

The Permaculture Practitioner, Journal 4 – Aerated Activated Compost Tea (Last updated October 2011)

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.



The Soil That Feeds the World

I saw my first Aerated Activated Compost Tea bubbling away in a greenhouse at Hohepa Farm at Poraiti on the North Island of New Zealand. I was, at the time, attending a course in applied Organics and Biodynamics. It was for me a life-changing experience full of discoveries.

It was during that course that I was handed a copy of *Teaming with Microbes, The Organic Gardeners Guide to the Soil Food Web* written by Jeff Lowenfels and Wayne Lewis.

This book described a community of life that was for the most part hidden from view tending our soils and feeding our crops.

I was, of course, aware of the various inhabitants living in the soil before reading *Teaming with Microbes*. Bacteria, Fungi, Protozoa, Nematodes, Arthropods and Worms are all familiar names to many of us.

Though on reflection I really had no idea of their ways and means, of the complex relationships they share and have with the food we eat.

Teaming with Microbes presents a clear message and that is that all we need to do is work with this community in the soil and in return it will work for us for free.

And yet much of the food we produce in the world today is grown in ways that undermines and opposes the soil community.

Herbicides, pesticides and soluble fertilisers can disrupt and destroy the delicate balance the soil community strives so hard to maintain in our soils.

It just seems so counter intuitive to oppose a community of life whose very existence revolves around making our soils and our crops healthy, and yet, primarily through our own ignorance, many of us do just that.

Leveraging recent research including that of Dr Elaine Ingham, a soil microbiologist renowned for her work with the life that resides in soil, Jeff Lowenfels and Wayne Lewis, in *Teaming with Microbes*, turn the lights on the soil community in a way that's easy to understand and entirely practical.

They describe an approach to soil restoration and health that involves understanding the soil community and working with soil mulches, compost and Aerated Activated Compost Teas, or AACT, as tools in the soil restoration process.

In this Journal entry I'm going to share with you how we've utilised AACT as part of an overall soil restoration plan at the orchard.



With AACT we're simply taking a sample of fungi and bacteria from high quality aerobic compost. And we're breeding these microbes, through heat, aeration and in some cases additional supplements, in water. The resulting tea can then be applied as a spray and a soil drench. So you can get some of the microbiological benefits of a compost pile over a large area without having to actually spread compost.

Before we dive into our application of AACT let's first look at a couple of underlying concepts that will help us to understand more about the soil community and where AACT could fit into your own soil health regime ...

Plants, Controlling the Soil Community

The soil community is no doubt more complicated than we can imagine. Every day new discoveries are being made about this complex community of life that we so freely influence through our horticultural pursuits.

In fact in the time I've taken to write this journal entry a new revision of *Teaming with Microbes* has been published describing a newly discovered member of the soil community call Archaea, previously thought to have only existed in extremely hot water environments such as geysers and hot pools.

Another recent discovery is that plants are very much in charge of the soil community; they manage the soil community to their own benefit.

Some of the energy they gain from photosynthesis is used to produce exudates. that are leached into the soil. These exudates, primarily made up of carbohydrates, lipids and proteins, are secreted in and around the plant rhizosphere, a zone extending only a few millimeters in and around the plant roots, to attract and feed bacteria and fungi. Bacteria and Fungi are the primary decomposers of the soil community.

There are so many types of bacteria evolved for so many purposes in the soil. But functionally overall they excrete enzymes that are able to break down organic matter into their most basic forms.

Fungi are similar to bacteria in that they also excrete enzymes to break down organic matter. Though there are two important advantages fungi have over bacteria. Firstly the enzymes fungi employ have greater effect on more resistant plant matter than bacterial enzymes. Secondly fungi are much larger than bacteria and unlike bacteria they can grow. Fungal threads, or hyphae, are capable of extending over much greater distances to get the food they want.

So near the bottom of the food chain, these fungi and bacteria in turn attract and are consumed by larger soil microbes such as nematodes and protozoa. And it is the waste products, which includes a cache of minerals and trace elements, from these larger soil microbes that our plants require.



