The Permaculture Practitioner, Journal 2 – Comfrey (Last updated June 2013)

This Journal series is a collection of notes and discoveries based on my own practical experience in Permaculture.

I have chosen to focus on a small number of design elements, practical techniques and sustainable practices that play a significant role in my own designs and could play a role in your own.

It is my humble opinion that these design aspects are of such high individual value to permaculture practitioners, and anyone interested in food production for that matter, that they warrant particular attention.

The order in which these journals are presented has no bearing on the design process itself. Rather they reflect significant discoveries of my own on the way to becoming a better practitioner of permaculture.

I've always been wary of preachers who have no dirt under their nails. So, unless I see good reason to, I only cover aspects that I have my own direct experiences to draw from. I hope you find these notes of some value...

About Permaculture

"The only ethical decision is to take responsibility for our own existence and that of our children" This is the prime directive of permaculture - (Mollison, *Permaculture A Designers Manual*, 1988)

From a values and ethics perspective permaculture practitioners believe in caring for the Earth, our People, in balance and fair share.

As a design system permaculture can be described as an interdisciplinary Earth practice that seeks to embrace and collaborate with nature to gain the outcomes we desire.

To me permaculture is very much a state of mind that reflects sound well thought out logic backed by a deep sense of wellbeing for all. It's entirely practical and can be implemented at a macro and a micro level, piecemeal and whole.

Pig in the Mud Forest …

Is a `one man' (that's me) orchard development on the slopes of the lower North Island of New Zealand.

Comfrey – The King of Accumulators

There's a paddock not far from the orchard that's covered in row upon row of comfrey. The soil in that paddock is some of the best soil I've ever seen. It's the colour of dark chocolate and it's teeming with life. It's soft, friable and it smells like well-matured compost.

I now know, after working with comfrey for some time, that these are the tell tale signs of a well-established Comfrey plot. Comfrey is good for your soil!

When I first saw that paddock, some years ago, it was the first time I'd seen comfrey in action. I already knew comfrey was supposed to be good for your soil but to see it working its magic on such a scale really got me excited. It felt like I'd discovered something new and important.

After some investigation I found out that the benefits of comfrey were indeed well researched and publicised decades ago. And the results of that research were quite outstanding and profound. With so many redeeming features It just seems odd to me that comfrey isn't as well known as it should be today.

Well I think it's time for the world to rediscover comfrey, the King of Accumulators, and I believe comfrey has the potential to address many of the problems now facing modern agriculture as a component of an approach more in tune with nature. And I hope this journal entry provides a worthy introduction to you on the benefits of comfrey.

A Keystone Design Element

In Journal entry one I described permaculture practitioners as those who seek out design elements that can fulfill many purposes. In doing so we achieve design integration and efficiency, we can get more out of design implementations for less effort and less waste.

I also referred to `keystone' design elements. These are the most versatile design elements I've come across that I can very easily build on and connect other design elements to. There's no doubt in my mind that comfrey is a keystone design element. It's versatile and so good at what it does.

Comfrey works for you without fuss. It's easy to propagate in cold and temperate environments and once you have a comfrey plant you have it working for you for life.

Origins

Common comfrey (*Symphytum officinale*) comes to us from the hedgerows of Europe and has a long and rich history more so as a medicinal herb than for its application in agriculture.

I'm no Physician so I'm not going to tell you how to use comfrey to improve your health. But what I can tell you is the history of common comfrey as an agent of healing.

Perdanius Dioscorides, a Greek physician who practiced in ancient Rome during the time of Nero, made the first documented record of a medicinal herb known as `Knitbone' over 2000 years ago in *Materia Medica*, the precursor to all modern pharmacopeias, used as part of a poultice to close up wounds and as a tea in treating `bloodspitters' and `hernias'

Over the years comfrey has been spoken of as an `old women's remedy' attributed with a slew of astonishing cures of various maladies of the digestive system and in accelerating healing for wounds and broken bones, hence the name Knitbone.

I believe its healing qualities are largely attributed to a substance found in the roots and terminal buds of comfrey called Allantoin. Allantoin, first discovered in the allantois (part of a developing mammal embryo) and also excreted by maggots as they debride wounds, is a cell proliferant.

Though today most modern herbal references will caution against internal consumption of comfrey due to the presence of natural toxins known as hepatoxic pyrrolizidines, which, in certain levels, are known to cause acute reactions and/or slower chronic conditions of the liver.

