Soils for wicking beds

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Summary

Many people think wicking beds are just to save water; the most important feature however is creating a mini ecology with a complex soil biology which can release nutrients and trace elements in the soil so the plants are rich in phytochemical to improve health. This article shows how even poor soil can be regenerated using soil biology.

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Who does the public relations for soil?

Dirty, boring, yucky, so 2012 as teenagers say. Now I am a soil nut, we could not exist without soil, we are totally dependent on soil for our food and clothing - don't think hydroponics will save us - most of the feed stock comes from soil anyway.

Many of our environmental problems come down to soil, one of the worst aspects of deforestation is the destruction of soil, yet soil could hold enough carbon to sequester manmade emissions for fifty years, giving us time to come up with alternative energy.

Soil is among the world's most critical resources yet we have a food supply system dominated by major companies who pressure farmers to destroy their soil to stay solvent. Let's face it farmers do not wake up each morning and say 'I think I will destroy another 400 hectares of soil, I only did 250 yesterday so I must make a special effort today'.

Rich or poor we all need soil.

What a learning experience

Some forty years ago (yes I know I am old) Australia suffered terrible dust storms losing millions of tonnes of top soil. I realised that at some point in time people would want to know how to regenerate top soil so I started a series of experiments. I bought every soil improver and clay breaker I could find, gypsum, dolomite, sea weed extracts, sulphur based clay breakers, saw dust, wood chips and so on plus I also experimented with different ways of working the soil such as contour ploughing and roto-cultivation, green manures etc. Whatever else you may say about these experiments they were certainly obsessive.

What did I find? There is simply no magic powder you can sprinkle on claggy clay that will convert it to beautiful loam. Pity - it would be worth a fortune, but that is the reality.

But over these last forty years I have found that you can make soil, not instantaneously, but you can make beautifully productive soil by following a **process**.

Now I anticipate some readers will want a simple step by step procedure. I do that right at the end but first I want to have a bit of a yarn to show how the basic principles were established.

Bartering food

My relationship with soil goes back a long way. I was born and Hitler declared war and tried to starve and bomb us into submission. Every bit of available land was brought into production to grow food. To me, as a toddler people growing food and bartering a sack of potatoes for a few cabbages was the way the world worked.

One of my earliest lessons about soil was the use of the use of the humble potato. A lot of waste land, basically covered with weeds and overgrown was brought into production. To get rid of all those weeds would have been a horrendous job, made worse as there were no people to do it - they were all busy making spitfires. But potatoes are a hungry crop that could out-compete the weeds and make the land productive for other crops later on. A useful lesson - look for ways of letting nature do the work.

That lesson was rammed home many years later when in a burst of ignorant youth I roto-cultivated my lawn to break up the heavy clay. When I finished it looked beautiful, a nice fine tilth. But after the first heavy rain it turned into concrete.

The mystery of the dead chook – it took 65 years to solve

Another early learning experience I can recall about soil is when we buried the remains of a chicken in the lawn. You will not be surprised with all those nutrients that the grass grew taller and greener than the surrounding grass. But the grass continued to be taller and greener for year after year well after all the nutrients had been dispersed.

It was some sixty five years later that I began to understand the mystery of the dead chook.

Not that long ago I noticed the traditional fairy ring of mushrooms on my lawn. These sort of come and go as they feel like it, we know how they work, a mushroom has a ring of 'cannons' ready to fire out spores. When the conditions are just right, and you need to be mushroom to know when that is, they all fire off together creating a ring of spores a meter of so away which makes the fairy ring. But if you look at the grass inside the fairy ring it is much longer and healthier than the surrounding grass.

Now we know that the fungi are particularly effective, far better than plants, at extracting nutrients from the soil, there hyphae are very fine so can exert very high pressures and they exude enzymes which can dissolve rock particles so the plants have an extra supply of food.

So the mystery of the dead chook was resolved, true the nutrients gave the grass a kick start, but they also started a fungal colony which year after year helped feed the grass, long after the nutrients had been distributed far and wide.

Farming the soil biology

Soil is created by the millions of creatures that live in the soil - the soil biology. This is a complex business which scientists spend life-times studying. But you do not need to know about every species in the soil, rather you need to know how to farm the soil biology, just like a farmer looks after his cows.

