The Permaculture Practitioner, Journal 1 – Tagasaste (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 Tagasaste – A multipurpose design element.

As Permaculture practitioners we 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 we get less waste.

The Tagasaste Tree (*Chamaecytisus palmensis),* or Tree Lucerne, is such a stellar contributor in this way that I like to think of it as a `Keystone' design element, upon which I can very easily build on and connect other design elements to.

This multipurpose legume can feed my livestock and provide solid fuel for heating and cooking. It can attract insects that in turn provide me with other benefits in the total design, such as honey from bees.

It can protect my developing orchard seedlings and nurture the soils in and around the orchard zone. And it can help me restore my wildlife zones that surround the orchard.

It has a rapid growth rate, is cheap and easy to propagate and is relatively low maintenance when planted.

With so many admiral qualities it's easy to see why the tagasaste has so much potential for us as a design element.

As Fodder

The tagasaste comes to us from the slopes of Las Palma in the Canary Islands. And it was here that a Dr Perez, a local medical practitioner, promoted it as a fodder crop of high potential back in the 1870s.

I understand tagasaste excels as forage in two ways. Firstly, it has a high crude protein content of up to 20-25% of dry matter and is highly palatable for livestock. Secondly, the tagasaste tree has an extremely rapid growth rate, achieving its full height of 5-8 metres, with minimal care, in as little as five years.

Planted along a fence line around a paddock the tagasaste can provide supplemental feed to livestock year round, as well as provide shelter and protection from the elements.

It appears a fair amount of forage research has been conducted in Australia on tagasaste. It's a popular choice of fodder for sheep and beef production, where other fodder crops would otherwise struggle in the salty arid conditions they have to cope with in parts of Australia. While I have no direct experience with tagasaste as a fodder crop, from the reading and research I've conducted it appears there are a number of potential risks that come with it. See the downsides section further into this journal entry.

For Solid Fuel

The tagasaste regenerates quickly and can be coppiced for firewood from as early as the third season in the ground. The wood itself is reasonably dense and as such makes for good slow burning solid fuel.

At the orchard we've experienced some surprising growth rates. On one particular season, full of hot days and wet nights, a batch of seedlings planted in late spring reached a height of three metres the following winter.

These growth rates were achieved on a topsoil base that only two seasons prior had been inhabited by commercial Monterey Pines (*Pinus radiata*). So we were dealing with highly acidic (5.3) soils showing a distinct lack of micro and macro flora and very little available macro and trace mineral content.

To Restore our Soils

The ability of this tree to thrive in such arduous conditions and the added benefit of being a legume makes me believe that tagasaste could be used more in general soil restoration projects and for control of soil erosion.

Where I live, these problems are particularly acute, as we are a country with the worlds largest man made forests. These forests are currently being cleared faster than they're being replanted and converted into paddocks to support our burgeoning dairy industry.

On Legumes

In botanical terms the tagasaste is a member of the family Fabaceae (or Leguminosae) or Legumes. And legumes are particularly useful as a design element because they have the ability to fix atmospheric nitrogen.

Nitrogen is a core element in the amino acid building blocks of protein structure, which are vital to healthy plant growth.

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. An aspect we'll cover in some detail in journal entry four.

There are other relevant aspects to nitrogen that we will discuss in other journal entries, but from all of this the key lesson for me is that we need nitrogen in the right quantities, and in the right form, in our orchard soils. We will encounter real problems if our soils exhibit too little and indeed too much nitrogen.

Nitrogen is more comfortable, so to speak, as a gas. In this form it's hugely abundant. I am told the air above any given acre of land on the planet contains somewhere in the order of 35,000 tonnes of nitrogen.

Legumes don't actually fix the nitrogen themselves rather they achieve this through a symbiotic relationship with compatible bacteria such as Rhizobia and other closely related species.

The bacteria attach themselves to the root system of the host legume and feed off the root exudates. They then fix the nitrogen and make it available to the host legume.

So we have a natural collaboration that provides nitrogen on site in the topsoil without having to purchase it or even spread it. It would be fair to say our legume gets first dibs on the nitrogen produced. In fact much of the nitrogen ends up in the various seedpods produced by legumes. Overall though we do get a net benefit of nitrogen in the surrounding soil.