So you see we have a natural bioconversion process controlled by plants to gain the nutrients and minerals they need from the soil.

This natural interplay continues as our nematodes and protozoa are in turn consumed by arthropods. Arthropods, animals with segmented bodies, jointed appendages, and a hard outer shell called an exoskeleton, are a large family of creatures.

They include such things, as insects and spiders and they tend to eat each other and are also eaten by much larger animals like birds and lizards.

These cycles of life all work the soil to our plants benefit in the conversion of nutrients that can be readily taken up by plants and in the development of a soil structure that supports this nutrient conversion process.

It's a fragile and complex balance that can be easily disrupted. It makes me wonder what sort of impact we make to soil health when we weed our garden beds or plough our fields?

So you can get a sense of the influence we have on this community of life every day.

In effect by applying AACT we're boosting the foundation of the soil community to promote it's health. If we do this our crops will benefit and so do we!

Much of the soil that feeds the world is tired and has been severely undermined by unsustainable production practices, used to grow plants and protect them from the very creatures that as part of a balanced community would normally contribute to the health of plants.

As part of an overall soil health plan AACT, combined with pioneer planting, can play a vital role as the first important steps in the restoration of these damaged soils.



AACT Application Notes - A Recipe for Soil Restoration

Simply put, with AACT, we are using a sample of high quality aerobic compost to breed the bacteria and fungal elements of that compost in a measure of tepid water. This is achieved by aerating water at around 20 degrees Celsius for around 2-3 days.

Just so you understand the scope we're talking about here, in one teaspoon of compost you can encounter up to a billion bacteria, 300 metres of fungal hyphae, up to 50,000 protozoa and 300 nematodes.

By the time we've finished the aeration process we will have at least quadrupled the bacteria and fungal counts.

Don't confuse AACT with compost extracts, leachates or manure teas. These latter treatments are for the most part anaerobic, without oxygen, whereas AACT is an aerobic treatment where oxygen is present.

Anaerobic conditions generally lead to trouble. For a start these conditions kill off the good microbes we want to promote in our soils. And secondly they are a perfect breeding ground for harmful plant and human pathogens.

Interestingly enough, rather like brewing our own beer, we can come up with variations of the AACT that can be bacterial or fungal dominant to suit a particular purpose. We talk about this a little more later on.

What's more impressive about AACT is that it's cheap and only requires 25 litres per acre to be effective.

Here's how I make AACT for our the orchard...

1. A Bucket or Drum

I use a fifty-litre brewers drum with a tap at the bottom. This is enough to cover a couple of acres at a time so one can do the math to come up with smaller or larger versions if need be.

2. An air pump

Good aeration is key to get the most of an AACT. Aeration gives the beneficial microbes, the microbes that help our plants grow, the edge to flourish ahead of those non-beneficial microbes, the ones that don't help our plants grow.

An air pump will provide plenty of aeration to make the AACT process more effective. The water needs to be made turbulent from the aeration.



Note to those with no power: While I have no experience in this I've heard from others that have made AACT without air pumps. To do this I understand you prepare your tea in a wide container, with a large air to surface interface, and make sure you stir your tea as often as you can so it doesn't go anaerobic.

Though just understand with this approach the risks of your tea going anaerobic are much higher. So be ever more vigilant to those conditions arising and if they do arise then don't use the tea.

3. Some fish tank tubing

We need bubbles and plenty of them. In order to do this I use fish tank tubing, approximately 5mm in diameter, and drill small holes in the last 20 cm's of tubing. Fold the end of the tube over, to seal it, and secure the seal with a rubber band. This technique makes for a cheap and easily cleaned bubbler.

4. A fish tank heater

I prefer to heat the water up slightly, to say 20 degrees c., so as to accelerate the process. This can be easily achieved with a fish tank water heater. All is not lost if you don't have access to a heater. In fact some folk prefer to use ambient temperature, the same temperature the resulting microbe rich solution will be applied to.

5. Some good quality compost

This is one of the most important components of AACT. We need high quality aerobic compost, much like we described in journal three, that's alive with beneficial Bacteria, Fungi, Protozoa and Nematodes. The microbes that help our plants grow.

