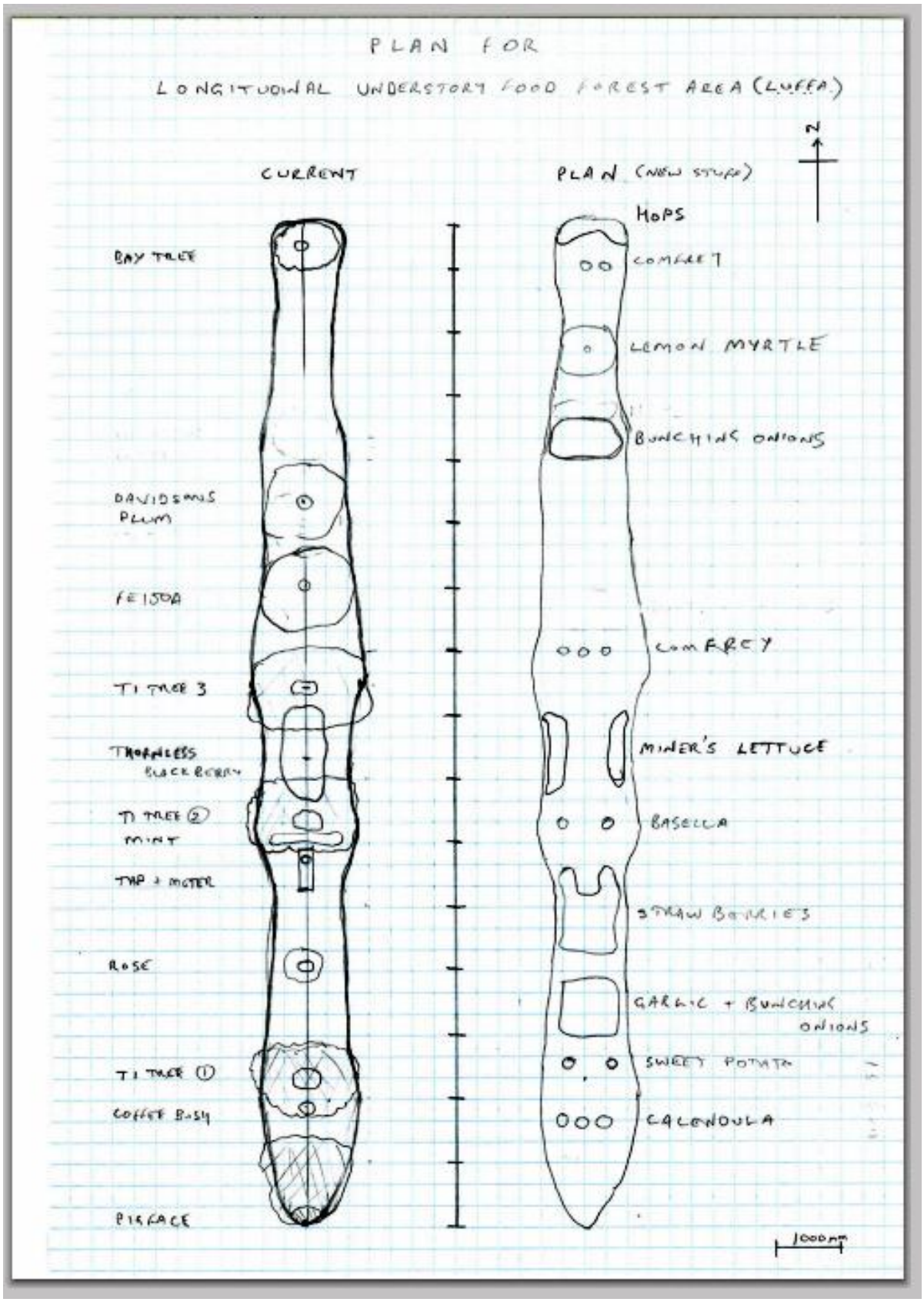
organic and conventional viewpoint as well as irrigation and sprays. The book has monographs on 19 different types of berries.

Growing and Cooking Berries – Mary W. Cornog – Yankee Inc (US) 1980 ISBN 0911658 09 2 – This book has a small section on general directions for growing berry fruit then a series of monographs covering the blackberry family; blueberries; elderberries; raspberries and strawberries. The remaining 60 or so pages are Taken up by various berry related recipes.

