

Chapter Four: Pasture Management and Cropping

Pasture is the collective term we use to mean the grass-based plant communities, which grow in the soil matrix.

When we refer to pasture we are not only talking about the aerial parts of the grassland plant species which we see above ground, but also their extensive root networks and associations in the soil, the whole thing is 'the pasture system' and the soil, plant and animal life within it are inextricably linked.

Another term that we tend to use in pastoral farming is the 'sward'. This is when we are generally referring just to the stem, leaves and flowering parts above the ground. In organic farming we are aiming to enhance the whole pasture system.

In many countries of the world pasture was a relatively rare type of plant community, prior to the development of pastoral agriculture, because most of the land was cloaked in forests. At that time grasslands were restricted to areas where trees couldn't grow for some reason, either because it was too dry, cold, wet or windy, or a combination of these climatic features, and/or the soil was not sufficiently developed to allow trees to grow. In New Zealand this includes our native tussock grasslands, which have become an essential element of our pastoral farming in the South Island.

The majority of New Zealand farmers, however, are dealing with situations where the forest cover has been artificially removed and we are using our domesticated grazing animals to maintain these enlarged 'clearings' by applying constant grazing pressure. Many farmers still find themselves in a constant battle with manuka and gorse, heralding the return of the forest, if the grazing pressure is too light or the land is left ungrazed for any length of time, providing there is still a local seed source.

Good organic management, which is consistent with a farm forestry approach, is about achieving the right balance between trees and pasture on the farm. Increasing numbers of farmers are now seeing the value of retiring marginal land to trees (natives or exotic timber species) and paying increased attention to improved management of the pasture system on their good land.

In this chapter we will be discussing how we can enable our grasslands to work best for us; what constitutes a natural, balanced, grassland which enables our grazing animals to thrive; how to manage our grazing regime to keep the livestock and grassland in balance; as well as, how to manage our views on what we have traditionally regarded as pastoral weed species and turn them to our advantage.

Pasture species

- A mixture of species in pasture is important for grazing animals to access a wide range of minerals, vitamins and other nutrients.
- Make it a priority to add extra species to your pastures, as these changes will quickly start affecting your animal's health in a positive way. Try over-sowing some chicory and plantain when conditions are good in existing pastures. Use a mixture of predominant pasture and deep rooting plants. Certain weeds could be beneficial – check before eliminating.

- No genetically modified or treated seed is permitted to be sown.
- Older varieties can be a better choice than newer hybrids.
- Quarantine paddocks need deep rooting and specific herbal plants added to pasture mix, enabling stock to recover from illness.

Within any naturally occurring grassland system there is normally a high diversity of plant species where there are grazing animals. Their grazing pressure prevents the domination of the sward by the larger, faster growing or more woody/fibrous species, and it prevents the natural succession of the community back towards forest. This is to the advantage of the grazing animals since it provides them with a more varied diet. Organic pastoral farmers seek to mimic the balance and diversity of natural grassland systems. This is achieved through an emphasis on providing pasture that is a mixture of many different species of grasses, legumes and other herbs. This is often referred to as a herbal ley, but strictly speaking it may not be a ley as it is often likely to be permanent pasture. The term ley is normally used to refer to a temporary pasture which gets ploughed up and reseeded. Interestingly, the dictionary definition for the term pasture is 'herbage', indicating that it has always contained herbs, until very recently.

A herb is a flowering plant that has a stem comprised of soft, non-woody tissue which dies down and grows again each year from the ground. This enables them to withstand grazing and distinguishes them from trees and shrubs which grow continually from their stem tips each year, getting taller and taller. Herbs may be annual (grow from seed each year), biennial (take two years to grow and seed), or perennial (grow again each year from the same rootstock), and these characteristics often affect their persistence or otherwise in the sward.

Clovers and the other leguminous pasture species with which we are familiar are also herbs, but we tend to separate them out into a category of their own since they are nitrogen-fixing herbs and adding fertility to our soils. They do this by virtue of a nitrogen-fixing bacteria, called rhizobium which they host in special nodules on their roots. Up to 70 to 90% of all the nitrogen required by the pasture can be taken directly from the air by this plant/bacterial association. Much of the nitrogen, plus other nutrients, is returned to the soil under grazing systems in the dung and urine of the grazing animals. This is why the grass/clover ley was always the fertility-building phase in the classical organic rotation between arable crops and pastoral farming, the deeper rooting pastoral herbs also enabling mobilisation of other minerals from deeper layers in the soil. Many so-called weeds are also herbs and provide benefits to the whole farm system (see Weeds and their Management section).

Even if you are still only deciding whether to convert to organic farming or not, there is certainly a lot to be gained from incorporating additional plant (herb/weed) species into your pasture renovation programme. Not all of the species listed below will establish on your farm. You will have to do a bit of experimentation to determine which ones work best in your area or consult with an agronomist who is familiar with these plant species in your area. Here are some things to consider:

- Some of the species will not establish in very fertile

soil and some actually require low fertility soil.

- Grazing pressure will also determine if these species persist in your pasture.
- Sourcing seed may be a problem if you want to obtain the seed before it is chemically treated.
- Get in early when the seed crop is being harvested.
- Work in with other organic farmers for bulk orders to appease the seed merchants and save costs.
- You must ensure that the seed is not GM or GE (genetically modified or genetically engineered) and is not treated (hasn't been coated with fungicide or insecticide etc.)
- New varieties are being added to the list of pasture species that can be grown on a farm. Many of these newer varieties will have been grown and selected under conventional farming systems, so do not be surprised if the seed grows or behaves differently, or is not up to expectation under an organic system. You will have to do your own experimentation on your own farm.

Plant species to consider

Let's consider the predominant pasture species, first the grasses, then the clovers and other legumes, and then the additional herb species. For identification of pasture species check www.pastureinfo.massey.ac.nz.

Grasses

Brome (Bromus species)

Brome grasses are perennial species, which have excellent winter growth in fertile, free draining soil, but do not tolerate poorly drained soils. There are several cultivars available, which tolerate different conditions from rotational grazing to set-stocking. They provide good feed quality without the risks of endophyte.

Matua, Erect Brome, (*Bromus willdenowii*)

Grows actively in winter and has two peaks of production, one late summer and early autumn and the other in late winter and early spring so this plant can fill deficits when the rye and clover are producing very little. It is the only certified cultivar available.

Matua is highly palatable – even the seed heads (no topping required!).

There are some disadvantages.

If this plant is grazed hard in summer it will die out.

Matua is also very low in magnesium and iodine so if clover is not a high proportion of the sward then stock grazing can suffer infertility and grass tetany (staggers). Lucerne does not combine with Matua as Matua is too competitive. This grass is troubled by the Hessian fly which can be found in the areas north of Taupo.

When to sow?

Early autumn. Sowing mixtures should be simple – short-term ryegrass cultivars can be included plus white and red clover, but not lucerne.

Sowing rate: 30kg/ha through a drill or 40kg/ha when broadcast. The seed can be de-awned which will make it go through the drill better.

Depth: no more than 2 cm deep.

Management: grazing should only be for 1 – 3 days with a period of 4 to 6 weeks between grazing.

Cocksfoot (*Dactylis glomerata*)

This is a summer active perennial with a deep root system. It grows well in poor fertility soils where it is dry. Generally slow to establish and has a lower digestibility than most other grasses. Cocksfoot has limited winter growth but is very useful as a component of permanent pasture in summer dry areas for its persistence and drought tolerance. Historically a very important element in the famous 'Clifton Park' organic matter-building and drought-resistant mixture for organic farms.

Seeding rates should be kept low as cocksfoot can dominate a pasture, reducing clover levels and digestibility. The strain Wana tends to grow in clumps. Kara, Ella Tekapo are other strains that tend not to do this.

Cocksfoot needs to be kept well-grazed so that it stays short and leafy to maintain feed value and prevent clump development.

Sowing rate: 1-3kg/ha

Ryegrass (*Lolium species*)

Ryegrasses, especially the modern highly-bred cultivars, have become the grasses of choice for the modern pastoral farmer because they respond so readily to the application of artificial nitrogenous fertiliser. However, this response may be largely in bulk of fibrous and watery material rather than in quality nutritional material. In organic regimes, where there is an emphasis on organic, low-nitrogen fertilisers and the use of clover as the nitrogen source, ryegrasses may not be so appropriate, and should certainly not be the only pastoral species used. Ryegrasses are especially suited for medium soil-types and good fertility, other grass species like Fescues, Bromes, and Timothy are more suited to extremes of soil type like free-draining or water-logged soils, and low-fertility. The older naturally occurring species like Perennial Ryegrass *Lolium perenne* may be more suitable for organic farms than the newly developed modern hybrids.

Endophytes in ryegrasses

Ryegrass endophyte is a fungus called (*Neotyphodium lolii*) found only in perennial, long rotation and some hybrid ryegrasses. The endophyte dies out in seed stored for longer than 15 months.

There are three types of endophyte that affect ryegrasses. Each produces a different phytotoxin. You can now purchase ryegrasses infected with the right type of endophyte to provide itself with protection from insect attack but avoiding the knock-on grass staggers and super-heat effects in dairy cattle.

There has been a huge advance by researchers, which is of benefit to all warm area farmers. Previously the only endophyte available in ryegrasses was the wild type endophyte. Unfortunately as well as the peramine and ergovaline which give resistance to Argentine stem weevil and Black beetle respectively, this endophyte also produces Lolitrem B which can cause ryegrass staggers. Endophyte research has led to new or 'novel' endophytes becoming available which have lower levels of toxins affecting animals (that is no/very low ryegrass staggers). These are AR1 and NEA2.

The AR1 endophyte produces peramine so gives resistance to Australian stem weevil but can be susceptible to Black beetle. The NEA2 endophyte produces peramine and ergovaline so gives resistance to ASW and Black beetle. Ergovaline is the toxin, which can cause heat stress in very warm weather.

Hybrid ryegrasses

Hybrid ryegrasses are bred from annual or short rotation ryegrasses and perennial ryegrasses and are in between in terms of growth and persistence. Some are closer in type to annuals (Italian type hybrids) and include the cultivars Maverick Gold, Geyser, Manawa, and Galaxy (a tetraploid). Some are closer in type to perennials (Perennial-type hybrids or Long Rotation Ryegrasses) and include Greenstone and Horizon (both tetraploids) and Marsden, Supreme and Impact.

Some cultivars contain the endophyte which gives resistance to ASW but causes ryegrass staggers and some do not.

'Greenstone'

This hybrid rye is extremely palatable. It is an upright erect plant, which encourages a high legume content and makes an ideal companion in a pasture mix with a more densely tillered ryegrass plant. This plant will persist only under rotational grazing. Endosafe Grasslands Greenstone has endophyte which produces peramine for Argentine stem weevil resistance but low levels of lolitrem B which means it has less risk of ryegrass staggers. The Endofree version has none of the endophyte and therefore no resistance to Argentine stem weevil and none of the toxins, which cause ryegrass staggers or heat stress and is suited for cool, summer wet areas where Argentine stem weevil is not a problem.

This plant gives excellent winter and spring growth. Better suited to the South Island.

Do not plant together with Fescue.

Sowing rate:

As a pure sward 28kg/ha. As a mixed sward 14kg/ha.

Tetraploid ryegrasses

These have 4 sets of chromosomes per cell (instead of 2 sets as in diploids). They are very palatable and are often less persistent. Endophyte has now been bred into some of them, which gives better persistence than when tetraploids were first tried in NZ. Tetraploids are sown at 30 to 40 % higher sowing rates as they have larger seeds.

There are now perennial tetraploid ryegrasses such as Quartet and Nevis, and long rotation tetraploids such as Banquet, Horizon, Greenstone and Sterling, as well as short rotation or annual tetraploids such as Feast II, Andy, and Archie.

Perennial ryegrasses

These include mainly diploids but also the 2 tetraploids mentioned above. The diploids are generally more persistent than the tetraploids but are less palatable. However they usually grow more dry matter (DM) and this can be of very good quality, especially if a later flowering type which is easier to manage such as Aries, and Tolosa.

Tall fescue (*Festuca arundinacea*)

With the change in the climate (getting warmer and wetter?) in the North Island there is a swing away from rye grass to fescue type pasture. These new variety pastures do have significant health benefits for stock as spore counts (for facial eczema) tends to be significantly lower and there is no rye grass staggers on this type of pasture.

Clover tends to establish reasonably well with fescue if grazing controls the growth of this plant. There are quite a number of Fescue varieties and each has its own benefits so you will have to research which type is best for your area. Palatability can certainly be an issue if you let the sward go rank.

This grass grows fast so you will have to have a quicker grazing round when using this plant. Heat stress was also a feature of the old type fescue strains and now there are strains with no endotoxin (which caused heat stress in cows especially in the north of the North Island). Fescue plants are deeper rooting compared to ryegrass with good drought tolerance but in the cold of winter, growth rates for fescue are very low. They are very useful in waterlogged and saline soil conditions where again ryegrass does poorly.

Tall fescue is slow to establish so it cannot be sown with ryegrass. There are so many benefits to be had by including a fescue plant in some of your paddocks as the predominant grass with clovers and herbs added for conventional and organic farmer alike.

Variety options:

Roa and Au Triumph are the older types, which have now been superseded by Vulcan, Torpedo, Quantum, Advance and Dovey. Dovey originally came from French plant material bred in the UK. Reports from trials show that this Fescue is fastest establishing, with a high yield, excellent rust resistance and for those summer dry areas there is good summer growth and good palatability.

When to sow?

Fescue must be sown when the soil is warm – above 12 degrees.

Sowing rate: bare seed 25-30kg/ha plus clovers (coated seed 20-25kg/ha plus clovers)

Timothy (*Pleum pratense*)

This plant is better suited to summer wet areas and particularly heavy soils. It also needs cooler temperatures

to persist, which is a great shame for the Northern areas. It is usually a minor component in a seed mix. This plant has a higher feed value than compared to ryegrass. It is slow to establish and performs better under low grazing pressure. Poor during winter and spring growth but peaks in summer.

Kahu is a high forage quality grass especially on moist sites.

Sowing rate: 1-2kg/ha. The seed is very tiny.

This grass is being promoted in a mixture with Meadow fescue (*Festuca pratensis*) and clovers as a non-ryegrass ley more suited to cold, wet soils. These two grasses are considered to be the most palatable of the permanent grasses, preferred by stock over ryegrass, and when in a mix with clover highly nutritious and digestible. Unlike ryegrass they persist in this type of heavy, clay soils.

Yorkshire fog (*Holcus lanatus*)

Prefers low fertility acidic soils. This is a perennial grass that can handle very wet soil. Yorkshire fog is an alternative grass species to plant for areas where perennial ryegrass production is poor and is often planted with Lotus.

Massey Basyn is a standard cultivar – Melita is a newer cultivar.

Sowing rate: 5-8kg/ha. Sow seed at 5-10mm deep in a good seedbed.

Grazing: must be well grazed in mid-spring otherwise it will become less palatable in late spring and summer.