High quality compost will contain for the most part beneficial microbes as the process of composting works against those non-beneficial microbes and pathogens.

I've used a mixture of compost types for my AACT in the past and will continue to do so. If you're new to compost making, and AACT, and wondering where to start you could look to biointensive compost methods, which uses combinations of immature vegetation and mature vegetation as well as good topsoil, see *GROW BIOINTENSIVE® COMPOSTING and GROWING COMPOST MATERIAL* by Ecology Action Staff in the resources section of this journal entry.

Using compost based on green manures alone for AACT can reduce the risk of introducing some of the more harmful anaerobic bacteria types and pathogens, normally found in the gastrointestinal tract of mammals, that might come through the manures present in unfinished compost

Of course the only real way to be 100% sure you have good compost is to get it biologically tested, but smelling compost can provide some very useful indicators...



Regardless of the type of compost used if it smells bad, think of vomit, putrefying matter and/or vinegar then it's a sign that anaerobic organisms, and their by-products could largely dominate the compost, so it shouldn't be used .

If it smells of ammonia then it's a sign that the compost may well be under cooked, i.e. it hasn't finished the composting process, and then once again I wouldn't use it.

Good compost smells of 'good soil', a clean, fresh, earthy aroma. That 'good soil' smell I believe is largely attributed to the presence of actinomycetes, which are aerobic bacteria. So it's a good indicator that we have a healthy batch of compost.

Conversely if compost is overcooked then I wouldn't use it either as it won't be as alive and full of microbes. So our resulting tea won't be either.

Another way to test compost is to plant something in it and just see how well it grows. Good quality compost supports good plant growth.

An alternative to compost that you could use for AACT is vermicast, from worms, which is full of beneficial microbes and plant growth hormones. Though I would also use the 'good soil' smell test on it as well. If our worms haven't been treated well then those beneficial outputs won't be there in good quantities. Treat worms just like any other livestock. Ensure they have the right environment to thrive and they will create good vermicast.

For 50 litres of AACT I use about 10 cup fills of compost or vermicast.

6. *Old sacks*

Some people just throw the compost directly into the water. While this certainly provides good mixing it means one has to strain the end product before putting it into a sprayer. I prefer to put the compost in an old coffee sack cut in half and hang the sack end in the water. The sack is secured by a bungee cord secured around the neck of my brewers drum.

7. *De-chlorinated water*

Stream water is best as it's fresh and already full of life. However if this isn't possible then tap water that's been de-chlorinated with a water conditioner is fine. If there is no other choice other than to use chlorinated water then it can be aerated it for 1 or 2 hours before the compost is added. The chlorine should have evaporated by this time.

So we have our clean bucket set up with an air pump above the lowest end of the tubing so if the power cuts out then the pump won't turn into a siphon and waterlog the pump. We then run our tubing, with holes, to the bottom of the bucket.



I then fill the bucket to the three quarter mark with water and begin heating the water. Aerating the water while we're heating speeds up the process.

With a bucket of water under aeration we now add mature compost. Putting 10 cups of compost or vermicast into our sack, hang the sack in the drum and secure it by wrapping a bungee cord around the neck of the bucket. This also helps to keep the heater secured and in place.

Aeration and heating are continued for approximately 2-3 days, longer is ok. The tea should turn coffee brown. It's good to monitor for that 'good soil' smell. If things smell funny then something is amiss. Another good indicator of a healthy tea is that the temperature will have gone up slightly on account of the increased metabolic activity.

Often if we don't aerate enough then the mix can go anaerobic and start to stink. If so I abandon that mix, discarding it responsibly, where it will do no harm and away from any areas produce is grown on, and start again.

With the tea complete we strain the mix into our delivery system. For small areas like garden beds I just use a watering can. For the Orchard I use a backpack sprayer though making sure it's not sprayed at high pressure. We're dealing with living microbes here so we do our best to treat them gently.

If new elements were introduced to the tea making process such as equipment, ingredients, methods etc, I'll do a test batch first and apply it to a small sample area, monitoring for any bad side effects, before considering wholesale application.