Our attention in this journal entry turns to the modern hybrids of comfrey and their application in the garden and orchard. The modern cultivated comfrey we use in the garden and orchard, or Russian comfrey (*S. peregrinum*), is thought to be a first cross hybrid of the common comfrey (*S. officinale*), and prickly comfrey (*S. asperrimum*).

Known for it 'mucilaginous' properties, in the late 1880's, Henry Doubleday tried unsuccessfully to develop stamp glue from comfrey. With more research Doubleday came to understand the potential for comfrey as a fodder crop and as a source of protein and spent the last 30 years of his life researching and promoting comfrey. It was his dream that comfrey would one day feed a hungry world.

Lawrence D Hills, who established the Henry Doubleday Research Centre in 1954, continued Doubleday's research. He identified a number of parent strains and from those 30 distinct varieties. He decided at the time that each variety would be identified by the word *`Bocking'* the place where his first trial plots were grown, and a number. The most common variety of comfrey used for agriculture is bocking number 14 as it has very high potash content compared with other varieties and is a very hardy plant.

A Mineral Mine

In *Comfrey, Past, Present and Future*, Lawrence D Hills describes comfrey as a mineral mine for plants.

By deploying a series of taproots that extend deep down into the soil comfrey is able to extract and accumulate large quantities of potassium (around 7%) and to a lesser extent phosphorous (around 1%), calcium (around 3%), magnesium and other trace elements.

The comfrey leaves act as storage bins for the cache of extracted minerals. The resulting proportions of minerals stored make for a well-balanced, readily available form of fertiliser that's ideal for many of our most popular crops such as potatoes, onions, tomatoes and citrus fruit.

The comfrey leaves themselves have so little fiber and so much protein, resulting in a carbon to nitrogen ratio of 14:1, that they will break down rapidly when harvested. For this reason comfrey has been referred to as `Instant Compost'

I like this term because it gets you thinking of comfrey as an instant compost source and the ways in which you can use that compost.

Comfrey leaves are commonly applied as a layer in the build process of compost piles, as an `activator', employed to fuel the composting process.

Kay Baxter's book, *The Koanga Gardening Guide* has a liquid fertiliser recipe based on comfrey. In a barrel pack it with comfrey leaves and then fill it up with water. Stir it daily and once the green leaves have disintegrated remove the fibrous stalks with a garden fork. The resulting liquid fertiliser is perfect for tomatoes and indeed many of your other gross feeders undiluted.

Kay also recommends leaving the drum uncovered as hover flies; beneficial predators who like eating aphids, love to lay eggs in the liquid feed barrels. You'll see what look like maggots with long tails wiggling through the water. They're the hover fly larvae.

My own liquid fertiliser set up is fairly rudimentary but it works. I like to keep two on the go; one prepared a week before the other. This means during spring and summer I always have access to liquid fertiliser. Using Kay's recipe I prepare mine in large plastic rubbish bins chalking the date prepared on each so I have an idea of when I can use them. I prepare them well away from the house so I can leave the lids open for hover flies and wont upset everyone at home with the smell.

Stir it daily and after about a week you'll notice a putrid smell coming from the liquid. This is a sign that the proteins from the comfrey leaves are beginning to break down. Continue stirring daily and after approximately 10 days, once the leaves have disintegrated, I extract my liquid fertliser from the rubbish bin with a nine-litre bucket and pour it wholesale over my garden beds. The remaining fibre, left at the bottom of the rubbish bin, is cycled through the compost heap.

Sometimes I find it just as convenient to work raw comfrey leaves in where I need it. I hand cut my comfrey with a machete and then run over the leaves with a lawn mower so I end up with an easily applied mulch amendment. If you do this be careful to cut well above the base of the leaf otherwise you may inadvertently end up transplanting sections of the crown root and you'll end up with comfrey popping up all over the place.

A comfrey barrier, using modern cultivated comfrey, planted around a garden can provide a very effective barrier for weeds, like Kikuyu (*Pennisetum clandestinum),* and also provide a healthy supply of raw comfrey leaf for your liquid fertliser. But be careful to ensure you don't plant comfrey close to anywhere that will be dug over at any stage. Comfrey roots extend beyond the reach of the plants themselves. So be sure to account for this when you plan your weed barrier and make sure the variety you have is indeed the modern non-self seeding variety. See the propagation tips later in this journal.