Has been shown to have important vermifuge properties in mixtures with chicory and other herbs, especially for newly weaned lambs.

Clovers and other legumes

Red Clover (*Trifolium pretense*)

These plants like the warmer temperatures and of course can fix nitrogen, which is so important for organic pasture-based systems. Red clover is a tap root perennial legume and is drought tolerant. It performs best under low stocking rates if grazed, but is of particular use in silage production due to its high yields, with crude protein analysis around 20%. Red clover is a short lived, high feed value plant. It has good summer growth but little winter growth.

It would also pay to consider growing red clover strains that have low phyto-oestrogen levels. Sheep are especially prone to oestrogenic effects of clovers (low fertility, prolapsed anus etc.). If you are having problems with oestrogen then consider G27 Red Clover which is a re-selection of Pawera, has a good yield and persistence and a low Formononetin (phyto-oestrogen) level. This plant is a smaller plant than Pawera, with smaller leaves, shorter stem and a prostrate growth form. Colenso has improved cool season production and has greater tolerance to grazing and contains low-medium phyto-oestrogens.

Sowing rate: 2-3kg/ha (coated seed rates are 1-2kg/ha higher). Depth 5-10mm.

White clover (*Trifolium repens*)

This plant is the mainstay of organic pastoral systems and must be present in your pasture as it is the most important nitrogen fixing plant, making a substantial contribution to the growth of companion grasses. Unlike red clover it is creeping and prostrate in growth habit, and it is also tolerant of and persists under a wide range of management systems and soil and climatic conditions. It is highly resistant to heavy grazing pressure, making it suitable for sheep as well as cattle grazing, and is highly drought resistant with a high feed value. The aim is for a sward of between 30-50% legume content in spring/early summer and possibly autumn with an interval of about 35 days between defoliation (grazing) to allow adequate time for nitrogen fixation. Dry matter yields can be in the region of 10-13t/ha in such a high clover sward, thus without the application of any additional nitrogen these clover/grass systems can achieve the same production more cheaply than conventional chemical systems.

White clover is slower to grow in spring than ryegrass and is susceptible to shading so spring management should be geared to keeping pastures short and leafy to maintain good clover content and to capitalize on the good growth in summer.

There are many varieties available. Pitau is a variety that adapts to a wide range of environments and was first released in 1975. This clover has a creeping prostrate habit with a network of spreading stolons. However, newer strains have improved characteristics like greater stolon density, a variation in leaf size – large, medium and small. Some have resistance to clover diseases like nematode and rot. Smaller leaf clovers like Tahora and Prop are best suited to sheep farms. Large leaf clover like Aran and Kopu and medium large leaf clover like Sustain, Challenge and Pitau suit dairy farm grazing.

A mix of Aran and Sustain is an idea for then you have the benefit of persistence and disease resistance and also high winter yields and improved tolerance to intense grazing.

Sowing rate: 2kg/ha Aran and 2kg/ha Sustain

Sow shallow at 5-10mm sowing depth.

Common birdsfoot trefoil (*Lotus corniculatus*)

Birdsfoot Trefoil is a non-bloating perennial legume similar to lucerne in its fertility requirements, but it thrives on dry-land soils too acidic for lucerne. This plant is an erect-growing, tap-rooted plant so can offer good yields of high quality forage during spring, summer and autumn in dry regions.

This plant contains condensed tannins, which prevent bloat in ruminants and also protect forage proteins from degradation to ammonia gas in the rumen so there is better amino acid digestion and greater growth rates for ruminants.

Photosensitisation (eczema) has been reported on odd occasions in animals grazing *Lotus corniculatus*.

This plant is very acceptable to all livestock types and deer especially so. It also makes excellent quality hay.



Trefoil is more resistant to pests and diseases compared to lucerne in dry areas.

There are some disadvantages with Birdsfoot Trefoil. It is slow to establish. This plant is not compatible with the common pasture species so ideally it should be sown alone and in a way so that weeds do not compete as this plant is not aggressive and does not spread vegetatively or readily re-seed itself.

Trefoil can be planted with lucerne where there is paddock fertility variability. Another option is to plant it with brome grasses but these are not really an option in the upper North Island. Birdsfoot trefoil must not be over grazed. It is sown with Fescue in South America, and this could be worth a try especially up North.

When making hay from this plant care needs to be exercised to prevent the loss of dry leaves.

Grasslands Goldie is the local cultivar bred in New Zealand.

When to sow?

Best sown in spring as this plant is winter dormant but will establish from early autumn plantings if a good cover grows before winter onset.

Sowing rate: 5-10kg/ha and the seed must be inoculated with a specific rhizobium strain for effective nitrogen fixation (which is not present in most NZ soils).

Depth: drill at 2cm depth in a well prepared bed and when the soil temperature is above 12 degrees celsius.

Management: Avoid grazing below 8 cm. Should be rotationally grazed.

Greater birdsfoot trefoil (*Lotus uliginosus/pedunculatus*)

A more luxuriant and larger cousin of the species which thrives on moist soils.

Cultivar Maku contains condensed tannins making it non-bloating and giving protein protection in the rumen of stock. Maku can grow on lower levels of phosphate than white clover, however it still responds to fertiliser.

Sunrise is another cultivar similar to Maku but tolerates grazing pressure though has better autumn growth and poorer summer growth.

Sowing rate: 1-2kg/ha

Sow in early autumn. Seed must be inoculated with the recommended strain of rhizobia. Can sow Maku and Sunrise together. Drill or over-sow.

Lucerne (*Medicago sativa*)

This plant requires high fertility soil with a high calcium base saturation percentage – a minimum of 68%. It does not fare well under the dairy grazing rotational system but can still be planted along tree lanes or in the quarantine paddock or can be planted as a crop, and is often grown for silage or hay. This is a legume so can fix nitrogen and can have a high protein content (18-22%), which makes a good plant to balance maize feeding, which is low in protein. This plant has a deep tap root so makes the plant drought tolerant.

It is recommended that lucerne is not grazed if reasonable persistence is wanted. Best production occurs when it is harvested by machine for silage. Over the growing season 5 to 6 harvests are expected with dry matter yields of about 14t/ha, if plenty of potassium and phosphorus are available and pH over 6.0. If grazing lucerne, allow 6 weeks between grazings.

Growing lucerne successfully as a crop depends upon a rapidly growing, dense stand. Best production results in the North Island appear to be highest when Lucerne is planted immediately after a crop rather than pasture.

Lucerne is susceptible to a wide variety of diseases and pests especially when grown in poor soil conditions but there are many lucerne varieties with varying disease and pest resistance. Consult with an agronomist who is familiar with the disease and pest problems in your area so that you can select a variety best suited to your area, if you are considering growing a pure crop.

An observation from a Marlborough farmer:

We find in our very dry summers, chicory and clovers will shrivel away to nothing but lucerne will get its chance in a pasture mix. We use lucerne (Wairua lucerne) in all our pasture mixes and still have it persisting in ten year old mixes. This is probably because it gets a chance when everything else gives up in the extreme summers. We believe this legume is very underrated for our drought prone area. Watch boron levels in lucerne.

When to sow?

Lucerne can be sown in either autumn or spring. In the warmer areas of NZ autumn establishment is preferred and in the cooler areas, spring establishment is best.

Depth: no deeper than 25mm in sandy soils, and clay and ash no deeper than 12mm.

Sowing rate: 15kg/ha and the seed must be inoculated with a rhizobium.

Strawberry clover (*Trifolium fragiferum*)

Strawberry clover is a clover (legume), which can suffer poor fertility, wet roots (waterlogged soils) and even saline conditions. It can also handle hard grazing. This plant has low phyto-oestrogen levels, a small leaf size, is a tetraploid and can spread by stolons and by re-seeding. It is ideal for areas where white clover does not thrive due to waterlogged or saline soils, low phosphate or a soil with a wide pH range.

Sowing rate: 3 kg/ha

Subterranean clover (*Trifolium subterraneum*)

This is an annual, creeping, low growing variety. Grows well in areas of poor soil fertility. It is a vigorous re-seeder and survives dry summers and must be allowed to re-seed to persist. Will reseed in good autumn rains.

Some of these clovers can cause oestrogenic effects in heifers (udder development).

Sow shallow

Sowing rate: 1.5 – 2kg/ha

Sulla

This is a short-lived perennial legume that provides forage for livestock and can be used for erosion control and soil fertilisation. It is a Mediterranean plant. The foliage contains condensed tannins, which increase the efficiency with which the grazing animal uses the forage protein. These tannins can make up 4 to 8% of the dry matter of the plant and enables stock to reduce the effects of intestinal parasites. Sulla produces non-bloating forage. The highest nutritional value peaks before flowering and is similar to lucerne and red clover at this time.

It may grow to 1.5m tall, has a deep branched root system. Doesn't grow well on sands and needs reasonably fertile soil like lucerne does. Will not tolerate temperatures below 4 degrees celsius. Needs rainfall of 500 to 2000mm per year. Sulla can be grown alone as hay, silage or forage crop; or it can be sown with tall-growing grasses like Phalaris or prairie grass as a permanent pasture.

Sulla is a useful plant for stabilising soil on slips, gully banks and roadsides. The large root system is left in the soil when the plant dies and a thick mat of herbage on top of the soil provides ideal conditions for the next generation of seeds to establish and the nitrogen content left behind the Sulla plant grows the next set of germinating seeds.

The stems of Sulla are totally unpalatable to stock and so management for quality forage, silage or hay means that yields are lower than if left to grow tall before harvesting. Crops should be harvested before growth turns reproductive (stemmy).

When to sow: Autumn or spring.

Sowing rate: for seed in the hull 10-20kg/ha; de-hulled seed should be sown at 5-10kg/ha. These rates should be increased if the seed is broadcast. Sulla will not grow unless the seed is inoculated with a special rhizobium strain.

Grazing management.

This plant is best not grazed lower than 15cm from the ground otherwise re-growth will be reduced and the plants may die. Grazing by cattle should be very light to prevent excessive damage to the plant crowns.

Herbs

Chicory (*Cichorium intybus*)

This is a broad leaved, tap-rooted drought tolerant herb and the most common herb recommended for organic and conventional systems alike. This plant has a high nutritive value (high metabolisable energy), highly digestible, and is high in minerals such as calcium, sulphur, potassium, sodium, boron and zinc and gives high stock performance and appears to be unpalatable to rabbits and hares.

Chicory grows well in summer and on dairy farms supplies a continuous summer feed and due to the protein content will

maintain milk production and milk protein content.

As a pure crop chicory can produce up to 18 tonnes of dry matter per hectare between early spring and late autumn.

Puna and Chico are strains that have established quite well in dairy pastures especially under organic and biodynamic farming where herbicide spraying has ceased. Best suited to free draining, highly fertile soils (not so good on clay soils due to fungal diseases of the crown and tap-root). Chico has been selected for improved winter activity and has upright standing leaves.

Disadvantages. As chicory can grow rapidly stock can be poisoned by nitrate/nitrite and there have been instances of bloat. Milk taint is another potential problem and if grazing pure crops then graze for only 2 hours after the morning milking (only if the crop is safe from nitrate). Lambs are also prone to pulpy kidney.

Sowing rate

As a minor species 0.5-2kg/ha in a grass/clover mix in spring or if sown in autumn then use a 1-1.5kg/ha. Will persist for 2 to 5 years.

For a chicory dominant pasture sow at 5-6kg/ha with a 4kg/ha clover mix of a 50:50 mixture of large-leaved and medium leaved white clover. Red clover could also be added at 4-5kg/ha or more for large-seeded tetraploid cultivars.

Ribwort Plantain (*Plantago lanceolata*)

This is a deep rooted, drought tolerant, mineral rich plant suited to rotational grazing, and an important element of organic systems, believed to have vermifuge properties and high nutritional value. There is rapid establishment and good winter growth.

Strains available are Ceres Tonic and Lancelot. Tonic is the preferred strain for dairy pasture and Lancelot for sheep pasture. Most herbicides used on conventional farms remove these plants and yet they are so beneficial for stock. They offer a wide range of minerals, notably iron, calcium, copper, zinc and sodium and are quite palatable.

Sowing rate: 3-4kg/ha in a mixture with grasses, legumes and other herbs.

Other plant species to consider

Reed grass (*Phalaris arundinacea*)

Commonly recommended as an autumn/winter growing species it is dormant in summer but is drought tolerant. Depending on the soil type it can spread through re-seeding and rhizomes. Check with your seed merchant re management of this species. It can also be toxic, especially to sheep.

Pink serradella

Grasslands Koha a deep rooted winter annual tolerant of acid soils. A legume.

Yarrow (*Achillea millefolium*)

This perennial plant is one rich in minerals and was once sown as a pasture species because of its ability to survive the summer dry and due to its mineral content being higher than clover and rye grass. This plant does have a rhizome system and if it dominates a pasture is difficult to get rid of. Tolerates grazing.

Sheeps/salad burnett (*Sanguisorba minor*)

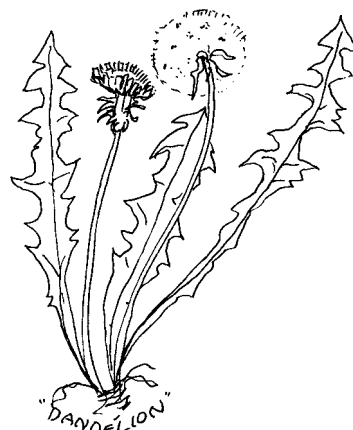
A fast establishing perennial for summer feed. It withstands cold winters and performs in dry, low fertility areas.

Seed sourcing and selection

As farmers' change to biological farming it is possible that conventional seed sources may become a problem (apart from the fact that it is treated with chemicals). Farmers who have well balanced soils on biological mineralisation programmes may find crop failures using the readily available hybrid seeds.

These hybrid seeds have been grown and performance selected on NPK soluble salt-type fertilisers. Ideally farmers would want to source seed that is open pollinated and from plants or crops grown on similar biological fertilisation programmes to achieve maximum efficiency. Many farmers find that the older varieties perform better in organic systems.

Important: Seeds should be from a certified organic source. If not, ensure the seed is not treated (with fungicide or insecticide) and has no GE, according to the requirements of your certifier. Check with your certifier before proceeding. Always get a certificate from the supplier giving the status of the seed regardless (even clean seed) and keep the labels from the bags.



IFOAM Organic Principles and Recommendations (2005) for Crops and Varieties

General Principle - Species and varieties cultivated in organic agriculture systems are selected for adaptability to the local soil and climatic conditions and tolerance to pests and diseases. All seeds and plant material are certified organic.