Soil biology has goodies and badies, mycorrhizal fungi and worms are highly beneficial creating the structure for the soil while nematodes can eat away the roots, and cinnamon fungi and phylloxera create much damage.

The aim is to 'farm' the biology to create conditions that encourage the beneficial biology while discouraging the detrimental.

Plants, by photosynthesis, provide the energy for soil biology. Some crops are beneficial for soil regeneration but generally selecting plants specifically for soil regeneration is faster and more effective. The plants selected depend on the natural soil type and the climate. I call these soil trees; they are grown purely to create good soil.

Xiulan, my wife thinks I am mad, 'you grow rubbish trees' she says. But this is one of the few times I am right and she is wrong, growing trees to improve soil may waste a bit of land, but it makes the crops I do grow much more productive.

Selecting the appropriate soil tree is an important job and it depends on the soil and the climate.

I live in an area which is subtropical, (near what is left of Bundaberg after the floods) it is at the same latitude as our major deserts and is dry for much of the year, there is no regular rainfall we just get the edges of extreme weather, mostly cyclones form the North in summer but sometimes we get a winter storm from the South.

My soil is a seriously heavy clay sticky, claggy and virtually unworkable when wet but like concrete when dry. These are pretty extreme conditions so I have to search for a seriously tough plant that can thrive. On the other hand I do not want it too ferocious so it becomes a weed, there are plenty of weeds that thrive in our conditions but they just get out of control.

The most successful plant I have found to date is Senna Alata. It can be grown from cuttings but seeds are probably the easiest and it can reach maturity and flower within the year. It can be grown as an annual or as a permanent tree to act as a host for the mycorrhizal fungi and worms.

It produces abundant foliage which I use to feed the soil biology, and seems to thrive under all conditions and is tough enough to out compete the weeds. It is a legume, so harvests nitrogen and is efficient at 'mining' phosphorous, so it is a good source of two of the big three N.P.K. The root system is extremely tough and seems to have no problem in penetrating my heavy clay. Once I tried to grow it in polystyrene vegetables boxes, - the roots just when right through.

The only snag I have found so far is that it is does not handle frost which kills of the stem and branches, but the roots seem to survive so next year the plant just regrows, and it is such a fast grower that I do not see that as a big problem.

I grow them in my wicking beds (they make great stakes for beans and tomatoes) but also use them in new system I am experimenting with which I call a sponge bed.

Wicking boxes and beds are fine for smaller use but what about on a larger scale. This is where I see the sponge bed could be the answer. There is no plastic sheet to provide a seal to prevent the water leaking away. Instead I am creating a highly absorbent layer deep in the soil. It works like a baby's nappy - holding onto the water to maintain that uniform moisture essential for the beneficial soil biology.

Moisture the key

Moisture is the key to soil regeneration. I know that most people think of wicking beds as a highly efficient way of watering with virtually no loss to evaporation or soaking beyond the root zone, but to me the way they maintain a uniform moisture to aid the soil biology is equally if not more important.

But why is moisture so important? To answer this I must talk about the differences between bacteria and fungi. They are both decayers, taking their energy from the organic material from plants, but they behave very differently.

Bacteria are everywhere; they can live almost anywhere on earth in the most extreme conditions form sulphur emitting vent holes deep in the ocean to high up in the atmosphere. They break down the organic material emitting carbon dioxide while a certain amount of

carbon goes into their bodies. But they are short lived and when they die their bodies are eaten by yet more bacteria releasing more carbon dioxide into the atmosphere.

The net result is that they are actually reducing the level of carbon in the soil. They are very small and do not move about and while they do release some nutrients to the soil they do very little for the structure of the soil.

Contrast this with fungi. They are even more effective decomposers, attacking the hard material like lignin (hard wood) which the bacteria tend to leave. This forms humates, (or humus) complex organic chemicals which are stable in the soil for years, both storing carbon and aiding the structure of the soil.

Fungi are very long lived (in appropriate conditions) and hold a significant amount of carbon in their bodies, but they are very effective at giving the soil its critical structure, breaking up the soil and making it porous to hold more water and nutrients and allow the plant roots to penetrate the soil. Plant roots exude saccharides which feed the soil biology, so there is a natural symbiotic relationship.