Comfrey leaves can be used at the time of planting various crops such as potatoes and onions. Extensive trials in the United Kingdom and elsewhere have shown that potatoes provide consistently heavier yields if they are grown in trenches laid with comfrey leaf. In New Zealand this would only be possible for mid and late potatoes, as the comfrey will still be dormant when its time to plant early potatoes. Though for early potatoes you can incorporate cut comfrey leaves to good effect into the soil as you heap soil around the growing plant.

You can grow comfrey just where it's needed as a fertiliser and that's what we've done at the Orchard. More on this later…

As Fodder

Russian comfrey is a perennial fodder crop, in the Lucerne class for nutritional value. By volume comfrey can produce twenty times more protein than soya beans! The world record comfrey production in a single growing season is 124 tons from an acre plot; in temperate regions 50-60 tons are possible. So as a source of fodder all of this means you can feed more livestock from less land.

Lawrence D Hills amassed a good deal of information from those using comfrey as a source of fodder. I have no practical experience in this topic at the orchard though I thought it appropriate to share some insights.

What I found of great interest reading through *Comfrey, Past, Present and Future*, is that with an average protein content of 24% of dry matter and low average fibre content of around 10% comfrey makes for an ideal fodder supplement source for pigs and poultry.

Comfrey has in the past been used as supplemental food for pigs particularly for fattening and for sows to boost milk production. It has also been used very effectively as a cure for scouring in pigs and other livestock.

Comfrey and poultry are thought to be highly compatible. The digestive systems of the fowl are quite intolerant of fibre. With too much fibre in their diets their digestive systems can slow down and egg production will drop.

A good rule of thumb, to maximize egg production, is to keep the total fibre content of your poultry diet to between 5 and 8%, and nearer to the lower limit the better. This is where comfrey can play a role.

Extensive trials in United Kingdom during the 1950's showed poultry to be consistently healthier when fed comfrey as part of their mash. Egg production was boosted, egg yolks were yellower and richer tasting due to an increase in vitamin A, and the eggs showed a marked increase in riboflavin, niacin and vitamin B12.

Comfrey is one of a select few in the plant kingdom able to synthesize vitamin B12. For vegetarians, who rely on eggs and milk as a primary source of vitamin B12, B12 boosted eggs from poultry fed on a diet supplemented with comfrey could well be worth further research and exploration.

Talking to some folks who have experience with comfrey and poultry I understand that for many animals comfrey is an acquired taste. You may be able to wean them onto comfrey but the best way is to introduce it is when they're young so it becomes a staple in their diets otherwise it may be ignored.

A good way to feed comfrey to poultry is cut, thrashed and left hanging in the chicken run. Comfrey planted just away and along the perimeter of the run can also provide regular access to comfrey leaf.

If you have room you could implement a dedicated comfrey plot then run chickens through the plot to keep the plot weed free (In most cases the chickens will seek out the weeds in preference to the comfrey). By doing this you will also allow the chickens to fertilise the comfrey. Then when the comfrey is cut it can be feed back to the chickens in their coops. This is something I'm looking forward to trialing at some stage in the near future on another site.

Note: There is some potential for the bioaccumulation of certain natural occurring toxins, known as hepatoxic pyrrolizidines, in the products of animals fed on comfrey. An aspect we'll discuss at the end of this journal entry.

Some Comfrey Application Notes from the Orchard

At the orchard we've planted comfrey in a ring of four to six plants around every fruit tree. It's so vigorous that it suppresses other weeds that might compete with my fruit trees for nutrients.

By planting comfrey around the root zone of my trees I let it work for me in collecting minerals, the major proportion of which is potassium, and nutrients and then depositing them in the topsoil layer as they die down over winter. Trees only begin storing potassium when the temperature gets below 15 degrees Celsius so you can see these events coincide quite nicely.

The potassium we get from comfrey can make our trees stems stronger and the leaves thicker. When in fruit production potassium determines how many fruit are set and how large the fruit will be.

The comfrey also retains moisture around our trees. This is good news for the trees and also for the community of life in the orchard. As we don't use any artificial irrigation at the orchard this is particularly useful during those long hot days encountered over summer.

I've heard from others who have planted comfrey too close to their trees experiencing rot and disease so best to keep your planting around the root zone leaving a gap between your comfrey plants and the tree trunk.

The comfrey will continue unaided to improve the soil structure in the orchard with those deep reaching taproots. And it will do so for the life of the orchard!