I spray early in the morning or evening so the full power of the sun doesn't kill our microbes. And I make sure we use our tea soon after it's made. I understand the shelf life for an AACT, once it's made, is not that long.

Tests by the folks at the food soil web, the organization established by Dr Elaine Ingham, have shown that after 6 hours the oxygen levels can be lowered by over 300%. If your tea isn't used within that time then we'll need to aerate it again and potentially add food to the tea to feed the microbes.

Clean the Equipment

It's really important to clean the equipment after each AACT. Without aerated water our brewing kit contents can easily provide the perfect breeding conditions for anaerobic microbes. So we could inadvertently infect our next tea if we don't clean our kit thoroughly after each one is done. As those sacks we use are quite hard to clean I replace them quite regularly to ensure I'm not passing pathogens on from one tea to the next.



Spicing it up

Consider this, All plants need nitrogen. An aspect we introduced in journal entry one.

In living soil nitrogen-containing compounds can be present in two primary forms, that is ammonium (NH_4^+) and nitrate (NO_3^-). Some plants prefer one form to the other.

When nematodes and protozoa consume bacteria and fungi they release nitrogen in an ammonium form. The ammonium is quickly oxidized or converted into nitrates by nitrogen fixing bacteria, you may remember these described back in journal entry one.

And for nitrogen fixing bacteria to thrive they need a soil dominated by other bacteria. If your soil pH is above 7 then that's a good indicator of bacterial dominance and one suited to plants who prefer nitrogen in a nitrate form.

Fungi drive the soil pH down. They do this by producing organic acids employed to break down organic matter into nutrients.

With less nitrogen-fixing bacteria around most of the available nitrogen stays in the ammonium form.

Most vegetables, annuals and grasses prefer their nitrogen in the nitrate form and as such do better in alkaline inclined soils dominated by bacteria.

Most trees, shrubs and perennials prefer their nitrogen in the ammonium form and as such do better in acidic inclined soils dominated by fungi.

So why is this useful and how does it relate to AACT? Well one can actually promote bacterial or fungal dominance into an AACT to suit a specific application.

As an example, for an established Orchard application it would make sense to promote fungal dominance.

Bacteria have a much better time of it in the tea making process than Fungi. So the best way to promote fungal dominance is actually in the compost before applying it at the beginning of the tea making process.

A few days before the tea is set up, mix in some simple proteins like soybean meal, powdered malt, oatmeal, oat bran or powdered baby oatmeal, at a proportion of four teaspoons per cup of compost, to the compost you plan to use in the tea making process. Keep the mixture in a warm dark place and after about three days it should be covered in white mycelia hyphae, so we end up with fungal dominant compost ready for the tea making process.



If we're producing a tea for our vegetable beds we may want one that is bacterial dominant. Simply add two tablespoons of non-sulfured molasses, cane syrup, maple syrup or fruit juice to twenty-five litres of water in the tea at aeration time to ensure bacterial dominance.

In much the same way that AACT can be tailored to specific applications it can also be applied to support specific targeted treatments. For instance a bacterial dominated tea can help to fight pathogens like dollar spot. A fungal tea can help fight powdery mildew by outcompeting them.

I understand that when adding foods to an AACT the oxygen burn rate goes up. If oxygen isn't replenished at a greater rate than what is consumed then the tea will become anaerobic. So we try our best not to overfeed the tea and ensure we keep them well aerated.

At the Orchard

The teas we've applied at the Orchard have evolved over time ...

When we first started work on the orchard we were dealing with soil that had been previously been inhabited by Monterey Pines, *Pinus Radiata*, and the soil pH was highly acidic (pH 5.3). We had some major fungal dominance going on.

And while fungal dominance is a good thing for orchard soils at the acidity levels we were dealing with the soil minerals and nutrients get locked away. So we had to find a way to bring the soil acidity down enough for our pioneers, the understory and our tagasaste trees, to get away and begin the process of soil restoration.

Over the course of two years we applied a number of treatments as part of an overall soil health plan that we'll cover in more detail in the journal entry seven of this series. A bacterial dominant AACT tea was one of those treatments.