Now the tagasaste is fairly promiscuous when it comes rhizobial relationships. So there's a good chance it will form root nodules with the native rhizobia already in your soil.

Rhizobial relationships are just one example of the many ways in which plants orchestrate and control the soil microbiology to their own advantage. And we'll explore these aspects in some more detail in Journal entry four.

For Native Forest Regeneration

As an added benefit for those of us living in New Zealand I see tagasaste being recommended as a friendly exotic pioneer in native forest regeneration.

Our Kereru, New Zealand's native wood pigeon, has a particular penchant for tagasaste, especially at times when other food sources are low in winter. And in native forest regeneration, Kereru are highly valued contributors, as they eat, and subsequently discharge, the fruit and seeds of many native plants. A Kereru poop is like a seed bomb full of organic fertiliser loaded with seed pretreated to grow.

So our fair-feathered gardeners will prepare, fertilize and plant native seeds. All we have to do is lure them in with tagasaste.

The advantage of using tagasaste trees for this purpose is that they're not likely to get out of control as they are relatively short-lived trees in New Zealand, from the accounts I've seen typically surviving no longer than 20 - 30 years, and at five to eight metres in height after a number of years the native canopy shades them out so they recede and die.

Some Tagasaste Application Notes from the Orchard

At the orchard, ably supported by a volunteer crew of family and friends, we've planted several hundred tagasaste in and around the orchard over the last three years.

Our initial efforts to get the seedlings away weren't very successful for a number of reasons relating to weather, pests and soil types. But after further research and adaptation of our planting plan and practices we can now pretty much count on the majority surviving that critical first season. Some propagation tips further in this Journal entry have been developed with these lessons learnt so hopefully you won't make the same mistakes I have.

In the orchard we planted one tagasaste to every fruit tree at four-metre intervals. Most of the seedlings are between one and two years older than the fruit trees so they can act as nurse trees for the seedlings protecting them from the elements. All of our trees are planted next to an irrigation channel, made by a mole plough, having a pointed shoe at the end of a long tip, to a depth of one metre and running one metre in from the orchard terrace edges. This ensures that any natural rainfall runs along and down these irrigation channels to feed the trees. We have no other irrigation in use.

The tagasaste also supports our orchard development in other ways …

Each tagasaste tree sends a small number of taproots deep down into the soil. These taproots, I am told, can extend as far down at ten metres into the soil where water and minerals can be collected and passed back up to its feeder roots. The feeder roots extend up and around the topsoil layer thus supporting the restoration of the soils supporting my fruit trees and those nitrogen-fixing bacteria. That very same root system extends throughout the orchard topsoil to prevent soil subsidence and leaching.

Bees also love tagasaste flowers so by planting tagasaste beside my fruit trees I support the pollination process. I could further utilize the bees to provide honey if I chose to. While not implemented yet, this is something very much on my 'to do' list.

Propagation Tips

Tagasaste are fairly easily propagated from seed. Though you will need to scarify the seeds to get them to germinate. Scarification is a natural process involved in the germination of seed. It involves breaching the natural seed coating by mechanical, thermal or microbiological methods. In the case of tagasaste the most effective scarification method I'm aware of is to soak the seed in recently boiled water for one minute before sowing.

When you sow your seeds it's a good idea to include some soil from under the parent tree into your potting mix. That soil should serve to inoculate your new seedling roots with the same compatible nitrogen-fixing bacteria employed by its parent.

A fully-grown tagasaste is quite frost hardy, down to -9 degrees Celsius. I learnt the hard way that tagasaste seedlings are quite susceptible to frost and should be planted well after the last frost.

Conditions present on the slopes of Las Palmas provide us with some important clues as to the growing conditions required of tagasaste.

Tagasaste enjoy reasonably dry friable soil types and can struggle in wet boggy soil. In these conditions they can get root rot and die quite quickly. Being a coastal tree tagasaste are fairly salt tolerant.