Propagation Tips

The modern cultivated comfrey that's most common today doesn't propagate well by seed. This is because the flowers have a false bottom that blocks insects from pollinating them. You may notice little holes in the side of your comfrey flowers made by bees as a successful workaround for this particular pollen harvesting challenge. Though the result is that pollination just doesn't quite work for modern cultivated comfrey.

So we can't propagate modern cultivated comfrey easily by seed, which means comfrey won't take over. It stays where it's put. This is a good thing because once you plant comfrey it's very hard to remove. When you plant a comfrey plot there's a good chance you'll have it for life so plan carefully.

Comfrey will grow in most soil types though the soil needs to be reasonably loose and friable so those tap roots can dig their way deep enough down into the soil for the plant to thrive.

Comfrey is very easily propagated either through root cuttings or root crown sets. Any piece of root cutting is likely to produce a new comfrey plant so long as it's kept moist and submerged in the soil. All you need to do is ensure is that the thicker end of the root is at the top of an upright planted cutting and make sure you keep the immediate area weed free.

Another way that I've propagated comfrey successfully is to cut the roots into 4-5cm lengths, put them in a damp coffee sack and hang the sack in any environment where it's warm and deprived of light. Over the course of a few weeks keep the sack damp, the root cuttings will sprout and they can then be transplanted directly into the soil.

The method I prefer and use the most is to pot my root cuttings and sprout them in my hot house before transplanting. I get a near 100% success rate with this method and for me it's less work. With a couple of friends helping me I can easily pot two hundred or so root cuttings in a couple of hours. And I know I'll end up with two hundred comfrey plants ready to transplant four weeks later.

Root crown sets are also easily propagated. Using a spade it's a fairly easy task to slice off the root crowns and then cut them into cubes of around four cubic centimeters, then plant them in much the same way as you would a root cutting. From my experience root crown sets will bloom almost immediately after transplanting.

Don't worry about the donor plants where you took your cuttings. Within a matter of weeks you'll find new leaves emerging from the ground where you previously harvested.

The best time of the year to propagate comfrey is late spring when the new growth on the donor plants has matured. This is about the same time you would first harvest your comfrey leaf. Though don't worry too much if you can't at this time as comfrey cuttings will come away at most times during spring and summer.

So once you have your cuttings sprouted and transplanted then the only other task is to feed them nitrogen. Comfrey needs a good deal of nitrogen to grow well. A comfrey plot is in effect a method of exchanging crude nitrogen for a balanced organic fertiliser.

Two good sources of natural nitrogen that you could use are poultry manure and/or urine. Two parts water to one part urine makes for a perfect comfrey fertiliser applied whenever you feel the need.

Another option is to install a pigeon loft right where you're growing comfrey. The Pigeons will fertilise the comfrey for you every morning and evening.

If you're using comfrey around your fruit trees I would advise against harvesting these for your liquid fertiliser. Better to use a dedicated comfrey plot or harvest from your weed barrier.

The Comfrey Plot

I have two dedicated plots of comfrey back at home. One of these is on a hillside that was previously covered in wandering willie *(Tradescantia fluminensis)* and greater bindweed *(Calystegia silvatica).* Over the course of two seasons these weeds have been well suppressed and I can now harvest the comfrey leaf from this plot for my liquid fertliser.

The mantra for good comfrey production is "Keep it clean, keep it cut, keep it fed".

So when you establish your plot keep the area around the comfrey weed free. This is especially important in the first season while the comfrey is establishing itself. And in later seasons be sure to clear the weeds out around the comfrey in spring when the first comfrey shoots start appearing.

A comfrey plot should be regularly cut throughout the season. The world record plots for comfrey production recorded up to six cuts in a single growing season. I typically do four. Though in the first season after planting don't harvest any comfrey leaf so the plants can develop and put all of their energy into getting those tap roots as deep down as possible into the soil.

If you're soils are poor then you will need to feed your comfrey plants plenty of nitrogen to get them established. See suggestions for feeding in the propagation tips. In one of my plots at home I've sown white clover (*Trifolium repens)* and red clover (*Trifolium pratense)* as an understory to the comfrey. As clover is a legume it will fix nitrogen into the surrounding soil and it will help suppress the weeds in and around the comfrey.

As far as I'm aware comfrey doesn't have any major pest problems. It is a member of the order Boraginacae and as such avoids the multitude of viruses and eelworms that most modern crops seem to struggle with.

Comfrey likes lots of water and if the taproots can't get down far enough into the soil then it may suffer from water stress and be attacked by things like leaf miners.