Recommendations

- A wide range of crops and varieties should be grown to enhance the sustainability, self-reliance and biodiversity value of organic farms.
 - Plant varieties should be selected to maintain genetic diversity.
 - Varieties known to be suited to organic cultivation should be preferred.
 - Operators should use organically bred varieties.
-

Herbal ley mixtures

When planning pasture species mixtures it is useful to consider what we are trying to achieve. On an organic farm we are trying to fairly closely mimic nature in providing a wide range of plant species for our livestock to graze on, as there would be in a natural grassy clearing. This is because we are aiming to provide our stock with the whole range of minerals and other micronutrients, as well as proteins, sugars and fibre, i.e. a complete healthy diet, from the plants that they graze, without having to provide any supplementary feed. This is the most cost-effective way to farm livestock, for milk production or live weight gains.

The goal is to be able to provide natural forage all the year round, or for as much of the year as possible, to take into consideration climatic extremes and soil type. This will enable optimal growth and production rates of our stock, without causing stress or illness. You should strive to create a pasture mix that will allow your stock to self-medicate. At the same time we want to build soil fertility.

Here are some mixtures that could help you achieve your goals.

In-conversion ley mixtures

The first consideration is to rebuild the organic matter in our soils to supply carbon. The most important plant to get into your pasture mix is white clover. This is the power house plant for biologically-based pastures. Fortunately most conventionally farmed pastures do have clover, often in conjunction with ryegrass, but usually not at a high enough density being around 20% of the sward. To optimize productivity the white clover content needs to be a minimum of 30% of the sward. Also you may like

to consider using a mix of different cultivars of clover, as different ones suit different soil conditions and types of grazing stock, also some are more persistent and disease resistant than others.

The other important consideration is the main grass species that your sward is based upon. As discussed in the individual plant section, ryegrasses have been bred for use in modern, chemical farming systems and they are designed to grow fast and aggressively and therefore can shade out clover and limit its usefulness in the pasture. There are several other types of grasses like bromes, fescues, timothy and cocksfoot that are worth considering as the main grass species in your final mix, instead of, or as well as ryegrass.

If you have the luxury of being able to set aside some of your pasture for a while to grow a fertility building ley which you then plough in and re-seed with your final mix, it is well-worth doing. In that case you might consider a mix like red and white clovers with ryegrass. Another mix to consider, if organic matter building is your main issue, would be red clover, perennial rye, cocksfoot and chicory, as these are all deep-rooting species.

All-purpose herbal ley mix

If you are farming on land of good fertility which is not drought-prone or seasonally waterlogged, then a good general purpose herbal ley mix can be a mixture of perennial ryegrass varieties suited to your soil type and situation, with a range of white clover types plus other legumes like red clover and greater birdsfoot trefoil, plantain (ribgrass) and perhaps chicory, plus other grass species suited to the site like cocksfoot on lighter land, or timothy on heavier land. This was the original mixture called 'Pochon' developed by a Breton farmer (Andre Pochon) for rotational grazing and forage production. It is especially suited for dairy farmers for use as high quality grazing or silage production. It can be adapted for use on good quality beef and sheep land by the use of some of the smaller-leaved white clover types which are more persistent and tolerant of closer grazing. Other herbs can be added to this basic mix but they may not persist long in the vigorous sward. Persistent perennial 'weeds' like dandelion and dock (sorrel) should not be eliminated from these established swards as they are relished by stock and contribute to stock health and nutrition – they are herbs for free!

Drought-resistant, organic matter-building ley mixture

Many farmers in New Zealand don't have the luxury of farming on such good soils, especially the sheep and beef farmers amongst us, and we are often trying to do our best on more marginal pastoral land. We need a mix of pasture species, which can tolerate the very dry summer conditions and still provide our stock with reasonable feed, as well as continue to build up the organic matter in the soil so that it gradually becomes more water retentive and fertility improves. The original ley mixture designed to do this was developed over 100 years ago by Robert Elliot, a Scot, and is known as the 'Clifton Park' mix, after his estate. It has been used with great effect by organic and conventional farmers alike ever since.

These leys are not based on ryegrasses but on a mix of other grass species, cocksfoot, fescue and timothy in particular, with white and red clovers and a mix of herbs including

plantain. Under dry conditions these pastures out-perform ryegrass swards and produce high quality feed which can be cut or grazed. Other grass species can be added to the mix and Yorkshire fog is well worth considering, as well as other legumes, which are tolerant of dry conditions like birdsfoot trefoil.

Heavy land mixture

On cold, waterlogged, clay soils we need species, which can tolerate and thrive in these conditions and again ryegrasses do not perform well here. Under these circumstances grasses like fescues and timothy should be the grasses of choice as they produce a highly palatable sward which is highly digestible when grown in association with red and white clovers. Other legumes and herbs tolerant of wet ground can also be added to the mix. This sward should not be over-grazed, allowing plenty of time for recovery between rotations, and it can be used for good quality hay if cut before flowering.

Forage production

Many species of legumes and other herbs make excellent forage, either in conjunction with grasses, or when grown alone or in mixtures. Red clover is a particularly good choice for silage production with high yields and feed quality, with up to 20% crude protein, without the need for nitrogenous fertilisers. It is highly palatable to stock and results in higher milk yields and liveweight gains than ryegrass alone silage. When grown as a forage crop it can be combined with Italian and hybrid ryegrasses, providing them with all the nitrogen they need for maximum production.

Vetches and other winter-hardy legumes can also be used as a companion crop in a mix with cereals like maize, sorghum or oats to be cut for silage.

Other species to consider, either alone or in mixtures, include ribwort plantain, chicory, lucerne, sainfoin, phacelia and comfrey.

Green manures

Green manuring is a technique, which has gone out of vogue in modern intensive farming but is a technique for adding fertility and drought resistance to the soil in between crops without the need for fertilisers. It uses the dynamic interchange of nutrients like nitrogen between the clover legumes and the grasses, the 'fixers' and the 'lifters', to increase and capture the nutrients, which are then ploughed back into the soil for use by the next crop, which may be a grass ley.

The advantage of green manure crops is that they maintain soil cover during the winter or summer when the soil may be prone to leaching or parching, and they build organic matter, which is often severely depleted after an arable crop has been grown. Using this technique soil structure, fertility and water retention are significantly improved after just two green manure crops in your rotation. A variety of different pasture species can be used depending on whether winter or summer sown, and your soil type.

Other herbal plantings

Herbs can be planted in areas where cows have selected

access to it. This enables the plant to continue to grow. If the animals have free access to these herbs, they tend to graze it so much that it refuses to grow.

A corner of your sacrifice paddock, or in the hedgerows is a good area to plant these. Put a fence between them and the animal at a height that allows the animal to reach under and nibble at it. Deep rooting plants are beneficial and will give the plants all the nutrients needed to keep well.

The animals will eat them when they have a need, and will instinctively know this and know what they need.

As well as these suggestions you can speed up the changes by trying to over-sow some species such as chicory and plantain, when conditions are good, into existing pastures. Experiment to see what suits your conditions and what doesn't.

Some varieties are:

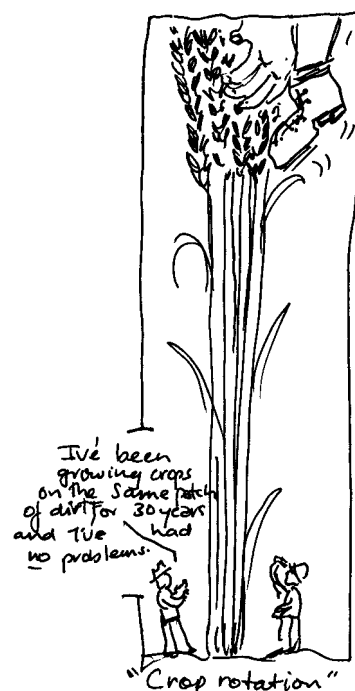
Chicory, red clover, plantain, yarrow, sheep's burnet, trefoil, fennel, timothy, borage, comfrey, cleavers, chickweed, dock, shepherd's purse, dandelion, chamomile, nasturtium, alfalfa, self-heal, melilot, sheep's sorrel, sow thistle (puha), and watercress.

See also the Animal Health chapter.

Techniques for sowing and establishment of herbal leys

There are basically two techniques for establishing a herbal ley, depending on what you want to achieve, either you have to plough up and reseed your existing pasture, or you can oversow the seed mix into an already established pasture. If there are essential elements of your existing pasture that you want to keep and it is really only a matter of enhancing it by adding species or boosting the clover content, then the latter is the best option, but it needs careful management to get a good result. It is best to use this technique on very open or damaged pastures where there is plenty of space for new seedlings to establish. It doesn't work very well on dense swards unless the sward is harrowed hard first, to expose the soil.

The best time to do over sowing is when the ground is warm and moist to give maximum chance for germination and growth for the seedlings to get away and compete successfully with the existing sward. This is usually late spring, but also autumn may be more favourable in the north. Herbal and legume species are slow to establish and greatly slowed down by cold (<10° C). Keep the perennial ryegrass sowing rate low (as low



as 12 kg/ha) to reduce competition against the slower establishing species, which can be increased slightly in their sowing rates to compensate.

The existing sward must be closely cut or heavily grazed immediately prior to sowing, and the seed mixture broadcast and lightly harrowed into the soil, followed by rolling. The seed can be surface drilled but only just below the surface as most of the seeds are very small and do not germinate if planted too deep. The pasture should then be lightly grazed until the new seedlings germinate, but then the stock removed and left ungrazed for 3-4 weeks to allow the seedlings to develop good strong root systems. However, the grass shouldn't be allowed to overtop the new seedlings, if there is a risk of this a high cut or quick mob grazing may be required. The sward should only be lightly grazed and not conserved for forage in its first year, to allow the new plants to establish and catch up to the already established plants.

Preparing and planting into a seedbed by ploughing and cultivation is the most certain way to get a good result, but obviously cannot be done in every circumstance. The seedbed needs to be very firm, the age old test being that a bicycle should be able to be ridden across it prior to sowing! Again, a shallow surface sowing method is required for the small seed, especially the clover, and care needs to be taken during establishment of the sward for best results. Grazing should not be started until there is sufficient root establishment to prevent the plants being pulled out by grazing stock, a 'tug-test' will determine this. After the first grazing the sward should be topped to control weed species before they have a chance to set seed. This may need to be done more than once in the first year of establishment. Ideally, the new ley should be grazed lightly in autumn and the following spring, and then shut up for conserved forage, to help the plants get fully established. It can be beneficial to allow the sward to set seed in its first year to boost plant density, if most of the plants you want have established and it's not too weedy. Heavy grazing in the first autumn will delay spring growth, but this could be beneficial if the grass is getting away better than the clovers, as it will allow the clovers to catch up. If planting in the spring then the sward can be grazed and conserved for forage in its first year.

If under-sowing pasture species into companion plantings like cereals it is often best to plant the understorey plants like the legumes first in the spring and allow them to establish before planting in the main crop, especially if growing a winter cereal. Then the fertility-building mixture can be cut or grazed just prior to planting the main crop. The timing of companion plantings is crucial to get a good result and can vary widely depending upon season, care being needed so that the understorey plants don't end up swamping the overstorey. However, it can be a cost-effective way of getting the herbal ley sward established and ready to be grazed once the crop is harvested.

In highly fertile pastures where it is difficult to get the herb species to persist in the sward due to competition by vigorous grasses, it may be appropriate to plant shelterbelts of mixed herb species, where the stock only have limited access and where competition from grasses is reduced. Examples of potentially suitable locations would be alongside/underneath a hedge line or tree-line, or on erosion spots in your paddocks, or on steeper slopes, beside dams or water courses, or in your quarantine paddock, or orchard.

Another technique for establishing an herbal ley is to use hay cut from an already established pasture, especially one from an organic farm. The hay would obviously need to be cut after the main sward species have flowered and set seed. The method to use then is to scatter the hay across your paddock, thinly enough to allow germination of the seed. This can be a very successful and cost effective technique and often the only way to get the species you want. It has the added advantage of providing extra organic matter to the soil at the same time.

A much more time consuming and labour intensive technique is to collect your own seed from field margins and waste places around your farm and the local neighbourhood, especially road verges. This is only really a viable option if you are sowing small areas of your farm like shelter belts and quarantine paddocks, as the quantity of seed you need is quite daunting! It does have the benefit however, of giving you locally adapted species and varieties which you know will flourish on your farm, and for nothing (well, in cash anyway). Perhaps one to get the kids onto?

There are a few places specialising seed from organically grown plants for use in small areas like orchard or quarantine paddock herbal leys. Some also specialise in heritage seeds, that is older varieties of seed which are long-established in New Zealand and are therefore adapted to our conditions over a long period of time and are possibly more suited to organic/biological systems. There is also a seed saving bank and network freely available in New Zealand to preserve these seeds.

Management of the herbal ley pasture

To get optimum results, the basic grass/clover sward of an organic farm does need a rather different management approach to that of the mainly grass-based swards of conventional farms. Organic farmers rely heavily on the performance of clovers for soil fertility, and your management needs to keep clovers in mind, over and above grasses. The techniques that we use to manage clover-based pastures are exactly the same as for conventional pastures, although the timings may vary and we may need to be more in tune with what is happening.

The main management tool is obviously grazing livestock, and these act as mobile mowers and fertilisers. Judicious management of grazing density, duration and rotation, can limit the need for any other pasture intervention, but of course our grazing is always a delicate balancing act and life is far from perfect, so there is always some tweaking required on your part. Rotational grazing is by far the most successful grazing technique on organic pastures as it allows the clovers the essential time they need to recover after defoliation, as well as which it allows time for intestinal parasite eggs dropped in dung to hatch, be exposed to the elements and die before re-infestation. The optimum time between grazing should be around 5 weeks for each of these processes, although this will vary depending on the growing season. Clovers can recover very quickly in spring and rotations need to be sped up to keep on top of the growth. Set-stocking will tend to favour the grasses over the clover so that over time the proportion of clover and hence fertility of the sward will decline, also causing a worm problem in your young stock, especially lambs.

A crucial aspect of grazing management is sward height. Over-grazing should be avoided and stock moved on before the sward gets below about 3-5cm, as below this there is little leaf area available for photosynthesis and so pasture recovery is significantly delayed. Equally swards should not be allowed to get too tall and rank as this will inhibit the activity of the clovers and reduce productivity. Optimum sward heights vary between 6cm for sheep up to about 10cm for dairy cattle, the aim being to keep the grazing period as short as possible, moving the stock on at the optimum stubble height for rapid sward regrowth. If under grazing or above average growth occurs the sward can be topped, if conditions allow, maintaining the optimum sward height. If the pasture becomes overgrazed, try to give it a longer recovery time before the next grazing. Wait until the favoured plants have recovered, or allow these plants to reseed next year if it knocked too hard.

In biological systems spring growth may be delayed over that achieved by using artificial nitrogenous fertilisers, as the soil needs to warm up sufficiently for biological activity to kick in. This is not such an issue in the north but in the south after a colder winter some allowance may need to be made for this in terms of amounts of conserved forage or fodder crops put aside for this time, and equally the same in the autumn. However, the benefit of biological farming will become apparent during the summer dry period when organic pastures will continue to perform long after conventional pastures have slowed down and dried up. This is due to clover being very active during the summer when grasses are often setting seed and resting, as well as the greater organic matter content of organic pastures giving them higher water retentive ability. Under New Zealand's strongly bimodal seasonal pasture growth curve, this will make a significant difference to overall productivity.