The mycorrhizal fungi form an even more effective symbiotic relation with the plants attaching directly to the roots, the fungi provide the plant with moisture and nutrients which fungi are very effective at harvesting (better then plants) while the plants provide the fungi with sugars and energy. Pretty neat deal!

The fungi are far more sensitive to moisture levels only flourishing in a limited range of moisture. To improve the soil we want to preferentially encourage the fungi which we can do by maintaining the moisture level.

Worms, the other great soil conditioner also thrive in moist conditions. However there are different types of worms which fulfil different functions in soil regeneration. The worms normally sold are compost worms which do a brilliant job of breaking down organic matter however they tend so stay in one spot.

Other varieties of worms are much larger and stronger and are deep burrowing; they will come to the surface to gather food then go back deep into the soil. As they travel they make the soil much more porous and play an important part in soil regeneration.

The major advantage of wicking bed is they maintain the soil continuously moist, not t wet not to dry, just the right conditions for the beneficial soil biology.

Bio-packs

But how do we get the right biology into the soil? I have many years experimenting and am now developing the bio-pack. I am using wicking beds with their consistent moisture levels to grow what is in effect a complete eco system of plants, mycorrhizal fungi, worms, micro nutrients and the other components of soil biology. These bio-packs are small enough to be shipped as an inoculator to initiate the soil biology.

Just scratch out a little hole in the ground, pop in a bio-pack, go and relax and let the biology do the work. Life may be hard but is doesn't have to be all that hard.

Soil dynamics

Soil can be created but is also being destroyed by the release of carbon back to the atmosphere. The organic materials in the soil are essentially long chain molecules with carbon as the backbone, just like plastics. But UV degradation and oxygen are powerful

destroyers of long chain molecules. If you have ever left a bit if plastic out in the sunlight you will have seen how it first goes brittle then cracks and finally disintegrates. It is the same with organic molecules on the soil; they are continuously being broken down by the deadly combination of UV and oxygen.

But to make matters worse, the bacteria are also breaking down the long chain molecules. The net result is a loss of carbon back to the atmosphere. On the other hand plants are continuously extracting carbon from the atmosphere so carbon is continuously cycling. If we manage the system using plants, such as soil plants, to continuously extract carbon from the atmosphere the carbon content and soil quality will continue to increase year after year.

However if we adopt inferior farming practices (as farmers are often forced into) with a lower carbon capture then carbon loss will exceed that gained so the carbon level will decrease.

Clay, if left unattended, will always revert back to its original form so it essential to keep the soil biology fed and watered so they just keep on making the soil better.

It is a bit like pushing a wheel chair up a hill. If you continue to push you will eventually get to the top of the hill. But if you let go it will roll back to where you started.

Soil carbon and climate change

This cycling of carbon is the fundamental administrative problem with using soil carbon as a mechanism in fighting climate change. The rules, decided over twenty years ago, say that the carbon sequestered should be permanent, yet soil carbon is continuously recycling. It is totally the wrong way to look at the role soil carbon plays in climate change. It will never be a permanent solution to climate change; we simply have to adopt new energy sources.

But that takes times, but soil carbon is a cheap and immediately available technology which can give us a window in time while we make that change. On a global scale we could use soil carbon to stabilise our atmospheric carbon for up to fifty years while we make the needed energy changes, but we need to rethink the role of soil carbon. The current logic is just about as sensible as jumping out of an aircraft with a perfectly good parachute but not pulling the rip cord on the basis that the parachute will be no use after you hit the ground.

Meanwhile people have their houses washed away in the Bundaberg floods.

Soil for wicking beds

Wicking beds may be a very efficient way of watering plants, but they need good soil. One of the aims of developing the wicking bed was to create those moist conditions for the soil biology, particularly the fungi, which makes good soil.

So where do we start. We could of course just go and buy some soil. But here is the snag. Processed soils are deliberately sterilised so any harmful bacteria has been killed, but that also kills of the beneficial biology.

OK so you can buy top soil. Sometimes you see ‘mountain soil’ advertised, giving the impression that the soil is imported from the rich mountains of Nepal at amazing expense. Now what often happens in reality is that the company goes around building sites collecting the spare top soil, they take it back to their yard and pile up into a mountain then sell this as ‘mountain’ soil

So generally I prefer to use local soil and improve this. At least the soil will contain local soil biology which is well adapted.

