

*The Permaculture Practitioner, Journal 3 – Seaweed (Last update  
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.



## *Seaweed – An Eminent Bio Accumulator*

At least once a week the dogs and I head down to the local beach for a walk. In the back of the utility wagon I always carry a three-pronged rake and a weed bag. Tools that make collecting seaweed a lot easier. On this particular beach, assuming we've had some recent stormy weather, there's always a reasonable chance we'll find a good mixture of green, brown, red and white seaweed.

There are over 14,000 types of seaweed though in horticultural terms we need only talk of their relative merits by broad groupings of colour.

Seaweed of all colours accumulates many useful things, and some not so useful things, for our soils. As an organic source of minerals you can't really beat seaweed and for many of us it's free and only as far away as the closest beach.

## *A Rich Bounty of Minerals and Nutrients*

Most of you will have heard that seaweed is good for your gardens and orchards. But what does it provide and how does it help?

Well it's a long list!

At the top of the list would have to be the sheer variety of minerals and trace elements seaweed contains.

While seaweed contains some amounts of phosphorous, calcium and magnesium I value it more in the orchard for the trace elements it supplies. Seaweed contains upwards of sixty different trace elements that are uncommon in other mineral sources that we might typically use in the orchard.

Thanks to the actions of a number of natural chelating compounds, organic molecules that chemically bond themselves to minerals, present in seaweed the trace elements come in a form that can be immediately taken up by our crops.

These chelating compounds not only unlock the trace elements they also hold them nicely in the soil, ready for our crops, so they are less likely to leach away. As an added bonus they continue work on trace elements already locked away in the soil. The net result is a gain of trace elements in excess of the amount supplied by the seaweed.

While small in quantity certain trace elements play a critical role in the development of plants and our trees. To put this into context lets look at just a few of the more notable trace elements and their role in plant development:



Iron, one of the most important trace elements for plants plays a critical role in energy collection for plants. Iron molecules support photosynthesis; the process plants employ to convert carbon dioxide into organic compounds using energy from the sun. Iron manifests in the chlorophyll of chloroplasts, the photosynthesis factories that convert infrared radiation from the sun into chemical energy.

Of near equal importance to the development of plants is copper. Copper in a phosphate form promotes elasticity of the cuticle or bark of a developing plant. A lack of copper inhibits growth and in trees often results in the occurrence of cuticle splitting at a rate greater than can be healed. These wounds can open the way for bacterial and viral infections.

Manganese is vitally important in the development of all seed germ. Manganese acts a loadstone that controls the magnetism in the seed germ to begin the formation of the plant. A manganese deficiency will result in deformations of the seed germ and poor pollination. Without manganese seed germination stops, for this reason it is often referred to as "the element of life".

So you can see how important trace elements are to our developing trees and to plants in general.

Seaweed also synthesizes vitamins. The browns and reds have been used for thousands of years in medicine and as a source for dietary supplements, containing good levels of beta-carotene, B1, B2, \*B12, C, D and E.

\*As I understand it certain bacteria associated to the seaweed we collect contribute the majority of the B12 present with seaweed.

Seaweed, like all living things, contains carbohydrates and lipids that break down to simple sugars and fatty acids respectively to feed the micro flora in our soils. This natural bioconversion process makes nutrients more available to our surrounding crops.

Proteins, too, both structural and active ones like enzymes, also break down firstly to polypeptides and then to amino acids. A small proportion of these molecules may be taken up directly by some crops but these also feed our microflora, which in turn can break these down to elemental nutrients like NPK, etc.

Nucleic acids constitute the genetic material in the cells of seaweed. They're essentially a specialised polysaccharide, a long chain sugar (carbohydrate), with a phosphate backbone and are therefore rich in phosphorus. The phosphorous is made available to the surrounding micro flora and in turn to our crops as the micro flora biodegrade.



Seaweed also contains polysaccharide molecules known as alginates. Alginates, or alginic acid, can play a role in soil building as they help to form the soil colloid. The salts formed by alginic acid bonding with soil metals act as soil sponges sucking up all the available moisture and retaining that in the soil in and around our plant roots. The soil crumb structure is improved and the roots of our trees find it easier to develop their roots systems. We end up with better water retention and less leaching.

The substances secreted by soil bacteria in the presence of seaweed include organic chemicals known as polyuronides. Chemically similar to alginates these polyuronides also serve to condition and stabilise the soil.

A number of hormones present in seaweed are also very useful in the orchard as promoters of growth. These include gibberellins, known to promote stem growth, and auxins, a class of hormone that promote the coordination and growth of the stems and roots of plants. Auxins are the active constituents in the rooting hormone you buy from the garden centre.

Seaweed supports our crops directly, through minerals, nutrients and hormones and indirectly by supporting the soil building process and the micro flora that live in our soils, which in turn feed our crops.

### *Application Notes*

The merits of seaweed in horticulture have been known for a very long time ...