Additional management techniques to get the most from your herbal ley pastures will be the usual chain harrowing, in spring-time especially, to break up matted vegetation and aerate the soil, and spread any dung pats lying around after the winter. However, chain harrowing through the season is likely to be needed much less than on conventional pasture as there is a much quicker turn-over and incorporation of dung back into the soil. Likewise dead vegetation decays and disappears very rapidly and does not tend to build up and cause problems like facial eczema. A mid-season topping of the pasture can sometimes be beneficial though, especially if grass growth is getting away and setting seed, or there are a lot of weeds which could usefully be deheaded before seeding. This type of management can be especially useful if there are perennial weed problems like creeping thistle, as they cannot tolerate frequent cutting. For weed control it is useful to rotate your pastures

between ones which are grazed only and ones which are cut for winter forage. For pastures to be shut up for hay or silage an early rolling is beneficial whilst the ground is still moist but not wet, as this levels the soil surface after any winter pugging and encourages tillering of the grasses for a thicker sward.

Biologically-managed pastures need plenty of aeration of the soil to maximise biological activity and so occasional subsoil conditioning, like mole ploughing, can significantly increase their performance, especially if they have been heavily pugged or damaged by heavy machinery. Some farmers swear by various 'spiking' techniques, like those used to condition lawns, sports fields and golf courses. The best time for these treatments is early in the season whilst the soil is still moist, but only once it is dry enough not to cause further damage to the soil structure. Equally, it is important that activities like fertilising/slurry spreading are only carried out when the ground is firm enough not to be damaged by the machinery, and so storage arrangements need to be adequate to tide over wet times. Pugging and damage to the sward and soil structure also need to be taken into account when considering strip grazing to ration forage or ensure an even graze.

Best utilisation of the pasture can be achieved by adopting leader-follower grazing patterns, where stock that require the most nutrition are given access to the new growth in advance of other stock. For example, high yielding dairy cows might be grazed ahead of dairy heifers or beef followers, or weaned lambs ahead of ewes. The sheep and beef organic system takes advantage of this technique as part of pasture optimisation and parasite control, allowing beef cattle onto the pastures first to graze the longer sward, followed immediately by sheep and then rested. In this system parasite control is achieved by each mopping up the worm eggs and larvae of the preceding stock type, since cross-contamination does not occur. This can be an important part of livestock health control for a successful organic sheep operation, especially if there are not enough paddocks where weaned lambs can be given 'clean' pasture. This means pasture that has not been grazed by sheep for sufficient duration for risk of contamination to be minimal (usually considered to be about a year), or land that has been cut for hay or forage, or land reseeded after a crop rotation. See Animal Health chapter for more information.

By adopting a biological approach to the management of your pastures, it won't be long before you will notice that those bare patches between the plants, that are such a common feature of conventionally managed pasture in New Zealand, start to close up, and the sward becomes denser and thicker at the base with increased biological activity in the soil. As well as being a healthier and more productive and more nutritious pasture, this closing of the soil canopy will protect that essential soil life as well as holding more nutrients in the sward to prevent leaching and loss to water courses or to the air. The soil will start to grow in depth and its structure will improve. Thus, there are positive feedback loops, which mean that the pastures become even more productive, which is why after the first few years of converting from conventional chemically farmed pasture, organic farmers find that their pastures regain productivity.



Fallowing

Fallowing is a term used to describe the process of leaving land untilled or unsowed after ploughing; usually for a season, a year or more. A summer fallow was a method used to destroy weeds.

It was not uncommon to leave one seventh of a farm in a fallow state but this is seldom done now.

Farmers of today are experimenting with leaving paddocks or certain areas of the farm to self-seed. (This may end up being a method of attempting to keep a farm free of GM content though will probably not be entirely successful). They are not tilling the land, just leaving it ungrazed, letting it seed, letting it lie down and then waiting for it to grow again. This is not fallowing in the true definition but is a method that is being trialled by organic farmers.

Kikuyu information

Kikuyu pastures, which are such a feature of livestock farms in the north, have particular management needs to enable them to be used to best advantage, many of which differ from the general pasture management described above. Biological management is in fact a much more suitable way to optimise the feed value of this grass. Under chemical management it becomes long and rank very quickly, shading out other desirable pasture species like clover, and becomes particularly deficient in vital minerals, causing problems like staggers in stock grazed on kikuyu dominant pastures. Under a biological system kikuyu can be managed as a balanced and beneficial constituent of your pasture, which provides nutritious grazing even during the driest summers when other pasture species have shrivelled up.

Kikuyu is a subtropical grass, originating from South Africa. It was introduced to New Zealand in the 1920's for erosion control. It is still available for sale but is now quite expensive. It is dominant in 40% of Northland farms, and has also spread down the coast as far south as the Bay of Plenty and Taranaki. Due to our climate changes it is creeping into other areas. It is considered by many to be an undesirable pasture constituent due to its ability to thrive and smother out other pasture species.

Features:

- It has roots that spread from stolon growth, both over and underground. It can send new roots down from the nodes on its overground stolons.
- Grows best when ground temperatures are above 15 degrees. The warmer and more humid, the more prolific the growth. It will also grow in lower temperatures.
- Little or no growth in winter and spring. – you also need other grasses.
- Frosts do not kill the roots of the plant but do put into in a dormant mode. The green growth deteriorates in quality and burns off. It then has very low feed value. It is important to have other grass species underneath the plant.
- The army caterpillar prefers kikuyu and will eat it in autumn. There is a toxin that can affect the kikuyu at the same time. Web worm will also eat it.

- Shades out other species
- Forms a dry fibrous mat as it gets older
- Good fibre source but very low in energy and carbohydrates when fibrous.
- Only needs a sprinkle of rain to grow.
- Is very efficient at taking up nitrogen when in a growing state.
- The plant is a natrophobe, which means it has low sodium levels. Sodium containing fertilisers will not increase the sodium content of natrophobic plants.

Plant species according to their sodium content

Sodium Accumulation in:

Stubble		Leaf	
Sodium rich plants - natrophiles			
Ryegrass	White clover	Sub clover	
Cocksfoot	Chou moellier/Kale	Barley	
Lotus	Yorkshire fog	Oats	
Phalaris			
Sodium poor plants – natrophobes			
Browntop	Alsike clover	Kikuyu	Lucerne
Poa trivialis	Millet	Paspalum	Maize
Tall Fescue	Rape	Desmodium	Sudax
Timothy		Soya bean	Lupin
Red Clover			

Table sourced from 'Fertiliser Recommendations for Pastures and Crops in NZ' MAF 1982

Kikuyu Management

Because organic farmers cannot use chemical sprays to eliminate kikuyu, it is best to make the best of its usefulness by managing it.

This is done by:

- Keeping it in a growing and leafy state. This also increases its food value.
- Control through topping or mulching to get rid of the matted kikuyu. Usually this is done in autumn. This also allows the other grasses to come though for adequate feed in winter and spring.
- Graze your non-productive older animals (dry cows) on it hard. You may need a lick as a mineral supplement. Molasses sprayed on makes it more palatable and adds energy through the molasses.
- Keep your stocking rates high and paddock sizes appropriate to ensure the kikuyu is eaten out properly on each rotation.
- The maximum grazing rotation should be 4 weeks. During growth spurts of kikuyu it should be reduced to 2-3 weeks and then topped to 2.5cm to allow re-growth.

- Old fibrous kikuyu can take 3 weeks to digest. For maximum production, feed your springers young leafy kikuyu, in the 3 weeks prior to calving.
- In summer/autumn be mindful of the risk of facial eczema by not allowing a litter mass to accumulate.
- Ensure there is minimum mat left before any chance of frosts – you can be left with no grass.
- Broadcast or over-sowing before mulching in autumn is recommended to improve sward diversity.
- Free-range pigs can help control kikuyu by rooting up and eating the juicy stolons, creating bare patches which allow the germination and spread of the other pasture species.

There has been recent research done on trial farms in Northland by the Kikuyu Action Group. Information from these trials is available on line from MAF www.maf.govt.nz/sff/about-projects/search/02-054/booklet-index.htm

Weeds & their management

Weeds! The word instantly conjures up an enemy to be conquered.

Weeds, along with animal health issues, are the most often given reason by farmers for why they believe they can't go organic. They believe they will be swamped by the enemy.

A weed only exists in relation to human activities. It is our term for a plant growing where we don't want it, and where we believe it is interfering with what we do want there. So the whole perception we have is of lack of value to us.

In nature there is no such thing as a weed. All plants have a function in the communities of which they are a part. Many of the plants which we call weeds are nature's colonisers. They are adapted to taking advantage of bare ground and germinating, getting established and setting seed quickly so that they are ready with dispersed seed for the next patch of bare ground to move into. So they are highly mobile, but they do not persist for long as they quickly make conditions unsuitable for themselves by providing ground cover where other more persistent species like grasses establish. This is the process of succession that we talked about earlier in the introduction to this chapter. It is only if we continue to provide suitable conditions for them by pushing the succession stage back to bare ground, that they can persist.

So the important point here is that we are the agents of change on the farm, and it is our management practices which, to a great extent, determine what conditions are available and suitable for what plants. So-called weed species are often providing us with an indicator of something that we are doing wrong, or could do differently, to make conditions less suitable for the undesired plants. Just blasting them with herbicides is not actually going to solve the problem, as we haven't changed the conditions. They are still tipped in favour of the 'weeds'. A good example of this is a high incidence of dock around gateways and water troughs, and other areas of high traffic. This is where the ground is highly compacted and drainage impeded,

and dock is one of the few plants able to tolerate these conditions, and it does so by means of a very deep and vigorous taproot, which penetrates the soil, increasing aeration and pulling up nutrients from the subsoil. So the plant is actually working in your favour, improving the soil. Large areas of dock infestation through your paddocks are likely to be an indication of a wider compaction problem and the solution may be to do some sub-soil aeration, not shoot the messenger.

IFOAM Organic Principles and Recommendations (2005) for Organic Weed, Pest and Disease Management

General Principles - Organic farming systems apply biological and cultural means to prevent unacceptable losses from pests, diseases and weeds. They use crops and varieties that are well-adapted to the environment and a balanced fertility program to maintain fertile soils with high biological activity, locally adapted rotations, companion planting, green manures, and other recognised organic practices as described in these standards. Growth and development should take place in a natural manner.

Recommendations

Pests, diseases and weeds should be managed by the knowledgeable application of one, or a combination, of the following measures:

- a. Choice of appropriate species and varieties;
- b. Appropriate rotation programs;
- c. Mechanical cultivation;
- d. Protection of natural enemies of pests through provision of favourable habitat, such as hedges, nesting sites and ecological buffer zones that maintain the original vegetation to house pest predators;
- e. Diversified ecosystems. These will vary between geographical locations. For example, buffer zones to counteract erosion, agro-forestry, rotating crops, intercropping, etc.;
- f. Thermal weeding;
- g. Seed bed preparation;
- h. Natural enemies including release of predators and parasites;
- i. Acceptable biodynamic preparations from stone meal, farmyard manure or plants;
- j. Mulching and mowing;
- k. Grazing of animals;
- l. Mechanical controls such as traps, barriers, light and sound.

On the biological farm it pays to get to know and understand your weeds, and to learn to live with them in an attitude of mutual respect and tolerance. Many of them are our friends, and the others can usually be managed at tolerable levels by understanding the problem that they are indicating and dealing with that. As we have already discussed above, many of them like plantain, dandelion, chickweed, and a whole host of other herbs are relished by the stock, and are important elements in the pasture for providing the minerals they need for full health. So it pays to think of them as natural substitutes for vet bills, then their financial contribution is valued and they are not seen as just taking up valuable space for other plants like grasses. In our crops or on areas of bare ground weeds are acting as a green manure, protecting the soil from erosion or leaching, and contributing to soil fertility in areas, where other plants cannot grow. Weeds also act as refuges for beneficial predator species of insects and other wildlife that keep a natural balance and protect us against pests and diseases in our target crops and pastures. So weeds do make a very important financial contribution to the successful functioning of our farms.

Many persistent plants, which are taking up too much space and adversely affecting our target crop or pasture can be managed by topping at the appropriate time before they set seed. This is particularly relevant in newly sown pasture leys or crops, or for persistent pasture species like creeping thistle. Most cannot tolerate cutting and will not persist, especially if cut more than once. The other main method of control is rotations of crop and pasture, and rotations between different crop types, so that weed species do not get a hold and become dominant.

For pastures where mechanical cutting cultivation techniques are not practicable, which would be the case for many sheep and beef farmers in New Zealand, the presence of dominant and persistent weeds may be telling us something important about our grazing management which could be changed. Set-stocking for example often leads to widespread problems of over-grazing, compaction and selective grazing, which favours certain weed species. Changing to a rotational grazing system and by rotational cross-grazing between different stock-types can significantly improve the quality and vigour of the pasture, and get a more balanced sward, eventually eliminating some of the weed species altogether.

There are many books, which look at weeds and their ecological niches which are well worth reading to get to know your allies and enemies, and to help you develop more long-term, lateral strategies in your farm management to make use of what they are telling you. Below are just some examples. As they say, it's all in the mind!

Some plants and their properties and indications of soil deficiencies:

Dock – trying to open up soil with deep tap root, poorly drained soil, lime indicator

Plantain, hawksbeard – phosphorous

Chamomile, willow weed, willow, speedwell - lime, calcium

Sorrel – calcium, phosphorous

Buttercup – cobalt, low pH, poor drainage

Nettle – iron and shallow pan (has 27 other minerals as well)

All thistles – nitrogen, copper, silica

Ragwort – copper.

Couch, dandelion – silica

Chickweed, cleaver, fumitory – copper, boron, zinc, phosphorous, iron

Bracken Fern and inkweed – potassium

Blackberry – iron

Fennel – copper, potassium, sulphur

Gorse – nitrogen

Willow weed – poor drainage

See also Tim Jenkins article on this subject in Organic NZ July/August 2010

The formation of and degree of colour the plants have can also give you an indication of missing key elements. For example plants lying flat instead of reaching indicates a lack of silica. This is done through skilful observations. A good soil science book would also give you information you need.

Weed control options

Weeds are seldom bad enough on organic dairy farms to affect production. Many weed species are eaten by cows, have high mineral contents and good feed value. The following strategies can be used to minimise problems from unwanted weeds:

- Often the main time that weeds are troublesome in pastures is during the first year after resowing, as the bare soil has allowed dormant weed seeds in the soil to germinate. Many of these are annual weeds that will die off naturally within the first year, though good pasture establishment technique and higher sowing rates will reduce this. Also good grazing technique and topping can be used to reduce the impact of these weeds prior to them dying off naturally.
- If densities of Scotch thistle, variegated thistle and nodding thistle are low enough, it might be feasible to chip them to kill them prior to flowering, ensuring the cut is below the crown of the plant which contains dormant buds capable of regrowing. Ragwort plants can be pulled from the ground when flowering, at which time root fragments left behind are less likely to regrow. However, ragwort seeds will continue to mature after the plant is pulled from the soil so flowers need to be removed from the paddock. Chipping of ragwort is usually not recommended as remaining root fragments may regrow, but in the absence of herbicides, careful chipping may be better than leaving the plants to grow.
- When pastures are well established, keeping them competitive over summer will reduce establishment of new thistle problems (e.g. using drought-tolerant species, avoiding over-grazing). Reducing pugging damage over winter (e.g. using feeding pads, grazing stock off the property) will help stop new ragwort establishing.
- Break-feeding over late autumn and winter can

help reduce the dominance of some weeds such as docks.