Regenerating soil

The three basic aspects of soil are the physical, e.g. particle size and distribution, the soil chemistry, what nutrients (or harmful chemicals) may be in the soil and the soil biology.

Let's see how we can improve an existing soil – starting with the soil physics. There is a very simple experiment which is really quite fun. Just take a sample of the soil (about a cupful) and put into a glass container. Fill with water and add a little detergent. Break up the soil until it is a uniformly mixed slurry. With clay soils this can be a bit of work. Then just let the particle settle and watch from time to time.

If you have not broken up the lumps of clay properly they will fall straight to the bottom. Don't worry just mix them up and start again, maybe squeezing with your fingers until all the lumps have been broken down.

The larger sand particles will fall out first. This may occur in a few minutes. It always surprised me that a soil which looks to be totally clay with fine particles may still contain significant sand particles. Sand can also contain significant amount of fines.

This will form a uniform layer at the bottom of the container. Next the finer particles, which may be classified by a soil scientist as silts, will start to drop out. This will take a few hours. Finally the very fine clay particles will settle out. It could take several days or weeks for these very fine particles to settle out and the water is clear.

You may also find bit of organic material floating on the surface.

It is pretty obvious what the distribution of particles in your soil is like just by looking at the various layers which are usually pretty clear, but if you like you can drain out the water and examine the various layers using a magnifying glass or microscope. (You can buy quite cheaply little magnifying cameras that fit onto your computer. I bought mine on EBay and it is great fun).

Having found out about the structure of your soil it is time to start rectification.

Rectifying your soil - structure

If your soil is predominantly sandy you are lucky as this is very good for wicking beds. Normally sandy soils are not considered good as they hold little water or nutrients. The larger particle size means there is less area for the nutrients to bond to.

But sand is still a pretty good wicking medium, we don't have to worry about the water draining away and using the 'compost pipe' the plants are fed a compost tea which provides lots of nutrients.

If the sand level is extreme with no fines then adding a little clay may be beneficial. Clay particles are so small that they have a larger surface area that the nutrients attach to.

A heavy clay soil is not such good news but still solvable. You need to mix in a combination of dolomite or gypsum and sand. Don't be mean with the sand, too little will just make the clay like concrete without breaking up the clay. Add at least 20% sand.

When the clay is wet if is very difficult to mix with the sand and dolomite, it just forms frustrating lumps. Not much you can do about this other then let the clay dry out when the clumps can be broken up manually.

Now I have to admit that breaking up lumps of clay is not my ideal way of spending a Sunday afternoon - so I cheat. When I have got the big lumps broken down I will fill my wicking box to within about 50mm of the top, then add a 50mm layer of vermicast (worm casting) into which I can put my plants. The worms and soil biology can then take over the job from where I left off.

Now you have a base soil you need to start working in the additives to give the soil body and tilth. This will depend on what is available locally. Vermicast is excellent as is compost or whatever organic material is available. I use tonnes of mill mud, a by-product form the sugar mill near where I live, but it is really up to you to find a local source of organic material.

Compost really needs to be a balance between brown and green material. Unfortunately much compost is what I call brown, food scraps may contain a little green material but are still largely brown. This is where the soil trees come in - providing a supply of green leafy material.

In principle I prefer direct in soil composting but sometimes pre-composting is needed.

Regenerating soil - chemistry

Next we have to consider the chemical requirements. This is a mature area of science with many references, in particular Garden talk by Colin Campbell and The new Organic gardener by Tim Marshall. Colin's book has some very useful tips on recognising deficiencies by inspecting the plants.

If you are going to use a lot of undecomposed organic material you will need to add extra nitrogen as decomposition takes out a lot of nitrogen. I use chicken pellets and blood and bone.

But a word of warning, with conventional growing there is always a loss of nutrients by leaching. This does not normally happen in a wicking bed unless you deliberately flush. This means that it is very easy to over fertilise. I know you can get all sorts of test done on soils but the easiest way is let your plants tell you. If you are finding they are growing too fast, such as lettuce bolting prematurely or radish and carrots splitting then you have too much fertiliser, particularly nitrogen.

Generally the big three (N,P,K) are readily available so be careful how much you add. I prefer organic fertilisers as they are slow release, but I am quite happy about adding extra potassium even as a chemical.