A Natural Approach

At the orchard we've use comfrey to nurture our soils and feed our trees. I know that comfrey will continue to do this, unaided, for the lifetime of our orchard. So we're saving on labour costs.

Comfrey also saves us money as once established we can rely on it to make available to our orchard trees many of the important mineral and nutrients present in the soil.

And we know that it does all this work sustainably and in a way that does no harm to the orchard and supporting environment.

The Downside

Once you plant it then it's very hard to remove. Though I believe pigs are very good at comfrey eradication as they dig into the soil and eat the roots out completely.

I've also had reports of geese eradicating comfrey, as they love eating comfrey above all other plants, and successive sheet mulching eradicating comfrey. But I don't have first hand experience with either of these.

As described earlier another potential downside would have to be the presence of hepatoxic pyrrolizidines, or PA's, in comfrey. PA's are naturally occurring toxins found in around 6000 plants across a number of plant families.

PA's have been known to cause acute reactions and/or other slower chronic conditions of the liver. As a result most modern herbal references will caution against internal consumption of comfrey.

What I'm interested in is the implications of these PA's for me in the garden. And while I haven't done this yet I'm considering using comfrey as a supplemental feed for my chooks back at home. Here's what I discovered so far…

PA's have been found in milk (Panter and James, 1990), eggs and honey (Jameson *et al*., 1990) in some cases from animals foraging, or fed teas, from ragwort, another plant containing PA's.

Though I've not seen any such studies done on the presence of PA's from products of animals foraging on comfrey. If you do find some information on this please let me know.

There is also some uncertainty about the safe levels of these compounds (Dolan *et al*., 2010 and references within) that might present a danger to animals and humans.

In *Comfrey, Past, Present and future,* the edition I have was published in 1976, Lawrence d Hill shares a significant body of research presented by Dr D. B. Long that attempts to determine just that…

Dr Long notes that "Prolonged and extensive use of comfrey herbage as a feeding stuff for animals has failed to reveal any deleterious effects, but rather that of considerable benefit to the health of livestock"

So studies were conducted on the alkaloid content and toxicity between the chemistry department of the University of Exeter, the Toxicology Unit of the Medical Research Council at Carshalton and the Michaelis Nutritional Research Laboratory at Harpenden.

From the research conducted, with the help of quite allot of rats and a fair amount of comfrey from differing strains and hybrids, and other considerations, Dr Long asserts "that it may be concluded there is no toxic hazard from the use of comfrey herbage"

Tests on various parent strains and hybrids showed that the modern cultivated comfrey hybrids, the ones we generally use, to have far less alkaloid concentrations in them than that of the wild variety prickly comfrey (*S. asperrimum).*

It was also interesting to note that these tests indicated the alkaloid under test proved to be quite an unstable compound and easily oxidized. Dr Long hypothesizes that, as livestock tend to eat comfrey only when it's `wilted', at that time enzymatic breakdown of the alkaloids in question could well have begun.

I've noted similar observations with respects to ragwort. It appears under certain conditions, including aerobic composting, that PA's in ragwort break down relatively quickly, in weeks, (Crew et al., 2009).

So that's what I've discovered so far. Providing recommendations and/or guidance to you on this topic is not something I'm comfortable with as it's not my area of expertise.

Though if I have one recommendation it's that you do your own reading on this topic and if you can get hold of a copy of *Comfrey, Past Present and Future,* so you can review Dr Long's body of research for yourself.

Personally, I can speak for myself, I remain comfortable in how I use comfrey in the garden and orchard as a mineral accumulator around my trees, as a liquid fertliser and compost and mulch amendment.

As a potential fodder crop I'm comforted by the research presented by Dr Long. Though I'm equally confounded by the ongoing debate that appears to continue on this topic. Given the obvious potential comfrey has as a fodder crop it would be good to see more research conducted on this topic. I'm keen to explore the concept of using `wilted' comfrey as a supplement for my chooks. A topic I intend to further research and one I'll be sure to update you on as new insights are gained.

Nomenclature

The botanical nomenclature of comfrey is confused. As such you may see modern cultivated comfrey, or Russian comfrey, going by the name *S. uplandicum* or more commonly *S. peregrinum.* Russian comfrey resulted from a rare first hybrid crossing of the Common comfrey (*S. officinale)*, and Prickly comfrey (*S. asperrimum)*.