- Californian thistle can be weakened by mowing it whenever it reaches the early flower-bud stage, preventing it from dominating pastures. At this stage, it has used up some root reserves to establish above-ground shoots, and is about to start replenishing these root reserves. If it is consistently prevented from replacing root reserves by mowing at this stage, the weed can be severely affected. Mowing could occur after grazing, or before cows enter a paddock so that they can eat mown material. Note that although many people believe mowing in the rain rots the root system, this relies on suitable fungal organisms to be present, which often isn't the case.
- Mowing can also be used to reduce seed production from species such as ragwort and Scotch thistle if they are mown once stem elongation has begun but before they have formed viable seeds. Generally these species will regrow again, but will produce less seeds than if they were allowed to set seed without any disturbance.
- Mowing can also be used to deal with any scrub-weeds such as blackberry or gorse that are not grazed out as seedlings by the cows. If scrub weeds are a problem in fence-lines, look at raising the bottom wire so cows graze under the fences more readily, thus removing scrub weeds as seedlings.
- Although most dairy farms are not fenced adequately for sheep grazing, some organic dairy farmers use sheep from nearby organic properties to graze ragwort at certain times of the year in bad paddocks. Sheep are less affected by the alkaloids in ragwort, and some sheep will actively seek out ragwort plants to eat.
- For some weed species such as ragwort, nodding thistle, Californian thistle and gorse, biological control organisms are available which will attack these weeds. They seldom wipe the weeds out from a paddock, but may help make the weeds less aggressive. Agents can often be obtained from local regional councils.
- Twin cress is only a problem if eaten by lactating cows, and generally only grows in newly established pastures. Milk taint problems can be avoided if new pastures with twin cress are grazed by any animals on the farm that aren't being milked.

Teas

Because these plants are high in particular minerals that are missing from the topsoil, it is prudent to return them to the land through spraying teas.

Method:

Gather the whole plant and put it in a drum. Top it up with water and allow it to steep. Biodynamic compost preparations (2 sets per 200 litres) added will be beneficial. Let the plants steep for at least six weeks. Spray on to the affected area.

Potentisation

Potentisation is a process where a small piece of every stage of the plant growth is taken – root, new growth, old growth, flower, berry. It is then potentised (usually 6x) and sprayed on to the area once a month. It is said it stops any further spreading of the weed and suppresses growth.

Peppering

This is used to eliminate the weed completely.

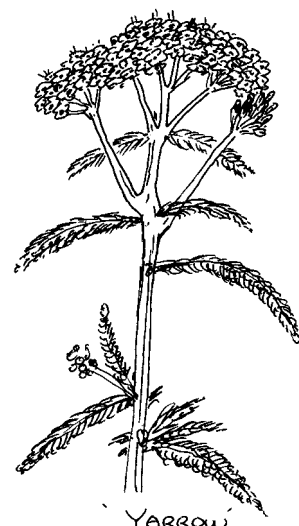
Collect ripe seed off your own property. Dry, then burn on as hot a fire as possible – there is some debate as to whether to burn on the full moon or the new moon. This then becomes ash. This ash is then sprinkled over the weed infestation area.

It can be bulked out with lime or rock dust, or sand and then spread.

If there are insufficient seeds, they can be bulked out with roots and whole plants.

The key, however is the seed or the ripe reproductive organ.

The ash can also be potentised to 6x by a homoeopath.



Integrating crop production into organic pastoral livestock systems

Integrating cropping into pastoral livestock systems, such as dairy, has a considerable number of positive benefits, from parasite and weed management through to increased profit and better cash flows. However, there are a number of counter balancing disadvantages such as increased farm complexity, capital purchases and increased risk. This document outlines the pros and cons of introducing cropping onto organic livestock farms as well as providing information on the practical requirements of implementing such a system.

However, this document is not a how-to-guide or a recipe to follow: farming, and especially organic farming, is far too complex to provide step-by-step instructions. Detailed information on organic crop production is a topic that would span several books. The information presented here assumes that the reader already has sufficient agricultural knowledge to manage an organic livestock farm and is therefore fully aware of the knowledge underlying what is presented. It is also essential that the people implementing any of the information provided have a good level of agricultural education/training and/or practical experience to accurately translate the ideas into practice and know when more detailed information is needed and where to source it.

A considerable number of general statements are made, and in most cases these will be correct. However, farming is a complex ecological system and there are exceptions to practically every rule; your mileage will vary.

Pros and cons

There are a considerable range of benefits from integrating cropping into organic, pasture based, livestock systems. Much of this comes from the increased diversity that cropping brings and the high level of biological and ecological complementarities of crops and stock.

Pest management advantages

Starting at the paddock level, rotating crops and pasture is a very powerful way of managing low mobility pests (pests in the broad sense, i.e. insects, weeds, diseases, parasites, etc.). For example, perennial weeds that tend to prosper in pasture can be eliminated during the cropping phase due to tillage and competition from crops, so 'cleaning' the ground for pasture re-establishment. At the same time the weed species that cause the most problem in annual crops tend to be annual weeds, the seedbank of which can be dramatically lowered under a multi-year pasture. 'Parachuting' one or two years of annual crops into a five or more year long pasture means that cropping weeds are unable to build-up their populations and most critically, their seedbank, so they never reach the amounts found on farms dominated by cropping. At the same time, as with any agricultural / ecological system, there are always exceptions to any rule, and there are weeds that are problematic in both systems,

e.g., Californian thistle (*Cirsium arvense*).

The other type of pests that is very susceptible to rotating crops with pasture are external and particularly internal stock parasites. These can only survive outside their hosts for a limited time (weeks or months). Ripping up a pasture and planting an annual crop, even if it is only for a few months, and then re-sowing pasture, will, in most cases, completely eliminate parasites from the new pasture. The fresh and strong growth from a re-seed plus the presence of more palatable pasture species that are often selectively grazed out of older pasture, makes it ideal fodder for young stock that are more susceptible to parasites and need quality feed. Such 'clean-grazing' is a critical parasite management tool on mixed cropping farms.

The critical aspect that makes pests susceptible to this rotational effect is their mobility. Pests that can readily move considerable distances, and do so on a regular basis, e.g., airborne fungi spores and blowflies, are not going to be affected by rotations to any great extent or at all. Those pests that are principally soil-borne with resting stages that only survive for a few months to a year or two can be very effectively controlled.

Crop and pasture benefits

The main limiting nutrient for crop growth across the world is nitrogen (N). As organic farmers are prohibited from using synthetic / soluble forms of nitrogen, getting enough N is a particular problem for organic cropping farmers. On the other hand, a well managed organic pasture with one or more nitrogen fixing species such as clovers and lucerne, often has an excess supply and large reserve of nitrogen, mostly stored in soil organic matter. Two to three years of annual crops can make excellent use of this nitrogen, if correctly managed, and can produce exceptional yields, comparable or even beating, the best yields from synthetic-nitrogen fertilised crops. Also, the high soil organic matter levels and superb soil structure that builds up under pasture also significantly helps to increase yields.

At the same time, a spell of tillage (cultivation) can also be useful for pasture production. For example, it allows issues such as compaction to be remediated mechanically by sub-soiling / deep ripping. Where significant amounts of rock phosphate or lime need to be applied, incorporating them into the soil, rather than just leaving them on the pasture surface can help speed up their assimilation into the soil nutrient pools. A cropping break can also be useful when it comes to pasture renewal. As described above it can be valuable to get rid of existing pasture weeds, and help clear out the pasture weed seedbank, e.g. other undesirable grasses such as poa (*Poa annua*) and barley grass (*Hordeum leporinum*) as most grasses have only short lived seeds with weak dormancy.

Under-sowing

Under-sowing is a technique where a crop / pasture is established underneath the previous crop before it is harvested or grazed off. It is a technique well worth pursuing as it eliminates an entire round of tillage operations and advances the availability of the pasture for grazing by weeks to months. However, not all crops are suitable for under-sowing. There is a critical balance to be achieved between

ensuring the main crop is not too adversely affected by the under-sow while ensuring the under-sown species have sufficient resources that they survive until after the main crop is removed. If the main crop is too competitive, e.g. triticale and rye, it may completely kill the under-sowing. At the same time if the under-sown species are too vigorous (e.g. red clover), sown too early and / or the main crop is weak or short, e.g. barley, then the under-sown crop can smother the main crop.

Unfortunately there are no hard and fast rules as to what works and what does not. The number of permutations of main crop and under-sown crop are huge, and due to soil and climate variations between farms, what works well on one farm can be a total failure on another. Trial and error, starting with manual, plot scale first attempts, based on the experience of others farming under similar conditions, before building up to field scale tests, is the only sure-fire way of working out what works for your farm.

Downsides at the paddock level

The paddock level downsides of introducing cropping into a pastured stock system are not that many. It can make feed budgeting more complicated, but that is generally not a big issue. Rapid changes of diet are nearly always detrimental for stock so they need to be weaned onto forage crops to prevent digestion problems. Break feeding is an obvious option here combined with grazing back on pasture and or using hay/silage.

Probably one of the biggest issues is getting both stock and cropping jobs done at the right time. Murphy's law will cause those really time critical jobs for both farm systems to be done at the same time, like milking and sowing before the forecast week of rain arrives during the night. Most of the more significant downsides at the whole farm level will be discussed below.

Stock feed

In colder climates where stock is housed for several months a year, fodder crops (i.e., those grown only for stock feed) are a staple of stock farms. While only a few places in New Zealand need to house stock due to our (mostly) benign climate, the benefits of non-pasture forms of feed can still be significant.

While mixed pasture is undoubtedly really good feed, and one of the cheapest and easiest to grow, it does not always match what the stock need in terms of nutrients and energy. Especially as pasture production varies over the year and different stock classes have different requirements, such as dry vs. milking, grown vs. growing. Fodder crops, and also crop by-products such as straw, can be valuable additional feed resources, allowing better matching of individual stock feed requirements, whether they only need maintenance rations or are gulping down protein.

Fodder crops for grazing can also be targeted to periods of low pasture availability, like those during late winter and suitable types can be stored to even out pasture supply or for unpredictable feed shortages. The downside is that pasture feed is nearly always cheaper, often considerably cheaper, when all the costs of cropping are taken into account than feed from crops. The additional benefits of feed from crops may need to be quite large to make the whole effort worthwhile.

Farm business pros and cons

Moving up a level from the paddocks to the farm business, there are also a range of pros and cons for integrating cropping into a stock farm. Cash crops can create a valuable new sales income, which can be a major help for cash flows and managing debt, if it is bringing in cash when the main business is not. More diversified sales streams also increase business resilience, in that if one farm product has a bad year, there is the potential for other products to compensate, or at least help through. However, this won't always be the case as some situations; drought with an irrigation ban will hit most products, both crop and stock, hard.

At the same time cropping creates a whole new set of jobs and increases the complexity of farm management and the overall business.

The amount of extra work and complexity are the key factors that are often significantly underestimated when making changes. History is littered with farmers who thought an alternative farming enterprise looked easy compared with what they were already doing and jumped in with both boots only to find out just how hard it was. Livestock farming is a technical business which takes aptitude, training and experience to do well. Cropping farming is just as technical but needs a quite different aptitude training and experience. To put it another way the amount of transferable skills between livestock and cropping farming is often much lower than anticipated.

Particular issues are that new machinery may well be required, which has the usual financial implications. The requirements for up-skilling both staff and management can be considerable. Marketing of crops can be a large job in itself. For most livestock products there are only a handful of outlets, such as the meat works, Fonterra and the wool merchant. In comparison crops, especially organic crops may need a lot of sales and marketing work, especially if the best prices are to be achieved. It is essential to ensure the costs of selling crops, and getting paid on time, or even just getting paid, are factored into cropping budgets. If the crops are for selling off-farm, it is essential to ensure you have a market outlet organised before you put the crop in the ground. Just because there is a general shortage of organic crops, does not mean that there is a guaranteed market. For specialty crops, like vegetables, a few tens of hectares could produce enough to supply the domestic market for years. More than a few farmers new to cropping have had to plough their crops back in at harvest because they did not sort out a buyer before hand.

Crop production in practice

This section looks at the practical issues with crop production on a predominately pasture based livestock farm.

Crop choice: easy to hard

Crop choice is to a large part decided by market requirements, whether the 'customers' are your own stock, or it is being sold off-farm. However, not all crops are as easy to grow, and if on-farm crop production expertise is limited then it would be a better idea to start with easy crops, rather than jump in with the ones that are complete nightmares.

Cereals including maize and sweet corn are the simplest crops to grow as they are mostly tough, robust and can look after themselves to a large extent. They require the least new equipment and most production operations can be contracted out. They are pretty easy to sell and they can be used for feed if off-farm markets don't work out. Unsurprisingly they will generally make the least amount of money.

Fodder crops are not far behind the cereals in terms of ease of production. As many of them are smaller seeded, arable drills may not do such a good job of establishing a good stand. In-crop tasks such as weeding may be more critical than with cereals and require more specialised machinery which many not be available from contractors. Fortunately the 'customers' are on-site, happy to help themselves and not that hard to please!

Vegetables and other specialist crops are a serious step up from cereals and fodder crops. They are much easier to get wrong. They have much higher variable costs, especially if hand-weeding required. Specialist drills, transplanters, weeding and harvesting equipment is likely to be required, with it being pretty unlikely that such jobs can be contracted out or even machinery hired or borrowed. Sales and marketing can often be very complex, especially for perishable crops. On the bright side very high returns are possible, many times than of any alternative farm system, stock or crop.

Production systems

Tillage and plant-available nutrients

In long-term pastures (greater than five years) most of the plant-available phosphorous and to a lesser extent nitrogen, accumulates in the top few centimetres of soil. This is because the plant-available forms of these nutrients are chiefly in the form of organic matter which, in untilled soil, such as pasture, accumulates on the soil surface. Ploughing will bury this organic matter layer which means that its decomposition slows, due to limited oxygen, resulting in the N and P it contains being unavailable for following crops for months, even years. The alternative is to shallow plough (less than 10 cm) or surface work longer term pasture rather than plough. However, this may create other problems in terms of less effective weed management and increased number of tractor passes for tillage. There are no hard and fast rules to predict if normal ploughing or no-

inversion / min-tillage is best for your farm so it is a matter of experimentation.