Now comes the minor and trace elements and this is where the controversy starts. Soil scientists generally talk about primary, secondary and trace elements. Plants must have some of these but the amounts are very small. That is to make the plants healthy.

But we are animals and the amount of these minor and trace elements we need is much higher than plants, the level of these elements in our bodies it typically ten times that found in plants. This is also important for the soil biology, worm farmers report that feeding the worms extra minerals improves their health.

And this is where I must digress.

Delusions of self sufficiency

When Bill Mollison first launched permaculture on the world it created quite a stir. His arguments about the weaknesses of modern mono-culture agriculture seemed so powerful that I was hooked and decided I would have a go at self-sufficiency. Now that was a learning experience. I learned that it is relatively easy to plant the seeds and grow a good crop; it is a totally different thing to plants seeds every couple of weeks or so and get a continuous supply of food.

First there is the human fallibility of not planting on a regular basis, now that is my problem - but then there is the issue of natural variability and the weather. Let me tell you what about the real world and self-sufficiency. I can put in a quarter of a packet of lettuce and the germination will be pretty poor so I know that I am not going to get a good enough crop. So I will race out and plant a full packet to allow for losses. Now as far as I can see I have done everything exactly the same as last time but this time I will have virtually 100% germination so I think I am going to be flooded with lettuce.

Now I live near Bundaberg and we were hit by a mind blowing amount of water. We had 820mm of rain in 3 days. We had 300mm fall on the Sunday night (when North Bundaberg was washed away). I reckon that we had 100mm fall in about three hours; I thought I would go outside with my torch to see whether the drainage systems I put in after the last floods were coping. The force of the rain and wind was so great I turned straight around and went back to bed. This was no place for humans to be outside.

In the morning I inspected, the drainage systems I put in after the 2011 floods went straight under my house. These had done an excellent job, just some wind-blown rain but no flooding. But my bumper crop of lettuces was totally pummelled into the ground.

I think back to the war time, when we weren't playing at self-sufficiency it was for real. How did we manage? Well we did not have a continuous supply of fresh vegetables, we grew crops which could be stored, we had sacks of potatoes in the cellar, mum pickled what seemed like sixty million jars of cabbage, made jam and preserves.

Now I am happy to let nature takes its course and just see what grows well. The answer on my block is pumpkins, I don't think I have every planted or bought pumpkins, many years ago someone may have given me a pumpkin and the waste went onto the compost. Now every year we have this forest of self-set pumpkins that invade our property - enough to feed us for a year. Yes it would be perfectly possible to be self-sufficient but in my case that would mean periods of living of pumpkins and that does not necessarily mean a healthy diet.

Now you have heard my views on our food distribution system, and it is just a fact that plants are bred for appearance and shelf life rather than taste or nutritional value. But give them a go; they have been remarkably effective in bringing food from all over the world to the local shop at remarkably low prices, (even if that means squeezing the farmer on price).

So what do we do? Well I am relatively lucky, I live in a rural area with a local market where I can buy food grown locally and even our supermarket (run by a local guy) buys in local produce. So I grow what I can and buy locally what I cannot. But I want to make sure that the food I grow provides the phytochemicals my body needs.

Phytochemicals are the complex chemicals produced by plants some of which are known to science while many are not. But as long as we eat some food grown in soil with a high concentration of the micro elements we need then there is a fair bet they are providing all the supplementary food we need.

I find it difficult to argue the case, on either economic or practical reasons, for trying to replace **all** bought in foods with home grown. But I strongly argue that you can grow high nutrient rich plants, full of phytochemicals, to provide the necessary minerals and speciality chemicals (vitamins etc.) needed to health. This is an infinitely better approach than stuffing yourself full of expensive vitamin pills.

Can we be sure

Now you may ask if science hasn't even identified all these phytochemicals then how can I say that these are important for health? Well no one can be sure, but life is about managing risks. On the one hand I can eat fatty meat and greasy chips or I can eat a combination of fresh vegetables I buy in, plus some I grow some myself in soil with a high micro nutrient load.

I look upon these home grown vegetables as a supplement - much better than eating tonnes of vitamin pills.

Am I right?

Well to help you decide can I tell you a little story from my studies into anthropology. It is a little known fact that some hundred thousand years ago there were two breeds of human like creatures on the earth.