The Berry Growers Companion – Barbara L. Bowling – Timber Press (US) 2000 ISBN 0 88192 726 0 – This comprehensive book covers the general principles of berry growing and even has a section on landscaping with berries. The book then has very detailed monographs on strawberries, bramble berries, blueberries and grapes and then smaller monographs on minor crops like currants, gooseberries and elderberries.

Appendices

Appendix 1 – LUFFA Map



Appendix 2 – Food Forest Plant List

1. Tall Trees (Canopy)

Alder
American Persimmon
Apple
Arazole / Mediterranean Medlar
Bay tree
Black locust
Carob
Cherry
Chestnut
Chinese Chestnut
Cornelian cherries
European Plum (Myrobalan)
Hawthorn
Honey locusts
Japanese Walnut (Heartnut)
Japanese Raisin Tree
Korean Stone Pine
Melaleuca
Macadamia nut
Pecan
Pear
Siberian Pea Tree
Tagasaste/ tree Lucerne
Medlar
Mulberry
Quince
Walnut

2. Smaller Trees

Almond dwarf
Apple Dwarf
Apricot
Avocado
Banana (Lady Finger)
Beech
Cherry Dwarf
Citrus Dwarf
Crab Apple
Date-plum
Elderberry
Finger lime

Lemon Myrtle
Lilly Pilly
Monstera (Fruit Salad Plant)
Nectarine
Olive
Pawpaw, Papaya
Prickly Pear
Peach Dwarf
Pear Dwarf
Persimmon Dwarf
Plum Dwarf
Tamarillo, Tree Tomato
Tree mugwort
Bamboo ‘Gracilis’
Serviceberry
Silverberry
Acacia/Wattles

3. Shrubs

Acacia/Wattle
Austral Indigo
Blackberry
Blueberry
Cape Gooseberry
Citronella
Currants
Curry Plant
Feijoa
Goji berries
Gooseberry
Guavas
Large Kangaroo Apple
lavender
Lemon Verbena
Mountain Marigold
Perennial Basil
Perennial Chilli,
Raspberry
River Mint
Rose
Rosemary
Scented Geraniums
Southernwood
Tomatillo
Witch hazel
Wormwood

4. Herbaceous Plants

Asparagus
Balm
Borage
Broad bean
Buckwheat
Calendula
Cape gooseberry
Cardoon
Comfrey
Dill
Fennel
French Sorrel
Garden Mint
Garlic Chives
Globe Artichoke
Hyssop
Lemongrass
Lovage
Marigold
Mallow
Nettles
Mint
Oregano
Parsley
Pepino,
Perennial Spinach
Rhubarb
Sorrel
Stevia
Tansy
Yarrow

5. Ground Covers

Alpine Strawberries
Sweet Alyssum
Basil Thyme
Black Cumin
Clover
Coral Pea
Corsican Mint
Cranberry
Creeping Thyme
Fat hen

Ground Elder
Lingonberries
Lowbush Blueberries
Marshmallow
Miner's Lettuce
Nasturtium
Pigface
Prostrate Rosemary
Roman Chamomile
Strawberry
Vervain
Violets
Warrigal Greens
Wintergreen

6. Roots

Arrowroot
Beetroot
Carrot
Cassava (Tapioca)
Chicory
Chives
Daikon
Daylilly
Echinacea
Garlic
Ginger
Ginseng
Horseradish
Jerusalem artichoke
Liquorice
Native ginger
Murnong
Oca,
Onion
Parsnip
Potato
Ramps
Salsify
Sweet Potato
Tree/Egyptian Walking Onions
Japanese bunching/Welsh onion
Yacon
Yam

7. Climbers (Vertical Plants)

Chokos
Climbing peas
Coral Pea
Cucumbers
Grapes
Honeydew Melon
Honeysuckle (Blue-berried)
Hops
Kiwi Berry / Hardy Kiwifruit
Kiwi fruit
Malabar Spinach
Nasturtium (Climbing)
Passionfruit
Perennial bean (scarlet runner bean)
Pumpkin
Rockmelon
Soybean
Squash
Sweet Potato (‘Bush Porto Rico’/'Centennial’)
Wild grape