Fertilisers

Generally crops are more fussy about soil nutrient status than pasture, or to put it another way, pasture is rather more forgiving of having sub-optimal soil nutrient status than crops whose yield can drop significantly under even slightly sub-optimal nutrient status with consequent yield drops and reduction in profit.

The only effective way to measure and monitor soil nutrient status is ongoing and regular soil tests of a type appropriate for the production system in question. Tests results should be thoughtfully interpreted and then organically approved fertilisers should be appropriately applied in the necessary amounts.

Vegetables in particular are 'fussy' about micronutrients so a full soil analysis is required well in advance to allow deficiencies to be corrected before crop establishment and alternative land sought where levels are in excess.

As lime and rock phosphate take a year before they start having an effect (unless they are finely ground with equally 'fine' prices) it's vital to apply them well in advance of putting a crop in, so testing will be required more than a year in advance of planting crops.

Contractors and organic standards

Using contractors is a great idea when growing small areas of crops on a predominantly livestock farm as it avoids the need to purchase capital equipment and out-sources the skilled labour requirement. However, organic standards are quite strict on ensuring that non-organic crops, seeds and agrichemicals are not brought onto organic farms in and on equipment that is not dedicated for use on organic land. Extensive clean down procedures are often required, which may be an issue for contractors and may incur extra costs. Be sure to fully discuss these issues with contractors at the earliest stage of negotiations.

Where comments are made in this document about how likely a task can be contracted out it is making a generalised statement about the availability of such contracting tasks in New Zealand as a whole, e.g., practically all contractors offer ploughing, next to none offer interrow hoeing. If you are farming in a predominately livestock production area, tasks that are easy to find a contractor for in cropping areas may not be available in your area, or at least not easily or cheaply.

Cereals

Crop establishment

The same standard tillage approaches as would be used for pasture re-seeding, like plough and harrow, are generally sufficient for cereal production. The main difference being

that the well consolidated seedbed normally prepared for pasture is too firm. One or two final tillage passes are generally more than sufficient for cereals, especially on the well structured, high organic matter soil found under pasture. Crop establishment is by drilling, or even broadcasting with a fertiliser spreader at a pinch. Standard agricultural seed drills are designed for the job. All tillage and establishment operations should be unproblematic to contract out.

Weed management

Weeding is likely to be the most critical in-crop management activity. If only one, and at a bit of a stretch, two years of crops are being grown between a five or more year pasture phase, and the cereals being grown are more competitive, i.e. anything as big or taller than wheat, then cropping weed populations may be sufficiently low that no weeding is required. The exception would be maize due to the lower plant populations. For all other situations weeding will almost certainly be required.

Weeding before the crop is in the ground

The domination of weed management for the last half century by herbicides has resulted in the common view that weed management is something that is done to weeds in the crop. However, for non-herbicide weed management systems using such an approach is a recipe for disaster. For intensive organic cropping systems around 95% of weed management should be achieved before the crop emerges.

A good example of such pre-emergence weed management is a long pasture phase with a short cropping break, i.e. a pasture dominated rotation, which works because the crop weeds don't have time to build up a large seed bank, and the long pasture phase provides time for the seed bank that is established to decrease to very low levels. In-crop

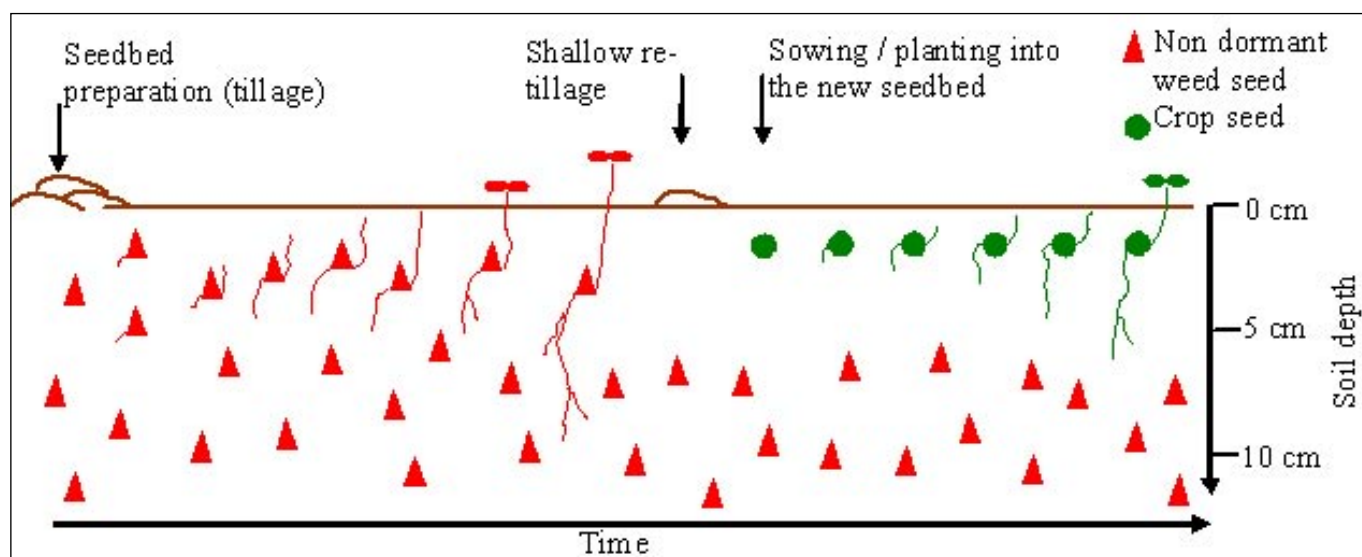
weeding should therefore be considered to be the icing, even the cherry, on the weed management cake.

This system is based on the facts that:

- Most cropping weeds can and will only emerge from about the top 5 cm of soil as they have insufficient reserves of energy and nutrients to emerge any deeper, i.e. they die before they make the surface.
- That some 90% of weed seeds in the soil are dormant so can't germinate even if conditions are right.
- Tillage is the most effective means of getting weed seed to germinate.

The false seedbed works / is implemented by creating a final seedbed as normal, but then instead of immediately sowing the crop, drilling/planting is delayed and the weeds, encouraged to germinate by the tillage, are allowed to emerge. The 'weedlings' are then killed by one more tillage pass and the crop is sown.

To get the most from this technique, the seedbed must be good enough, especially moist enough, to get the weeds to germinate, if it is not, then don't bother with the technique. Totally critical to the technique's success is that the re-tillage used to kill the weed seedlings must be as shallow and cause as little disturbance to the soil as possible, and in all cases it should be no deeper than 5 cm. If deeper re-tillage is undertaken, e.g. a rotary hoe is used, then a completely new seedbed will be formed and non-dormant weed seed, from below the 5cm emergence threshold will be brought to the surface and germinate amongst the crop. The problem is that there are only a handful of machines specifically designed for this task. The best off-the-shelf machine to implement the false seedbed technique in arable farming is the spring tine harrow.



A key weed management technique for all organic cropping systems is the false seedbed. The figure above shows how this is done. It is also incorrectly called by other names such as a stale seedbed.

Illustrative scheme of a false seed bed: A seedbed is prepared, weed seeds in top 5 cm of soil germinate and then emerge, the soil is then re-tilled with the minimum disturbance necessary to kill weed seedlings, the crop is then sown, germinates and emerges from mostly weed free soil.

Weeding machinery - spring tine harrows and interrow hoes

When it comes to choosing one piece of weeding machinery for cereal and similar crops the clear front runner by a country mile is the spring tine harrow (aka tine weeder, finger weeder etc.)

These are very versatile tools, they can do a very good weeding job in the right conditions, be used for re-tillage in the false seedbed technique, they can also be used for secondary tillage, pasture renovation and with the addition of a seeder unit can also be used to sow small seeded crops including pasture species. Compared with many other weeding machines, they are pretty simple, don't need to be steered as they weed the entire field surface and are relatively inexpensive (but not compared with a set of chain harrows). Like pretty much every other piece of agricultural equipment, there are the cheap makes that don't do a very good job with a build quality to match, and at the other end are the 'Rolls Royces' that are exceptional but leave a hole in your wallet. Ask other owners what they think of their makes and don't hesitate to ask for a demonstration. Normal tillage type harrows have been used for weeding cereals crops, but don't be surprised if they do more harm to the crop than weeds. They are probably better left in the shed.

A key issue with spring tine harrows is they are more effective against dicots than monocots and they will only kill weeds at small growth stages; cotyledons to about four true leaves. Kill rates decrease alarmingly at larger growth stages. This means there is a pretty small window of time to get the weeding done in the early stages of the crop before the weeds and crop are too big. If it is wet during this time weed control may be lost. Spring tine harrows also perform much less well in stony or cloddy ground. They also take a fair bit of brain power and experience to figure out how to set up and use to the best effect, even though they have few adjustments: tine angle, height/pressure and forward speed, because each adjustment has an effect on the others. Getting it wrong will result in significant crop damage. This not a job to give to the casual farm hand.

Talking with experienced users and seeing demonstrations is strongly recommended.

Where crops are grown on a more regular basis, with less than four years pasture break, or if soils are stony, or wet weather at critical weeding times is likely to occur, then more aggressive weeding machinery, mainly interrow hoes, will probably be required. Like spring tine harrows, not all interrow hoes are created equal. They range from machines designed for arable crops, mainly maize, which are big, tough and not very precise, to specialist vegetable weeders of a complexity and accuracy that would make NASA proud. Get the right horse for the course, and as for spring tine harrows, talk to other farmers and independent advisors with experience of different types and makes.

While hoeing widely spaced maize crops is pretty straight forward and there are a range of interrow hoes available off-the-shelf for the job, the same is not true for hoeing cereals. Significant production changes, such as 30 cm (12") rows are likely required, machinery will need customising and guidance will become an issue. Unless you are growing maize in an area where a lot of it is grown, being able to get a contractor to interrow hoe is highly unlikely, and even where it is, the time critical nature of weeding means that relying on busy contractors is far from ideal. It is considered very unlikely that contractors will be able to hoe cereal crops. It is therefore most likely that an interrow hoe will have to be purchased.

In comparison to spring tine harrows, interrow hoes are much more aggressive, they will work in stony and cloddy soils (though not as well as on a fine tilth) they can take out pretty big weeds and still do a half-decent job in wetter conditions. They are not however, a weeding panacea so they must not be relied on for all weed management

Pests and diseases

Pests and diseases are generally not problematic in organic cereals and maize compared with their non-organic counterparts because synthetic fertiliser nitrogen encourages fungal diseases and aphids. Having pasture

Spring tine harrows: Six meter width machine folded (below), 15 meter machine with pneumatic seeder (top right). Typical agricultural interrow hoe setup for maize (bottom right).



dominated rotations and large separation distances between similar crops can also considerably help. Depending on your location within New Zealand (and if more new pests have recently arrived from overseas), some interventions may be required. Unfortunately the number of organically approved fungicides and pesticides for crops are very limited, they are not effective against all pests and can be prohibitively expensive to use on lower value arable crops. Never apply any material until you have checked with your certifier.

One pest that is a major problem when rotating crops with pasture is grass grub (*Costelytra zealandica*). This can devastate crops, especially more widely spaced (lower population) fodder crops and vegetables. Prevention is better than cure, i.e. sample paddocks for grub and avoid those with high populations as killing grubs in established crops is next to impossible.

Harvesting

Most harvesting can be done with standard farm equipment, such as headers and grass harvesting equipment and can be contracted out. Clean down of harvest equipment, especially headers, used on non-organic crops can be a big issue.

Fodder crops

Most of the above section on cereal crops equally applies to fodder crops. Key differences are that many fodder crops have small seeds and need wider spacings so they benefit from specialist seed drills that can maintain accurate shallow sowing depths and spread seed more thinly and evenly apart than standard agricultural drills. At the same time, typical ag. drills and even broadcasting through fertiliser spreaders will work, but more seed will be required, sometimes three times as much and the stand will be poorer.

As noted above, many fodder crops are poor early weed competitors so effective early weed management is essential. False seed beds should be considered almost mandatory unless weed pressure is very low. Spring tine harrows can be used in-crop, but not until the fodder crops have about six true leaves, otherwise the weeder will kill too many. Even so the weeder will have to be set to a much less aggressive position and used at slow speeds. This means the amount of weeds killed will also decrease. Ideally an interrow hoe would be used, with precision vegetable type hoe blades, rather than the tillage type blades used in maize and cereal crops. However, machinery cost and availability may preclude this making the spring tine harrow the only option.

Pests and diseases are similar for cereals, except the brassicas, which will attract cabbage white butterflies. As these are fodder crops some damage is not problematic, but if there are large populations of caterpillar they will depress yield and even kill small plants. The biocontrol BT (*Bacillus thuringiensis*) is very effective and specific to lepidopteran larvae. Check with your certifier before use, as it may be restricted, and not all formulations are permitted.

Fodder crops can be grazed in-situ, typically using break fences. Many can also be harvested, typically being ensiled. This work is often suited to contracting.

Veg and specialist crops

Just considering growing vegetable crops requires the input of expert and experienced advice. Thorough training and prior hands-on experience for the key staff responsible for vegetable production would be a very worthwhile investment. This section will therefore be brief, and restricted to pointing out the many issues that need to be considered. It is most unlikely that contractors will be able to provide vegetable production services, especially under organic production standards.

Standard primary tillage, such as ploughing can be used, but specialist secondary tillage equipment may be essential and the bed system is mandatory. This requires standardised wheel spacings for all machines operating in the vegetable crops. Soil compaction management needs to be first class.

Specialist seed drills and transplanters are almost certainly required for accurate seed depth and spacing except for very small areas where manual transplanting and pedestrian seed drills can be used.

Unless annual weed seedbanks are exceptionally low intensive weed management will be required. The use of false seed beds is essential, ideally using purpose designed machines to get the best result. The related stale seedbed technique which uses flame weeders will be required for direct drilled crops. Spring tine harrows are generally unsuited to vegetable crops as they cause too much crop damage. High precision interrow weeding machinery will likely be essential. Agricultural hoes are not up to the job and purpose designed, high precision, vegetable hoes are needed. Intrarow (in the crop row) weeding tools, such as rotary finger-weeders, are likely to be a sound investment. Interrow hoes will need to be guided / steered. For smaller machines, (such as the photo below to the left) manual steering of rear-mounted hoes is a simple and cheap option though it takes quite a bit of skill, requires constant attention and is as tedious as watching paint dry. For larger hoes, either front mounting (figure below to the right) and steered by the tractor or rear-mounting with computer controlled guidance systems, either vision or better RTG GPS combined tractor and implement steering will give superior results than human steering and are much easier on operators. Even with the very best equipment and skills some hand weeding will be required. Costs start around \$2,000 /ha, with \$5,000 typical and \$10,000 to sort out problems.

Pests and diseases can be major problems and vary from crop to crop and area to area. Large grass grub populations can destroy entire vegetable crops, see the cereal section above for further comments.