The first group were not particularly intelligent and just went about their business of surviving in the way that seemed best to them at the time and basically having a good time. But at least they were action orientated and got things done. These were the sort of guys that would pull the rip cord on the parachute, even if they had not worked out what to do with the parachute when the landed on the ground.

The second group were super intelligent; a bunch of Fourier's, Newton's and Einstein's who spent much of their days discussing issues of the greatest significance. Great debates of the highest complexity but they only took action were they were totally sure with total scientific proof. (Non rip cord pullers). Now one day they came around to discussing sex. They came to the conclusion that they did not have a proper understanding of sex and that as DNA was not going to be discovered for another hundred thousand years that they should wait until the discovery before having any more sex. WUSP was there motto, wait until scientifically proven.

Despite their super intelligence they became extinct while the other mob prospered. But the 'smarties' did not go quite extinct. A few of the lads thought that they should conduct some scientific experiments on sex, purely for knowledge of course.

So they high tailed it over to the other camp, where things had been quite active. After a good meal of kangaroo steak George asked Mavis if she fancied a bit of hanky-panky. Now Mavis thought well washing up won't be invented for a hundred thousand years, so why not, so off to the bushes they went to ensure the propagation of the species.

Now the lads from the intellectual camp met up with Mavis's younger sister and cousin and started to chat them up - as young lads do. Now these young lasses had not had any hanky-panky for some time and hadn't been brain washed into the benefits of abstinence by the yet to be invented religious orders, so they told the lads to stop talking, grabbed them by their kangaroo shirts collars and took them off to the bushes. And so their genes survived which is why we have people saying we should wait until the science had been confirmed before taking action on climate change (by for example exploiting the benefits of soil carbon). The solution to that is to incarcerate them all in North Bundaberg which was wiped out in the last floods.

So we may not be sure that eating at least some vegetables grown in soil rich in micro-nutrients is the proven way to health but it is certainly the best show in town.

But here lies the snag. It is easy to add the micro-nutrients to the soil, but these were made by grinding up rocks which are insoluble. Just adding micro-nutrients does not do much good, the plants cannot access them. This is one of the many roles of soil biology.

Regenerating soil - biology

Biology is what gives soil its structure; it creates aggregates and fine passages which enable the roots to penetrate the ground and the soil to hold much more water.

Soil biology is what releases the nutrients which may be locked up as insoluble minerals into the complex soluble chemicals which the plants can take up.

Whether you are starting with a clay or sandy soil the soil biology can convert it to open quality soil with a good tilth. It is as the heart of making us healthy by eating healthy plants.

You can see I get a bit steamed up about soil biology.

So what do you need to do to get a good soil biology? Well just take what I am about to say as a bit of a shock treatment, forget about your plants, whether they have enough water and food, just be totally obsessive about your soil and its biology. (I told you I was a soil nut). But this is not as daft and extreme as it sounds. If you look after the soil biology the plants will automatically grow well.

Now do not think for one minute that you can just go and buy one of my bio-packs and you will end up with beautifully rich soil, because you won't. Putting a bio-pack into your soil is a bit like having a baby dumped on your door step. If you just leave it there it will simply die - you have to look after it by feeding and watering it (and let it breath).

Watering with a wicking bed is easy. In a wicking box it is convenient to use a sight glass, (which also makes them easy to drain). In the larger wicking bed, it is not so easy to

put a sight glass, so even if you use a compost pipe it is still a good idea to have a pipe so you can see the water level. The only decision is whether to keep the water reservoir topped up (shallow cycle) or to let the water level drop until almost empty then refill (deep cycle).

I prefer the deep cycle for two reasons. First the deep filling and emptying cycle is actually sucking and expelling air - like breathing. Secondly I now fill my wicking bed completely with soil and do not use a separate reservoir. The plants can then use the full depth of the soil, the roots do not mind an occasional saturation you get with the deep cycle but with a shallow cycle they will not live in the continuously wet soil.

Feeding the soil biology is more complex.

Soil biology cannot photosynthesise (generally, algae and some specialist organism can). They are totally dependent on the plant for the plants for energy. Mycorrhizal fungi gets its energy directly from the plants but the rest of the soil biology has to chump up dead plants.