A practice known as 'lazy beds' has been practiced for centuries around Ireland and Scotland on coastal areas where little or no topsoil exists. Left to rot in beds seaweed combined with sand or sandy soil and in some cases fish waste has served as a topsoil replacement in which to grow potatoes, turnips, swedes and oats.

When it comes to harvesting seaweed you should check with your local authorities in the first instance to ensure you can indeed collect it legally and which beaches you are allowed to collect it from.

Also as permaculture practitioners we need to be mindful of the fact that everything plays a role in its' own ecosystem and by removing seaweed from the beach we can disrupt that ecosystem. Beach cast seaweed no doubt provides a habitat and a food source for a myriad of life forms.

Ecologically, it makes sense to pick up seaweed on bathing beaches, as authorities are more likely to remove it anyway. I also recommend harvesting only after a storm, when there is plenty to go around, take only what you need and make sure you leave plenty still on the beach to fulfill it's natural role.



When you're collecting seaweed for your garden I would go for the brown varieties first and then the rest in no particular order. The brown types have far more alginates in them than the others. In brown seaweeds alginates contribute somewhere in the order of 10-30% of dry matter.

By far the easiest way to apply seaweed to an orchard or garden is to incorporate it raw and fresh either in the mulch layer, if you have one, or on top of the sward. By applying raw seaweed you can be sure nothing is lost from the seaweed as it might be if it were processed in some other way.

Though if you don't live near the sea you can purchase a dry seaweed meal and apply it as you would fresh seaweed. Or you could make a tea out of a commercial seaweed extract.

In *Seaweed in Agriculture and Horticulture* W.A Stephens, a pioneer in the field of seaweed extracts, shares the results of many field trials using seaweed extract.

In one case in 1965 John Cooke of Funtington in Sussex produced 565 pounds of potatoes from six sets. At the time it was believed to be a world record crop. He achieved these results using a mixture of bone meal, wood ash, straw and compound fertiliser as well as cow, pig and poultry manure together with seaweed. The seed potatoes were soaked in a 25 percent solution of seaweed extract for two hours once a fortnight over a six-month period prior to planting. Once planted the potato haulms were foliar fed seaweed extract every two weeks.

Trials on vegetable seedlings showed that when soaked in seaweed extract for 24 hours vegetable seedlings showed much improved root development and suffered little shock when transplanted.

Numerous field trials with seaweed extract used as a foliar spray in orchards demonstrated improved fruit production and up to four times the shelf life of fruit once picked when compared to trees not sprayed.

Now some of the commercial processes used for creating seaweed extracts are not easily replicated at home but if you have time and dedication you can make your own ...



## *Some Seaweed Application Notes from the Orchard*

In the past, at the orchard, we've employed a recipe for making a seaweed extract described in *Grasp the Nettle* by Peter Proctor (see the resources section of this journal entry)

To make a batch of seaweed extract simply half fill a 40-gallon drum with fresh seaweed then add a quantity of warm water (30 degrees Celsius) to make an initial solution and then top it off with cold water. If you can use rainwater so much the better as fresh rainwater contains less chlorine and chlorine will do its best to inhibit the fermentation process.

Leave the drum in a warm place, to assist the fermentation process, and give it a stir once or twice a week to aerate it. In two months you should end up with a sweet smelling clear brown mixture. When that occurs strain it and you're left with the concentrated liquid.

As we implement biodynamic principles and practices at the orchard we also incorporated biodynamic preparations (502-507) to our tea at the beginning of the fermentation process. We'll discuss biodynamics and biodynamic techniques in journal entry six.

The resulting concentrate was applied at a rate of 10% to a water solution; once again using rain water if possible, as a foliar spray three times a year at the orchard.

Before using your own brew wholesale on your orchard trees you might want to test it out on a small sample area first.

### *Foliar Sprays*

Foliar spraying is a method of applying a specific solution as a spray onto the leaves of plants and trees.

This is a pretty expansive, complex topic and one I'm not going to attempt to cover in any great detail in this journal entry.

However to understand why we use seaweed as a foliar spray let's look at the basics behind this practice.

Field trials with seaweed have shown that plants treated, through foliar sprays; with seaweed products have shown improved leaf vigor and better resistance to pests.

It appears from my own reading on the subject that more research is required to fully understand why plants benefit from this specific treatment but many agree that this is due in part to the minerals and trace elements we get from seaweed.



Some also believe that naturally occurring antimicrobial substances found in seaweed also contribute to foliar health.

The healthier the leaf the thicker it becomes. And the thicker it becomes, generally speaking, the more sugars it can generate from photosynthesis so the healthier our trees become. The healthier the tree is the more resistant it is to disease and pests.

Foliar spraying can be a highly efficient and targeted treatment but there are many factors governing its success and that is why many report greatly varied results from the application of foliar sprays.

To better explain this we need to dig into some basic botany ...