Other Journal Entries in the works

In the next journal entry we look at seaweed as an eminent bioaccumulator of many good things that we can use to support our orchard soils. We break seaweed down into the various constituents and look at the practical application of those constituents through methods such as seaweed teas and foliar sprays.

Related topics covered will include Trace Elements, Iron, Copper, Manganese, Some Basic Botany and what is Good Compost?

And in journal entry four we dig into the soil community and how our crops and trees control the soil community to their own benefit. We look at a practical technique called Aerated Activated Compost Tea that can be used to boost the foundation of the soil community and in doing so support the health of our trees.

Related topics covered will include Nitrogen forms, Worms and Vermicast

And thanks for the Help!

To Shar Packer, Kay Baxter, Laureen Bamford, Phyllis Tichinin, Dan Hemenway and Mike Packer my sincere thanks for your contributions to this Journal entry.

- Tim Packer @ Pig in the Mud Permaculture (tim@piginthemud.com)

The Books I Always Have Nearby

The Koanga Gardening Guide by Kay Baxter

Design your own Orchard. Bringing Permaculture Design to the Ground in Aotearoa by Kay Baxter

A home gardeners guide to Growing Nutrient Dense Food by Kay Baxter

Teaming with Microbes: The Organic Gardeners Guide to the Soil Food Web, Revised Edition by Jeff Lowenfels & Wayne Lewis. A Timber Press Publication ISBN: 13: 978-1-60469-113-9

Permaculture: A Designers Manual by Bill Mollison. A Tagari Publication ISBN: O 908228 01 5.

The Man who Planted Hope and Grew Happiness by Jean Giono

Nourishment Home Grown by Dr A. F. Beddoe. A Whitman Publication ISBN 1-885653-20-4

How to Grow More Vegetables than you ever thought possible on less land than you ever imagined by John Jeavons. A Grow Bio Intensive Publication ISBN: 1-58008-233-5

The One Straw Revolution by Masanobu Fukuoka. An Other India Press Publication ISBN: 81 85569 31 2.

Grasp the Nettle. Making Biodynamic Farming and Gardening Work by Peter Proctor with Gillian Cole. A Random House New Zealand publication ISBN 1-86941-657-0

Other References and Resources related to this Journal

Comfrey, Past, Present and Future by Lawrence D. Hills. A Faber and Faber limited publication IS/BN 0 571 10521 I

Natural plant toxicants in milk: a review K. E. Panter and L. F. James *J ANIM SCI* 1990, 68:892-904.

Report on Carcinogens Draft Background Document for Riddelliine. Scheduled Peer Review Date: January 24-25, 2008

Naturally Occurring Food Toxins Laurie C. Dolan *, Ray A. Matulka and George A. Burdock ISSN 2072-6651

Loss of Pyrrolizidine Alkaloids on Decomposition of Ragwort (Senecio jacobaea) as Measured by LC-TOF-MS- Colin Crews, Malcolm Diffield, Franz Berthiller and Rudolf Krska

Disclaimer

I offer this information to you in good faith on the understanding that the information I provide is at best an introduction. You should do your own research and/or training if a topic interests you and consult with experts if need be.

And while I have done my best to ensure the information is accurate I cannot take responsibility for errors or omissions, or for any consequences arising from reliance on the information I've provided. What you do with the information I provide in these journal entries is of your own accord and accountability.

Koha – A Value Exchange

I firmly believe, in a world facing such overwhelming challenges, that one of the most empowering things we can do for ourselves and for our legacy, the next generation, is to grow produce in our own back yards that is truly healthy. Healthy for us, for the Earth, and for the complex web of life we share the Earth with.

Using permaculture ethics and principles as a compass on a journey still in progress I've documented, in a number of journal entries, a number of practical experiences and important lessons picked up on the way to achieve this end. Every design situation and treatment must be unique, as will be your own journey in permaculture, though I do hope they can help you in some way.

You can download the journals from my website, <http://www.piginthemud.com/>, without charge. If these journals have been helpful to you, then please consider making a donation through my give a little page here - <https://givealittle.co.nz/cause/piginthemud> or by simply scanning this QR code…

Funds received will be used for research that will once again be shared freely, areas of focus include Comfrey Research and Cultivated Fungi Research. (Suggested Koha for downloads - $3.50 each or the set for $20)

These journal entries may be updated or added to on occasion, and I'm hoping to add more journal entries when I can, so do check the website from time to time. Share this knowledge! Please find others who would benefit from this information and pass these journals on.

Cheers and Thanks,
Tim @ Pig in the Mud