Tagasaste are very tolerant of pruning and it pays to prune them to suit the form you're looking for otherwise they tend to go a bit straggly.

To grow well, tagasaste benefit from a reasonable amount of phosphate, and for those of us in New Zealand, this can be a problem, as our volcanic soils tend to retain phosphate in a form that's unavailable to our plant roots.

Phosphate, a compound made up of phosphorous and oxygen, plays a big role in the overall health of our soils and seedlings.

It has the ability to lock onto to other minerals and make itself available to our seedlings in a way that is easily taken up.

Once in our seedlings, phosphate plays a very active role as a catalyst in photosynthesis, so more sugars are built more quickly, and in plant digestion, so more food is used to fuel growth. The processes also serve to deposit the minerals brought into the seedlings by phosphate right where they're needed. Once those minerals are deposited phosphate is recycled back to the soil to begin the process anew.

Based on the evidence of a soil test, to boost the phosphate process, we applied 40 milligrams per square metre of reactive phosphate rock (RPR) once in spring, for the first two seasons. RPR is a slow release phosphorous. Please understand these quantities, or any other provided in this journal entry, should not be considered as recommended guidelines. They are simply what I decided to implement at the time..

Now while RPR is a great source of phosphate I'm mindful of the fact that RPR can only be obtained from sources outside of my own country. So there is an embedded energy cost involved with RPR that makes it unsustainable for continued use.

Also be aware that RPR is a byproduct of uranium mining, as the elements often occur together. Sources from different regions around the world have shown higher than normal levels of radiation and cadmium. So if you've determined that you need phosphate and you use RPR check with your supplier about the source first and what guarantees they can provide you of its safety.

Research is coming to light that shows that soils with high levels of microbial activity and humus are able to lock up toxins, and to a certain extent radioactive elements, through a complex biosequestration process. However should these fungal dominated processes die down then the pollutants can just as easily return to biological circulation.

By using RPR we're helping the seedlings to get away so that they in turn assist with the soil restoration process. Ongoing and sustained use of RPR without reason could actually hinder the soil restoration process. Let me explain …

In much the same way as TV dinners stop people cooking, ongoing use of phosphate may send out signals to my plant community to stop nurturing the natural processes involved in mining phosphate.

To explain this a little better I need to touch on the important role of fungi in our soils and another symbiotic relationship plants have with a specific type of fungi called mychorrhizal fungi.

Mychorrhizal Fungi.

Fungi play a crucial role in the health of our soils. There are over 100,000 known kinds of fungi and some believe ten times that waiting to be discovered. There is one particular group known as mychorrhizal fungi that play a vital role in unlocking nutrients from the soil and making them available to plants.

Mychorrhizal fungi form symbiotic relationships with plants and in exchange for root exudates they mine the soils for nutrients and water and then deliver these directly to the root systems of our plants. They can effectively extend the reach of a plant root system by an order of 700 to 1000 times!

In the book *Teaming with Microbes* by Jeff Lowenfel's and Wayne Lewis fungi is described as living containers of fertiliser. And this is a good way to envisage how fungi can work for you in the orchard. Fungi are particularly adept at mining phosphorous, and other nutrients such as calcium, copper, iron, magnesium and zinc. And they do this by releasing powerful enzymes that unlock these nutrients from the soil and then transport those back to our plants root systems in an available form.

It is now believed that up to 95% of all plants have mychorrhizal relationships. And it is also known that while fungi are hugely beneficial they are also extremely intricate and fragile. Such things as pollution and rototilling can easily disrupt them.

Continued use of RPR may undermine the natural relationships my plant community has with mychorrhizal fungi. In a way it's like I'm flooding the nutrient pool within the orchard with a freely available resource and the plant community could well decide to limit the exudate production as a consequence.

So we need to find ways to promote the fungi in our soils and they'll do the hard work of unlocking key nutrients and minerals, such as phosphorous, for us.

To support this natural process at the orchard we applied 300 grams of lime per square metre on an annual basis. Into season four, with more soil testing, it was decided for the time being that these regular applications were no longer needed. We'll go into some detail on this and soil testing in journal entry seven.