Our orchard seedlings gain nutrients from both the soil, through their roots, and from the air, through their leaves. Both are leveraged to get the right levels and balances of energy, nutrients and minerals in place for optimal health.

Leaves are responsible for photosynthesis. They achieve this through chlorophyll filled cells, in a region of the leaf known as the mesophyll layer.

The skin of the leaf known as the epidermis, and the cuticle, a thin waxy layer covering the epidermis, work together to protect the mesophyll layer from sap sucking insects and from dehydration.

Stomata, slit like openings in the leaf surface, also work to regulate hydration, air and plant food energy both in and out of the leaf. Each stomata slit is opened and closed by two modified epidermal cells.

These stomata provide us a back door, so to speak, to get the contents of our foliar sprays past the defense systems and into the leaves themselves.

In our fruit trees, as they are deciduous, the majority of stomata can be found on the underside of the leaf. They are extremely sensitive and for foliar feeding to be truly effective we want these stomata to be open as much as possible during spraying.

Stomata tend to contract in hot temperatures, to conserve water, so it's best to apply foliar sprays in the very early morning or evening when temperatures are a little cooler.

When spraying with a backpack sprayer we spray the solution as fine mist. The finer the better and we also tend to spray upwards so we're achieving good coverage of the underside of the leaf surface.

If you want to get more serious about foliar sprays you can buy specialist spray units that homogenize and electrically charge the solution so it adheres to the leaf surface more effectively. I have no personal experience with these tools.



You can also use the seaweed tea, with a spreading agent such as soap or detergent, as part of a natural insecticide spray. The potassium ions from the seaweed tea are directly insecticidal. So, for example, a good control for aphid infestations would be seaweed and detergent in a dilute spray. The potassium also kicks in to bolster the plant's general resistance to pest organisms once the initial infestation is suppressed.

Seawater is in itself full of minerals and trace elements. A seawater foliar spray made from one part seawater to twenty parts fresh water is a great addition, from time to time, to your irrigation plan.

My personal experience with foliar spray solutions is limited to seaweed and indeed some biodynamic applications that I'll cover in journal entry six...

Aside of foliar spraying, whenever it's possible, we also incorporate fresh seaweed around the drip line of our trees at the orchard.

We also apply good quality compost in and around our trees at least twice a year. One of the many components of that compost is seaweed. Aside of the various minerals and nutrients that seaweed provides it also acts as a compost activator so helps to get the compost pile cooking when it's made.

### *So what is Good Quality Compost?*

So while we've touched on the topic, lets take a quick look at what makes for good quality compost...

Sir Albert Howard in *An Agricultural Testament* describes compost as "a complex residue of partly oxidized vegetable and animal matter together with substances synthesized by fungi and bacteria which break down these wastes" -.

At a high level compost creation involves microorganisms breaking down raw materials and then synthesizing them into what is known as humus.

In *GROW BIOINTENSIVE @ COMPOSTING and GROWING COMPOST MATERIAL* by Ecology Action Staff, humus is described as "A partially decomposed, transformed, synthesized and more 'stable' form of organic matter than the original plant materials."

Humus is packed with microorganisms, primarily bacteria and fungi, and they provide us with good quantities of nitrogen, biologic carbon and other minerals present in a form that is both stable and available to the soil community. These primary constituents of compost are vital to the health of our soil community. A good quality compost could well have a high humus content of around 30-40% organic matter.



Now compost and seaweed are literally worlds apart but you can see how they work together to support soil health and that of our orchard trees. In permaculture the design process is very much about finding common connections between design elements and working with them as part and parcel of the whole design implementation.

We'll leave compost there for the moment. In Journal entry six, on Biodynamics, we're take a closer look, but for now let's direct ourselves back onto the subject of seaweed ...

### *A Natural Approach*

At the orchard we use seaweed in a number of ways to assist the soil building process. We're also using seaweed to feed the communities that live in the soil and nurture our trees.

The fantastic range of trace elements and nutrients seaweed provides will also be taken up by our trees improving their health and the potential of the fruit we grow.

The work we do with seaweed at the orchard is part and parcel of an overall permaculture design that includes other design elements, techniques and practices working together as system.

### *The Downside*

Aside of the good things seaweed provides us it also known to bio accumulate toxins and heavy metals if they're present in the water. And if you introduce such things into your garden there's a reasonable chance they'll make it into your crops. So it's not a good idea to collect seaweed near industrial zones. Find a source that comes from relatively clean water and you should avoid these problems.



## *Other Journal entries in the works*

In the next journal entry 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 in journal entry five 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 thanks for the Help!*

To Shar Packer, Kay Baxter, Lauren Bamford, 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: 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*

*Seaweed in Agriculture and Horticulture* by W. A. Stephenson Published by Bargyla and Gylver Rateaver as a reprint in the Conservation Gardening and Farming Series C: Reprints ISBN 0-9600698-3-6



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



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## *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