Harvesting: Fresh market produce, e.g. lettuce, broccoli, generally has to be hand-harvested (with significant labour management issues), and on larger areas will need supporting by special collection and handling machinery. Bulk harvested crops, e.g. potatoes, onions, can be manually harvested from very small areas (¼ of a hectare), but mechanical harvesting for larger areas is more cost effective, even though specialised equipment is required. Some crops can be bulk handled and stored but many, especially fresh market, will have to be hand packed in crates. Packing into final retail packs can be a complex and expensive task so is best contracted out to packhouses. Finding sufficient workers who are prepared to work the

long hours often required for field work, doing boring, hard, menial tasks in all weathers for rates of pay that have to be covered by crop returns, can be sufficiently difficult to preclude vegetable production by itself.

Sales and marketing can be a major job, and not one many stock farmers have the training or experience to do well. Out-sourcing should be considered.

Small, manually steered, rear-mounted interrow hoe (top)
six meter, front mounted tractor steered hoe (bottom).



Conclusions

Integrating small amounts of arable and fodder crop production into a predominately pasture-based livestock farm system has a lot to recommend it. However, it should not be undertaken without fully understanding what is involved from the paddock to the whole of the business. Having more than about a sixth of the farm area in crops, moves into the area of mixed farming, and while such a system has many advantages, especially under organic management, it is a significant change to the farm system and requires equally significant changes to farm management and capital equipment.

Integrating vegetable production into a livestock farm is a major undertaking and carries high risks and needs very different skills to stock management. Alternatives such as share-cropping or renting fields to a local organic vegetable grower, can produce the paddock-level benefits without the associated farm business-level problems of one person having responsibility for both systems.

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Chapter Five: Animal Health and Stock Management

The organic approach to animal health is to use effective management, good nutrition and animal care based on the natural physiological needs of the animals. This will provide stock with the health to resist infection, fight parasite attack and repair metabolic disorders.

Organic animal health management does not rely on single solutions, but is based on a whole system of keeping various elements at optimum levels and in balance.

This chapter contains information on animal health. It covers a wide range of information from management to ensure good animal health, followed by specific problems, their causes and characteristics, prevention measures, and treatment for acute cases.

Material was gathered from many sources and many people have given us information and treatments that have worked for them. It is a collection of information to help you better understand aspects of animal health and some options you have.

We do not claim to have found every treatment and we do not claim to have used them all. They are guidelines only. Any treatment could be successful depending on appropriate materials, knowledge, and method of administration at the time.

At all times however, we must remember our obligations to provide the five freedoms under the Animal Welfare Act Code of Practice:

1. Proper and sufficient food and water
2. Adequate shelter
3. The opportunity to display normal patterns of behaviour
4. Appropriate physical handling
5. Protection from, and rapid diagnosis of injury and disease

Standards and Codes are available on the MAF website:

www.biosecurity.govt.nz/regs/animal-welfare/stds/codes



Animal health & stock management

- Good stock management is essential
- Observe and evaluate
- Inform yourself of the range of remedies available
- Use professionals for advice, especially for diagnosis
- No animal must suffer
- Animals need time to adjust to organics

IFOAM Organic Principles and Recommendations (2005) for Organic Animal Management

General Principle - Organic livestock husbandry is based on the harmonious relationship between land, plants and livestock, respect for the physiological and behavioural needs of livestock and the feeding of good-quality organically grown feedstuffs.

Recommendations

The operator should:

- a. Provide adequate good quality organically grown feedstuffs;
- b. Maintain appropriate stocking rates, flock or herd sizes, and rotations to allow for natural behaviour patterns and to maintain natural resources and environmental quality;
- c. Practice methods of animal management that reduce stress, promote animal health and welfare, prevent disease and parasitism, and avoid the use of chemical allopathic veterinary drugs;
- d. Apply management practices that promote sustainable land and water use.

Good stock management combined with healthy soil, balanced pasture, shade, shelter and water, results in good animal health with few problems. The same good management principals used on conventional farms need to be applied in an organic system too. However, the organic farmer needs to take a 'step back' and look at what he or she is doing with the animal within the whole farm system

The selection process over the last 100 years has led to higher yielding animals within an environment that is modified from their natural habitat. A cow in the wild was designed to generally raise 1 calf to weaning per year, which equates to production of around 100kg Milk Solids. We are trying to now extract >400kgMS/cow, 4 times what it was designed to do. We make cows walk around farms to and from cowsheds. They are designed to roam and forage quietly and slowly. The rumen is typically designed

to breakdown fibrous, bulky and starchy feeds through bacteria and micro-organisms, and we are changing the diet radically to a more soluble carbohydrate/protein base. Cows were not native to New Zealand. We now have animals modified through selection with greater demands put on them. The following section will give information on some of the things you need to do to create the healthiest possible environment for your animals.

Because of the demands on animals today, there is a need for better management to enable the production levels expected to be achieved. Management of pastures, ensuring the animals have adequate grass and water and that they are well fed at all times. Good stockmanship is also important for the physical and mental well-being of the animals.

Observations are also important. Stand back and look at the whole picture. Ask yourself questions and find possible reasons and answers, then look for the solutions. Why did this happen and when? What has caused this? What options do I have to solve this problem? Which ones do I use or try? Who can I talk to? What can I do to prevent it happening again?

Often a problem surfaces, and if you stand back for a while to see what happens and observe (instead of using first aid immediately) the problem sorts itself out. That does not mean, however, that you have the right to let an animal suffer. Some animals do not have the natural ability to fit into an organic regime and this usually comes out as an animal health problem. The suggestion is that if that animal shows repeated weakness, cull or sell her and question whether to keep her offspring.

Preventative measures are the key to many outbreaks; and tonics, herbal remedies and some homeopathic remedies are effective in these cases. Feeding your animals appropriately and ensuring they are healthy is still the number one strategy. For acute cases, homeopathy and some herbal remedies can be effective.

Stocking rates need also to be considered for healthy animals. No-one can tell you what the stocking rate for your farm should be, as each farm is different, but you are the best judge of what stocking rate ensures the animals are contented and have adequate feed to remain a good condition score and healthy. It is also really important to develop a good relationship with a vet sympathetic to alternative remedies, as there will be times when you need them, especially for diagnosis. A good homeopath or herbalist is another valuable contact person.

The longer you spend working through building up an organic system, many metabolic problems in stock disappear, and as a result you deal with less and less problems as time goes by.

Stock management

- Organise plan A and B as to how you are going to convert with the aim of having healthy soil; strong, diverse pasture and healthy well fed stock.
- Plan your fertiliser regime and include any nutrition shortfalls.
- Consider the animal health problems you already have and how you are going to deal with them.
- Watch your grazing patterns. Feed your young stock well.

- Consider your stock numbers.
- Observe your grass and its growth patterns. Feed it with liquid fertiliser.
- Avoid nitrogen problems. Use fish fertiliser wisely.
- Liquid seaweed is a good conditioner.
- Test, measure and observe the mineral status of your herd and plants and soils.
- Allow for supplements or crops for times of feed pinches.
- Source supplementary certified organic feed to fill shortfalls in nutrition. Work with your organic advisor or certifying agency on this.
- Animal health problems generally change from metabolic problems to environmental.
- When a problem occurs stand back, look and think about it. Evaluate the situation. Why has it arisen? What can be done now? What are the alternative remedies? What can be done in the future to prevent this reoccurring?
- Think laterally, be observant, talk to others, have strategies and plans.
- If you are not getting a response to therapy, conventional treatment can and must be used to ensure that the animal doesn't suffer. Check with your certifier about how to manage an animal that has had a prohibited or restricted treatment.

IFOAM Organic Principles and Recommendations (2005) for Animal Nutrition

General Principle - Organic animals receive their nutritional needs from organic forage and feed of good quality.

Recommendations

- Operators should offer a balanced diet that provides all of the nutritional needs of the animals in a form allowing them to exhibit their natural feeding and digestive behaviour.
 - Organic animals should be fed by-products from the organic food processing industry not suitable for human use.
 - Ruminants should receive a balanced diet according to their specific nutritional needs and should not be fed a diet that consists entirely of silage and concentrates.
 - All feed should come from the farm itself or be produced within the region.
 - Colouring agents in feed should not be used in organic livestock production.
 - All animals should have daily access to roughage.
-

Animal health and feeding

Under an organic system animals must be fed on their natural foods, which for cattle and sheep is pasture. Goats are natural browsers, rather than grazers, preferring a varied diet of shrubs, weeds, herbs and long pasture. All ruminants need a diet that is high in fibre. This is because of the particular workings of the rumen. The rumen contains a rich and diverse cocktail of bacteria and other micro flora and fauna, which permit the animal to digest the cellulose of the plants it ingests. It is similarly a finely balanced system and needs to be looked after in the same way as we look after our soils.

Only certain friendly microbes contain the enzyme cellulase, which is required, and they work best at a pH around 6.5. They produce simple organic acids, called volatile fatty acids (VFAs), which provide energy for the animal. Inadequate fibre in the diet, can lead to difficulties in achieving a stable pH in the rumen during late winter and early spring when there is insufficient fibre in the pasture. This can be corrected by feeding small amounts of hay or straw (up to 1 kg dry matter per cow per day). Feeding high levels of concentrates like cereals or maize without adequate fibre gives rise to problems in the rumen caused by low pH (acidosis), which in turn can affect the liver and leads to gut torsion and lameness in dairy cows. Barley beef systems can have similar animal health problems. For more information read box: Fibre content of a ruminant diet.

Supplements

Supplementary feed must be certified organic. Allow for supplements in times of feed pinches, just as you would do on a conventional farm. You can make your own, or can source certified organic feed.

Crops are a good option and can still be grown using mechanical methods to keep weeds under control. If you chose the right crops, they can be either grazed or made into silage. For dairy goats grow brassicas such as kale, root crops such as beetroot, fodder beets and carrots; they love the tops as well. They enjoy Jerusalem artichokes, yacons and most fruit. You might grow a hedge of coprosmas or other shrubs for regular cropping. See the pasture and cropping chapter on tips on growing crops. It is important to remember to look after the soil as best you can when cropping.

Stocking rates

When considering converting look at your stocking rates. It is probably better to be slightly understocked than to run the risk of having too many. After a while you will find the right balance. Remember, unless there is another source of certified organic grazing off farm, or certified organic stock that can be bought in, you may have to look at having all stock on the farm.

Will you need to cut down on the number of milking cows to accommodate your young stock? If the answer is yes, what

priorities are you going to put on your culling – high SCC (somatic cell count) cows? Low fertility cows? Mastitis or cows with bad feet? Low producers? As a general principal it is a good idea to identify problems you already have and cull these out or deal with them as much as possible to avoid further problems. If, during conversion, problems occur and the cull rate is higher than normal, put another plan into action to replace any necessary animals.

Remember, brought in animals (conventional) are certified for milk 12 months after arriving on the farm, but will never be certified for meat. Therefore if this happens, in beginning conversion, producing cows may be the answer, if your milk will not be sold as organic for up to 12 months. Otherwise, yearlings, grazed for 12 months could be the answer if you are nearer conversion and you can anticipate the problem.

Fibre content of a ruminant diet

How can we tell if the diet contains enough fibre?

We could send the plant material away to a laboratory and get an indication this way but this takes time and is costly. It is not uncommon for the result to indicate that the diet contains enough fibre and yet when you go and look at the cows they indicate that all is not well.

The cow can tell us in two different ways that her diet has enough fibre:

Cud chewing. Take the time to watch the herd after they have had their morning fill of pasture etc. (3 or more hours access to a new paddock) and see how many are chewing their cud (assuming that they are not asleep, drinking, licking other cows, bullying etc.). As a guide you should have 60 to 70% of your herd chewing their cud. They should chew each cud for about 30 times and then swallow it and there should be two cuds (regurgitations of rumenal contents) for each minute.

If cows are not chewing their cud then the rumen microbe factory is not a happy camp. Veterinarians typically see chronic lameness and mastitis problems in herds with dysfunctional rumens. If you wish to limit these problems modify the diet and let the cow tell you when you have got it right - 2 cuds per minute and 60 to 70% of the cows cud chewing after 3 or more hours eating.

Dung consistency. The second way the cow tells us that her diet has enough fibre is by what is coming out the rear end! When her dung falls on the ground you should hear a plop, plop sound and if she is stationary the dung should form a pile.

If the dung comes out and hits the ground six feet behind the cow and disappears out of sight on pasture or runs away on a concrete slope you should be trying to determine what is wrong and rectifying the problem. There could be many causes for this type of dung but if parasitism, Johne's disease, other infectious causes (Yersinia, Salmonella, Coccidiosis etc), excess nitrogen and poisonings are discounted then look to see if adequate fibre is present in the diet.

What has fibre in it?

Mature pasture (summer) has a higher fibre content in it compared to immature pasture. Hay and straw are an excellent source of fibre. To be effective the plant stem lengths have to be over 3 cm long - if you have chopped a fibrous plant up (maize for example) into small pieces to compact it in a pit you do not have long fibres present! You now have to provide this fibre if the grass or the other components of her diet do not provide enough. Straw (or hay if you don't have straw) should be fed with maize silage or with any high carbohydrate containing foodstuff for cows at a rate of up to 1 kg per cow per day. It is imperative that the cow chews her cud to make the many tens of litres of saliva required to neutralise the acid pH which develops with the breakdown of these rapidly digestible food types in the rumen. If this is not provided you will have cows with many types of rumen microflora that would have been killed off by the acidic pH, cows with belly ache and increased numbers of cows with bowel upsets like displaced abomasum, bowel torsion etc. These types of problems were once rarely seen in dairy veterinary practice in New Zealand but are common place now. Lameness can follow weeks to months after an acute or severe rumen upset with problems resulting from subclinical laminitis with the white line of the foot revealing defects.

Don't overlook fibre content in a cows diet!

A sign an animal has enough fibre in her diet is:

1. 'Trip-up' cow pats
2. 70 percent chewing their cuds when otherwise not occupied.

General tools for animal health

This section provides a summary of the main tools available to the organic farmer for dealing with specific animal health problems. In all cases a fairly brief summary is given, which is enough to get you started. However, it is strongly recommended that you form your own opinions about what works for you and what doesn't, by reading more widely and giving things a go on your own farm. Always remember, however, that the welfare of the animal is paramount. It may take you a little time to gain confidence and get things right – don't let your animals suffer in the meantime.

Important: Although the products recommended in this manual were consistent with the organic standards at the day of print, organic standards change constantly, and it is important that you check any product that you plan to use meets your certifier's requirements before using.

The most widely used tools are the practices of homeopathy and herbal medicine. Homeopathy has been around for more than 100 years and many farmers in New Zealand are now using homeopathy successfully. The use of herbal medicine has been in existence from the beginnings of recorded

human history. Cider vinegar is a proven treatment and is a mainstay for organic farmers.

NOTE: The word 'remedy' is used frequently in this section, particularly in relation to homeopathy. The term 'homeopathic remedy' has widespread use throughout the international homeopathic literature and the word 'remedy' is used here to maintain consistency with established terminology.