We applied lime because we want to use the calcium that's in lime. Dr Carey Reams, a pioneer in the field of biologic ionization, used to say, "Calcium is to the soil what grease is to a bearing."

In the soil it has a major effect on the soil structure. It makes the soil more granular enhancing aeration and drainage. The soil becomes mellower and is easier to work so our seedlings have a better chance of establishing their roots systems faster. And by extension this supports the mychorrhizal fungi associated with our tree roots.

By volume calcium it is the most significant mineral taken up by plants. When in the plant it provides a major contribution to the plant structure and chemical reactions. The more calcium taken up by our trees the better they get at attracting nutrients out of the air, such as carbon dioxide, potassium, magnesium and nitrogen.

It also supports the nitrogen taken up by our seedlings in a way that makes the nitrogen more effective so less it needed.

Lime can be obtained in numerous forms. It will work faster if you apply a finer grind. To get the best out of a lime application it pays to supplement it with the trace elements Boron and Cobalt along with some high quality humic acid granules to chelate and hold all of these amendments in the root zone better. The cobalt contributes to B-12 formation and works with boron to make the calcium in the lime more available.

Note: In researching types of lime for the orchard I discovered in *Nourishment Home Grown*, by Dr A. E. Beddoe, that Dolomite, a calcium magnesium blend, should be avoided, as every pound of magnesium available in soil chemistry will release a pound of nitrogen. On the flipside it's good to know that we can use magnesium in certain forms, some use Epsom salts, to reduce soil nitrogen in and around our plants if need be.

Pest Protection

Unfortunately rabbits, hares and possums all saw my tagasaste seedlings as fine dining. Failure to protect them meant rapid and certain devastation. Over the years I've developed a four-point pest protection plan that works well.

My current protection plan involves spraying, or dipping, new seedlings with a commercial product that I believe is made up of egg powder mixed into a resin. When applied to plants, on a dry day, it sticks to the leaves and makes them unpalatable to rabbits, possums and hares. If you apply this formula as your seedlings are being planted it's very effective.

A homegrown alternative can be made though I don't have any experience with this. To make one litre (protects 50 seedlings) take five fresh eggs mix with 600 ml of water and add 150 ml of acrylic paint (preferably white with a reasonable solids %) and mix well. Spray about 20 ml onto each seedling. It would pay to try this formula out on a test tree first.

The first encounter a pest has with your seedling is vitally important, as the pest will establish a foraging routine. So if they are deterred first off then the chances of your seedling being eaten down the track is much reduced.

As the tagasaste is so rapid in its growth habit I tend to spray with this resin every six months to ensure complete foliage cover up until they're big enough to survive the foraging.

Secondly I protect the new seedlings with a physical barrier. At the Orchard I install plastic tree guards as the seedlings are planted. These tree guards stay on until the third season.

Then I apply a commercially available paste that produces a smell that deters possums from foraging.

Lastly I've installed possum kill traps in the bush surrounding the orchard. These traps are quick and merciful and as they are installed on the side of a tree so the risk of trapping non-target species is largely mitigated. Any deceased possums are recycled in and around the fruit trees.

A Natural Approach

So you can see at the orchard we've used tagasaste to accelerate a significant soil restoration process and to protect our slower growing fruit trees.

While conventional orchards tend to focus on the immediate soil conditions around the root ball of fruit bearing trees, we're using tagasaste and a number of other

similarly important design elements to facilitate a whole health approach where the ecosystem in and above the ground is healthy and natural.

Ultimately this approach, while more work intensive at it's inception, is more balanced and aligned with nature, so the effort to maintain this regime down the track should be reduced.

It took three years to get our soils to the point where we even considered putting in the first fruit trees. And today our trees would still be considered seedlings, so I'm not declaring victory yet, but already we're noticing the reduction in ongoing maintenance required. I strongly suspect this has much to do with the whole health approach we've taken.

A wise man told me once "We don't have time to rush … " and it continues to guide me well as an aspiring Permaculture Practitioner.

The Downside

I can't say I've found much of a downside working with tagasaste for my purposes, in my own bioregion. Though, as with every element in a design, there is always the potential for it to behave differently in other conditions and/or environments.