On my first generation wicking beds I had a plastic water pipe feeding the bottom of the bed, in the second generation I added a worm bed, typically a plastic bucket with holes in the bottom, filled with organic waste and worms. Then I thought this is silly I am wasting a lot of space in the bed and the worms are a bit restricted and may not work through the bed properly, so I combined the pipe and the worm bed into one.

It's dead simple. When I make a bed I just put a pipe into the box, fill the box with soil and the compost pipe with (yes you have guessed it) compost. I pull out the plastic pipe making sure the compost is pushed down. Next put in the bio-pack, then the seeds, water and I am away. It is really a question of minutes to set up a box.

This is a relatively new method. A hole is formed in the soil using an old flower pot or a pipe, this is then removed and the hole filled with compost.

I have had no problem with the water pipe clogging up, but I have a variety of weapons (see pic) to clear it out or make a new one if needed. I am also using these tools to make compost pipes in existing beds.

To maintain the box I water through the compost pipe, this flushes out a compost tea which flows to the bottom of the box then wicks up. I can add fertiliser and the trace elements to the compost pipe. Using chicken pellets and blood and bone help the compost to decompose.

I do pre-compost some of my rubbish but I also like to add fresh green material to my compost pipe.

Adding further compost is where wicking bed users seem to have a variety of approaches. Some like to use it as a mulch around the plants. I am sure this is good but I have a slightly different view. Surface mulch is broken down both by UV light and bacteria whereas my approach is to say that all that light that is falling on the mulch can be used to grow more plants, I like companion planting putting new plants in among the others as a space appears.

I could argue the technology for doing that but the real reason is that I am just a messy person and just like having a rolling stream of plants filling up all available space – it just suits my personality. Many people like plants in nice straight rows, if you are one of those I salute you and please come and tidy up my house which is a mess. (Xiulan is in China so I can get away with the mess, as the saying goes while Xiulan is away Colin messes up, I think the original was more to do with cats and mice).

Have I had problems? Well yes some of my early beds which used mainly clay with no sand have become quite hard but that was after about five years. I simply aerated by pushing in a fork and levering back until the soil cracked. I did not dig or disturb the soil and it worked fine. I will just have to wait another five years to see how the current system using more sand, dolomite and the bio-pack work out over time.

I will just mention that in my sponge bed I am putting the cutting from my senna trees into trenches so it goes **into** rather than **onto** the soil, but these are still experimental and the topic of another article.

Bringing it all together

So at last here is the summary

Check the available soil for sand and clay content.

If the soil is predominantly sandy then you can use 75% soil but if clay is available 50% sand with 25% clay may give more body to the soil.

If the soil is predominantly clay then use 50% clay 20% sand 5% dolomite or gypsum

Add 20% vermicast or compost

Add 5% organic fertiliser chicken pellets and blood and bone

Build the compost pipe into bed and fill with compost (insert dummy pipe, pack soil around the outside, carefully pull out dummy pipe).

Create small holes every metre and bury bio-pack level with surface

Plant as you see fit

Ensure compost pipe is regularly filled with fresh compost and add trace elements as needed.

About bio-packs

Bio-packs are my latest passion to provide a broad spectrum soil biology. I am trying to create a miniature self-contained eco-system. I am growing plants which have been inoculated with mycorrhizal fungi so it is properly established before shipping. The plant I have selected as a host or mother is gotu kola. This is a herb with reputed major health benefits, is tough and fast growing. Upon request I will also incorporate some senna alata seed. I should point out that these only germinate when the soil is warm.

The bio-pack is heavily loaded with a mixture of both compost and burrowing worm eggs and trace elements, certainly sufficient to start a wicking bed off. You should probably add further trace elements annually. We can supply if needed.

At this moment I would describe the systems as pre-commercial. To be honest I have no idea what the demand for bio-packs will be, this is the first time I have announced them. For the moment I have set up a couple of wicking beds and will supply straight from the bed on

receipt of request. The senna are setting seeds as I write but these need to be dried out ready for the spring.

Currently I am looking a price of $25 per bio-pack (plus p&p) which will inoculate a meter square. If there is the demand I will organise larger scale production by a commercial organisation. In view of the length of time it takes to establish a mini eco-system in a wicking bed I doubt if they will do it cheaper than I can.

You should contact me directly if you are interested. colinaustin@bigpond.com