Whenever we could get to the orchard a bacterial dominant tea made from our standard recipe, ten cupfuls of compost with four tablespoons of orange juice and two cupfuls of vermicompost added at the start of the tea making process, was applied with a backpack sprayer on and around the orchard soils.

Vermicast, from worms, is bacterially dominant as worms eat more bacteria than anything else. And that's why you'll find more worms in bacterial dominant soils than fungi dominant soils. So it's a useful amendment in a bacterial dominant tea.

After two seasons the understory and those tagasaste trees that had survived the frosts, pests and droughts were all beginning to look well established.

It was time to plant our fruit trees, from this point on our AACT formula changed to a more balanced recipe with no additives.



Now we're into the second season after planting the fruit trees and it's time for us to get some more soil testing done to establish how our overall soil restoration plan is progressing and what treatments, including AACT's, need to be effected going forward.

Though I suspect as the fruit trees mature and our soils achieve a more healthy and balanced state we'll potentially utilise fungal dominant teas as a soil drench in collaboration with compost. I suspect they'll be applied as soil drench in autumn after leaf fall, to speed up leaf decomposition and to help prevent disease growth through the leaf litter, and early spring on an annual basis.

As a foliar spray we'll apply AACT on our trees a couple of weeks before bud burst, so our beneficial microbes have good leaf coverage, thus leaving little room to for undesirable microbes to set up shop. And if no leaf disease occurs then further applications up to once a month may occur if we get time. I also understand it's not advisable to apply AACT at the peak of pollination.

Worms

So we touched on the subject of vermicast as an alternative compost, or amendment in our teas. But there's so much more that's good about worms and their byproducts that we should spend some time looking just a little closer.

Teaming with Microbes cites some astounding facts about worms...Charles Darwin once said that every particle of soil has been through a worm at least once! Every acre of healthy soil can have up to three million worms in it, capable of moving eighteen tonnes of soil in one year, and from that produce somewhere in the order of ten to fifteen tonnes of vermicast a year!

In the pursuit of food worms dig and dive through the soil, passing volumes of soil particles through their gizzards and shredding organic matter down to a size that can be consumed more easily by symbiotic bacteria living in their intestines. And it is the byproducts of these bacteria that are absorbed by the worms for nutrition.

They build tunnels and burrows that aerate the soil and provide paths for plant roots to establish themselves more easily. They break down organic matter and pass it back to the soil as vermicast, enriched with microbes and plant available minerals and nutrients.

They do such a good job of unlocking these minerals and nutrients that vermicast, as compared to soil; can have 50% higher organic matter than the soil that hasn't been passed through a worm, up to seven times more available phosphate content, five times more nitrogen, and three times more magnesium and up to one and a half times more calcium available than that of the soil it resides in.

Vermicast is like black gold to our soils and to our trees and by applying AACT to our soil we boost the very foundations of the community in which worms play a very significant and beneficial role.



A Natural Approach

As permaculture practitioners we seek to understand and collaborate with the natural world in a way that gains the produce we need while at the same time caring for the land and those we share the land with. AACT aligns with these objectives perfectly. It's a cheap and effective way of improving soil health.

AACT and its part in the soil community have enormous scope and potential for gardeners working towards more sustainable and cost effective practices.

Though remember AACT is only one, and often one of the first treatments in the overall soil restoration plan. The microbes you liberate onto your soil, through the AACT application, will need to keep feeding. This is where pioneer planting as well as mulch and compost applications comes in to play.

We'll cover pioneer planting, and the orchard understory, in the next journal entry. And then we'll bring these other treatments together into the overall soil restoration plan in journal entry seven.

Now what I have described about the soil community and AACT in this journal entry is rudimentary at best and describes only how I've applied AACT to my own situation on a non-commercial orchard.

My hope is that it conveys enough to help you to understand how AACT can fit into the big picture and how practical making your own AACT can be even at the smallest end of the scale.

Teaming with Microbes is one of those books I always have nearby. It has a great deal of information on the soil community, aspects of soil health, AACT and how to apply AACT to different applications and situations. I certainly recommend doing your own reading and research before you begin making teas.