While I have no direct experience with tagasaste as a fodder crop from the reading and research I've conducted it appears there are a number of potential risks that come with it…

I've heard of a rare condition observed in some cattle in Australia called `tagasaste staggers'. This condition is thought to be caused by mycotoxins, which are toxins produced by fungi that readily colonize crops, on tagasaste when in flower.

If you're concerned about this then perhaps you could consider planting the tagasaste as a windbreak away from the fence line of your paddocks so you can regulate foraging to suit.

Also phenolic compounds (tannin like compounds) are produced by tagasaste when under stress, said to be more prevalent in summer, and can interfere with the protein metabolism in a ruminant leading to a protein deficiency. Supplemental feeds with a high protein source such as lupins to your animals in autumn are recommended to overcome this problem.

Tagasaste also really struggles without free draining soil so for many of you reading this Journal entry it may not pan out to be as useful for you as I find it. Though don't despair, there is likely to be an alternative option in the same family that will be better suited to your local conditions.

Alternatives Legumes to Consider

The Leguminosae Family really has a lot to offer us as permaculture practitioners. If you don't have access to tagasaste where you live, and/or your local conditions don't suit it, then there's a fair chance you can find a substitute, with similar benefits, within the same family that will grow well …

Masanobu Fukuoka, in his book "The One-Straw Revolution", talks of the morishima acacia, which is utilised in his Orchards, in Japan, in much the same way as I have with tagasaste. He notes the ability of the morishima acacia as a legume to nurture soils, as an attractant for beneficial bugs such as ladybirds and bees, as a windbreak and as a fodder crop for livestock.

Members of the genus *Caragana*, which comprise some 80 species of flowering plants in the family Fabaceae, could also provide an alternative. The Siberian Pea Shrub *(Caragana arborescens*) has a similar archetype to tagasaste and is well known to be an excellent source of protein for poultry and source of pollen for bees. It has also been noted as an excellent windbreak and in its ability to prevent soil subsidence.

The Mgunga Tree (*Faidherbia albida)* from the savannas of Africa has been widely publicized recently as local scientists have discovered that it can boost nearby maize crop yields by an order of 280 percent. As a legume it fixes and accumulates nitrogen and then, at the same time farmers are sowing their crops, the Mgunga goes dormant and drops its nitrogen rich leaves onto the soil for the maize crops to take advantage of at just the right time a nitrogen boost is needed.

Other members of the Acacia genus such as *A. pravissima, A. retinoides* and *A. cultriformis* are said to demonstrate many of the same qualities as tagasaste and are able to handle clay soils that tagasate won't tolerate.

Alfalfa is a widely used legume in agriculture used as a soil conditioner and forage crop for cattle. We'll look more into the use of legumes, and pasture species, as a component of an Orchard `Understory' in a later Journal entry.

Nomenclature

The botanical name for the tagasaste is *Chamaecytisus palmensis.* From the Latin translation we have *charmae,* meaning prostrate or on the ground, and *cytisus* meaning clover. And *palmensis* provides us with the plant origin, which is Las Palma.

Other Journal Entries in the works

In the next Journal entry we'll look at comfrey (*S. peregrinum*) the `King of Accumulators'. We examine the various applications of comfrey in design and some experiences in propagating, growing and protecting my own comfrey plots.

Related topics covered will include making a liquid fertiliser from comfrey leaves, Comfrey and Chickens, Potassium.

Then in Journal entry three 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 thanks for the Help!

To Shar Packer, Kay Baxter, Laureen Bamford, Phyllis Tichinin, Jeff Lowenfels, John Ridout, 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

Designing and maintaining your Edible Landscape Naturally by Robert Kourik. An Edible Landscape Book Project publication ISBN: 0 9615848 0 7

Mycelium Running. How Mushrooms Can Help Save the World by Paul Stamets. A Ten Speed Press Publication ISBN 10: 1-58008-579-2

Perennial pastures for Western Australia. Department of Agriculture and Food, Western Australia. Bulletin 4690. Moore, G., Sanford, P. and Wiley, T. (eds) (2006)

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