For those of you reading this with a commercial angle in mind I'm afraid it's not in the scope of this journal entry to cover applications, nor the rules and regulations that I'm sure are in abundance, around AACT for commercial production.

In addition to *Teaming with Microbes* perhaps look to Dr. Elaine Ingham's book - *The Compost Tea Brewing Manual - Latest methods and research 5th edition* for a comprehensive manual on making, applying and assessing compost tea applicable to both the home gardener through to the commercial grower. I would also consult with a local knowledgeable authority and relevant standards body on the topic.

Learn more about the soil community through the books referenced, or even better do a course, so you can learn how to make great AACT, and the knowledge you will gain will help you to approach soil health as a vehicle to producing better healthier food.



The Downside

If done properly there really are no downsides to AACT...

Though understand that whenever one breed's microbes there's always the potential to breed the ones we don't want. Without some form of biological lab test it's not possible to ascertain exactly what proportions of what microbes are in your teas.

Generally speaking, for AACT, if our inputs and production techniques are of high quality then the outputs, our beneficial microbes, will be present in masses and they will have outcompeted the non-beneficial microbes.

Using thoroughly clean equipment, high quality aerobic compost full of beneficial microbes and plenty of aeration will ensure the best possible prospect of making good AACT.

Once you get into making AACT it would pay to get your initial tea's tested so you'll be able to verify your production inputs and methods are on the right track. The folks at soil food web offer testing services around the world as well as training courses and workshops on how to practically assess the quality of your ingredients and teas. See the resources section further in this journal entry.

Be aware that if, for some reason, non-beneficial microbes are introduced to your garden and/or orchard from any source then the potential exists for those microbes to persist there for some time.

As an example, In discussing *E. coli* as an indicator of fecal contamination in tea and of the presence of other human pathogens, Dr. Elaine Ingham, in *The Compost Tea Brewing Manual – Latest methods and research 5th edition*, explains that if one consumes 'unwashed' vegetables anytime within one hundred and twenty days of a source of questionable material being applied to those vegetables then there is a possibility *E.coli* could still be present, "especially if that crop production system doesn't have adequate aerobic organisms to out-compete the coliforms." Though "a good washing will likely take care of the problem, both on your hands and on the surface of the vegetable."

So a healthy soil community will not only support the health of our crops but can also have a direct bearing on how long non-beneficial microbes persist should they be introduced.

It also impresses on me the importance of maintaining high standards in hygiene for ourselves and for our harvest when handling produce from the garden through to the dinner table. An aspect I have perhaps been a tad too relaxed on in the past.

In addition, to reduce the potential for contamination when purchasing compost from a commercial source, Dr. Ingham recommends that we ask for their *E. coli* test results, to ensure they are indeed monitoring and managing this risk, and if we can also get active bacteria and fungi counts as they are part of the protection mechanism as well.



Other Journal Entries in the works

In the next Journal entry we go down to the understory. The understory provides the permaculture practitioner with a huge array of tools to support the orchard development. We examine what it can do for us and we take a look at our understory recipe used at the orchard.

Related topics covered include founding concepts from Masanobu Fukuoka, Beneficial Insects, Green Manure and plants as soil indicators

And in journal entry six we look at the concepts, strategies, systems and techniques employed by biodynamic practitioners to invigorate soils and promote soil health. We explore the cosmic elements, such as the sun, the moon, our planets and their relationship to the stars, to understand their rhythms and how those rhythms influence crop production.

Related topics covered include the Biodynamic Compost Pile, Carbon and Terroir

And thanks for the Help!

To Shar Packer, Kay Baxter, Lauren Bamford, Jeff Lowenfels 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: 0 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

GROW BIOINTENSIVE® COMPOSTING and GROWING COMPOST MATERIAL by Ecology Action Staff. Self-teaching mini-series booklet #32. A GROW BIOINTENSIVE™ publication



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

The Compost Tea Brewing Manual. Latest methods and research 5th edition by Doctor
Elaine Ingham. See <http://www.soilfoodweb.com/>



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