Homoeopathy

Homoeopathy is a gentle, effective system of healing, which assists the natural tendency of the body to heal itself.

- Based on a gentle system of healing.
- Based on the principle 'like cures like'
- It is cheap, effective
- Thousands of remedies are available
- Each remedy is individual so keep trying until you get the right one
- Get a good homeopathy book and find a helpful homoeopath
- Attend a course to learn all about it.

Note

Homoeopathic remedies stated throughout this manual are recorded from experience and used by various people. There is however, no scientific data to back up the results as yet. They are to be used to aid recovery, but if the animal needs other treatments, these should also be given. We suggest you inform yourself further by attending a course or finding a good reference book on homoeopathy.

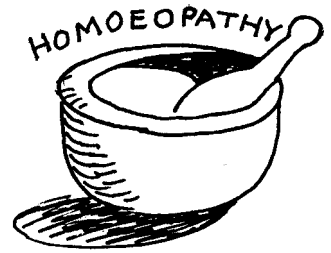
Introduction

Traditionally, homoeopathy has been used to treat illnesses for people using homoeopathic preparations determined by a careful building of the 'symptom picture' for each individual.

Many farmers are becoming aware of the possibilities of using homoeopathy as an alternative means of looking after health in their stock, either by learning about homoeopathy themselves or consulting a homoeopath specialising in the care of animals.

There are two approaches to the use of homoeopathy with animals. One is to use it as a means to encourage the immune system of animals to repair themselves, and the other is to use it to optimise good health in the stock during 'at risk' times so that the animals are much less likely to develop poor health in the first place.

There are products now available for applying homoeopathy to animal health issues that are easy to use, do not involve the need to learn about homoeopathy and which offer methods of application of the products which are simple and do not require the training and supervision of staff.



Whichever approach or service farmers use, homoeopathy can offer significant savings for farmers and is particularly useful for those converting to formal certified organic methods of farming, or just have a preference for biological methods which don't involve pharmaceuticals.

What is homoeopathy?

Homeopathy is a gentle, effective and scientifically based system of healing that assists the natural defence mechanism enabling the body to heal itself.

A central principle of the homoeopathic approach is that every being is unique and the treatment must be tailored to the individual on all levels, physical, emotional and mental.

Homeopathy seeks to heal in accordance with natural laws of healing and uses substances from the mineral, animal and plant kingdoms to make remedies.

The history of homoeopathy

The founder of homoeopathy was Samuel Hahnemann, a German physician and scholar (1755 – 1843). Hahnemann became disillusioned with the practice of medicine of his day because of the harsh and brutal treatments such as cauterising, mercury treatment, bleeding, purging and blistering. These treatments were relatively ineffective as cures and caused terrible side effects for the patients. As a result, Hahnemann gave up the practice of medicine and began to translate medical books in order to earn his living.

It was while translating Dr William Cullen's book "*Lectures on the Materia Medica*" that Hahnemann found what was to become the key to the development of homoeopathy. In this work Cullen claimed that the substance cinchona bark, from which quinine is extracted, cured intermittent fever (malaria). He stated that the cure was effected because of the astringent and bitter qualities of cinchona bark. Hahnemann was sceptical of this explanation and tested small doses of the cinchona bark on himself. He observed that he developed similar symptoms to those of malaria.

After further testing the substance on many people, Hahnemann concluded that cinchona bark, produced in a healthy person, (one who did not have malaria), similar symptoms to this disease. This was the first proving of a substance. Hahnemann went on to experiment with many more substances in the same manner. He observed and documented the symptoms of his findings, eventually collating all the information in a book called *Materia Medica*.

Principles of homoeopathy

Homoeo = similar Pathos = Suffering

Law of similars.

Like cures like

This means that a substance that will produce symptoms in a healthy person will cure a sick person displaying similar symptoms. For example, a person with a cold may develop watering eyes and a burning runny nose. The remedy Allium Cepa (derived from the red onion) produces these symptoms in a healthy person and will help to relieve the cold.

Potentisation

Hahnemann found that his patients reacted better, more dramatically and gently, if he diluted the medicine. He developed a serial dilution method of 1 in 100, called the centesimal dilution scale. The number listed after the remedy's name is the indicator of how many dilutions it has undergone. Eg belladonna 30c has been diluted 1 in 100, 30 times. In between each dilution Hahnemann shook the medicine vigorously which he called succussion. With these highly diluted potencies Hahnemann discovered he could safely employ even poisonous substances for their therapeutic benefit; eg homoeopathy often employs Merc Sol for severe infections. The potentisation process removes the toxicity of the crude substance. Homoeopathic pharmacies prepare medicine today as per Hahnemann's medicine. The most common potency used in New Zealand is 30c. Upon homeopathic advice higher may be prescribed. The higher the potency the stronger the effect.

Why use homoeopathy?

- Safe and effective form of treatment
- Effective on humans and animals
- No suppression of symptoms for later reappearance
- No dependence on diagnoses – requires observation of symptoms
- No need for laboratory trials on animals for proving medicines
- Allowance for and dependence on patient individuality
- A treatment for the whole patient
- Works with the body's defence mechanism to effect improvement
- No environmental pollution
- No withholding period
- Fits with organic standards
- Duration of disease is shortened.
- Lower costs

Things to remember when using homoeopathy

Store in a cool dark place, well away from sunlight and strong smelling substances.

Avoid electrical fields when finding a storage area.

Always succuss or pulse the bottle before use (pump bottle

to ball of other hand a few times) to get energy levels moving.

Avoid touching remedy during administration

Avoid contamination of bottles. This makes them ineffective.

Use a spray bottle or a dropper from the bottle. It can be put on the tongue or any other mucous membrane of the cow.

Use the same dispenser for the same remedy.

Administration

One spray per individual cow, goat or sheep

1 capful or 1 dropper in trough for whole herd. As goats are irregular drinkers it is probably best to administer individually, or else put in a bucket of warm water in shed.

If sunny administer at night (sunlight renders it ineffective).

Frequency as a general rule of thumb

Acute: 1 spray every 15 – 30 mins for 4 treatments only

Chronic: 1 spray 2x per day for 3 days

Prevention: initially 1x day for 3 days, then 1x per week or 1x per month per instructions

Remember:

Little is more effective.

30c is considered a safe potency to work with.

Herbal medicine

- Herbs have strong healing powers
- Include the use of any herbs, plants, or weeds with medicinal properties
- Are used fresh or dried in teas, poultices, and ointments
- Identify herbs by their botanical name to ensure the correct plant is used
- Always have fresh herbs in the garden, dried herbs in storage, and ointments made up ready

Herbs are used for every condition known to humans, in the treatment of both human and animal disease, internally and externally.

Modern medicine has attempted to mimic the properties and benefits of herbs by isolating the active constituents in the laboratory and synthesising them. This is not ideal because herbs heal synergistically with a complex interaction of all the constituents to provide healing properties for the whole body.

We find herbs in the garden, the pasture, the bush and even among the weeds. Many herbs grow in a specific location to replace a vital soil nutrient, eg gorse is high in nitrogen. These plants are called soil indicators, and are usually weeds. They but can be made into weed teas to boost nutrient levels in the soil. Herbalists have experimented for centuries with various plants, and no longer use plants such as belladonna, which is poisonous, although it can be used safely in homoeopathy.

Treating your animals herbally means being prepared. There are no over-the-counter remedies at the local veterinary clinic. The available literature on herbal remedies for animals only applies to livestock in the Northern Hemisphere with different health issues, using herbs, which are often unavailable here. If they do happen to grow here, we may call them something else, as common names are not universal; such as "carrot weed" (*Daucus carota*) which is definitely not the 'carrot weed' growing in Northland, New Zealand.

However, any reliable medicinal herbal book will give you the information you need. The information for humans can be applied to any animal. You simply adapt the dosages to the size of animal you are dealing with. A herb which promotes milk production, for instance, such as fennel, will do so in a woman or a cow.

Use a veterinary guide to let you know what condition you are dealing with, then refer to a herbal book for the appropriate treatment. Individual conditions and their remedies are too extensive to list here.

You are also going to need a book to identify herbs growing in New Zealand, as you cannot rely on local common names to guide you. Always go by the botanical name of the plant, or you may end up treating your animal with something totally ineffective, or poisonous.

Below is a list of common herbs found in the wild or at garden centres in New Zealand. Some we call weeds, other herbs, but others are hiding as garden ornamentals by another name. Try to grow as many as you can, in the house, garden, herbal leys, or around the edges of

paddocks where they can't be trampled. Some won't grow in your region, but fortunately there are many herbs to choose from and just one or two from each group of herbal actions should be sufficient. If they are perennials, you will be able to use them fresh, but if an annual, you will need to harvest and dry. Also, some herbs we might only use a part such as the flower, which needs to be collected and dried at the appropriate time.

Remember to harvest, and prepare your herbs beforehand if they are seasonal. Some herbs, such as chickweed (*Stellaria media*) or cleavers (*Galium aparine*) can disappear just when you need them. Even comfrey goes underground in the winter and is hard to find in the long grass.

When you have a list of what you can harvest locally, look up their uses and create a personal reference chart of their actions and applications to individual ailments. Keep a column free for comments about dosages, methods of administration or a formula you find that works. You will build a worthwhile body of knowledge to share and use yourself again and again. Experiment a little, the herbs in the list following all have a long history of use and are very safe.

Once you have established a ready supply of the basics, practice makes perfect. This is how it was done for many hundreds of years. You are carrying on a proud tradition.

One which has many health benefits, for yourself, your family and your animals.

Exercise caution with all herbs when the animal is pregnant or lactating.

Herbs can be classified according to their actions or their effect on the body. Using an NZ Veterinary Guide or similar text, you can identify the type of treatment required and then refer to the chart for the appropriate herb or combination of herbs. A problem such as facial eczema may need an antifungal such as garlic, and a hepatic (liver support) for the damage done to the liver. Good diagnosis will make treatment more effective.

Garlic has had over 3000 scientific studies done on its antibacterial, antifungal, anti-yeast, anti-viral properties. There is not a herb that has been more widely researched.

Read *Components and Biological Properties of some Allium Species*: Jerry Lutomski, 1987, Poland Institute of Medicinal Plants.



Actions and related herbs

To maximize the effectiveness of these herbs, look at your references to make sure you use the correct variety, use the appropriate part of the plant and the appropriate dosage.

Common name	Scientific name
Antimicrobial (anti-fungal, viral and bacterial)	
Garlic	<i>Allium sativum</i>
Thyme	<i>Thymus vulgaris</i>
Calendula	<i>Calendula officinalis</i>
St John's Wort	<i>Hypericum perforatum</i>
Echinacea	<i>Echinacea purpurea</i>
Eucalypts	<i>Eucalyptus spp.</i>
Sage*	<i>Salvia officinalis</i>
Analgesic (pain relief)	
Willow	<i>Salix spp.</i>
Poplar	<i>Populus spp.</i>
Alterative (blood purifier)	
Red Clover	<i>Trifolium pratense</i>
Cleavers	<i>Galium aparine</i>
Nettle	<i>Urtica urens</i>
Curly Dock	<i>Rumex crispus</i>
Echinacea	<i>Echinacea purpurea</i>
Antiseptic (infections)	
Australian Tea Tree	<i>Melaleuca spp.</i>
Thyme	<i>Thymus vulgaris</i>
Echinacea	<i>Echinacea purpurea</i>
Garlic	<i>Allium sativum</i>
Manuka	<i>Leptospermum spp.</i>
Rosemary	<i>Rosmarinus officinalis</i>
Eucalypts	<i>Eucalyptus</i>
Calendula	<i>Calendula officinalis</i>
Yarrow	<i>Achillea millefolium</i>
St John's Wort	<i>Hypericum perforatum</i>
Oak Tree	<i>Quercus spp.</i>
Sage*	<i>Salvia officinalis</i>
Anti- inflammatory (+also promotes healing)	
Yarrow +	<i>Achillea millefolium</i>
Calendula +	<i>Calendula officinalis</i>
Elder +	<i>Sambucus nigra</i>
Plantain +	<i>Plantago major, Plantago lanceolata</i>

St John's Wort +	<i>Hypericum perforatum</i>
Comfrey +	<i>Symphytum uplandicum</i>
Borage	<i>Borago officinalis</i>
Echinacea +	<i>Echinacea purpurea</i>
German Chamomile	<i>Matricaria recutita</i>
Poplar	<i>Populus spp.</i>
Rosemary	<i>Rosmarinus spp.</i>
Willow	<i>Salix species</i>
Feverfew *	<i>Tanacetum parthenium</i>

Antispasmodic (reduces muscle spasms/ contractions)

Lemon balm	<i>Melissa officinalis</i>
Vervain	<i>Verbena officinalis</i>

Carminative (digestive) e.g. colic

Fennel	<i>Foeniculum vulgare</i>
Dill	<i>Anethum graveolens</i>
Peppermint	<i>Mentha spp.</i>
German Chamomile	<i>Matricaria recutita</i>
Ginger	<i>Zingiber officinale</i>
Lemon Balm	<i>Melissa officinalis</i>
Sage*	<i>Salvia officinalis</i>

Demulcent (soothing) e.g. burns, wounds, poultice

Comfrey	<i>Symphytum officinale</i>
Aloe vera	
Calendula	<i>Calendula officinalis</i>
Plantain	<i>Plantago major, Plantago lanceolata</i>
Flaxseed (Linseed)	<i>Linum usitatissimum</i>
Chickweed	<i>Stellaria media</i>
Marshmallow	<i>Malva sylvestris</i>
Mullein	<i>Verbascum thapsus</i>

Galactagogue (promotes milk production)

Goat's Rue	<i>Galega officinalis</i>
Borage	<i>Borago officinalis</i>
Fennel	<i>Foeniculum vulgare</i>
Milk Thistle	<i>Silybum marianum</i>
Nettle	<i>Urtica urens</i>

Hepatic (strengthens liver function)

Dandelion	<i>Taraxacum officinale</i>
Yarrow	<i>Achillea millefolium</i>
Globe Artichoke	<i>Cynara scolymus</i>
Milk Thistle	<i>Silybum marianum</i>
Curly Dock	<i>Rumex crispus</i>

Insecticidal (kills or repels insects)

Neem	<i>Azadirachta indica</i>
Pyrethrum	<i>Chrysanthemum cinerariifolium</i>
Garlic	<i>Allium sativum</i>

Oxytotic (stimulates uterine contractions) e.g. retained afterbirth

Pennyroyal*	<i>Mentha pulegium</i>
Wormwood*	<i>Artemesia absinthium</i>
Feverfew*	<i>Tanacetum parthenium</i>
Tansy*	<i>Tanacetum vulgare</i>
Yarrow*	<i>Achillea millefolium</i>

Pectoral (strengthens lungs)

Horehound	<i>Marrubium vulgare</i>
Comfrey (external use)	<i>Symphytum officinale</i>
Mullein	<i>Verbascum thapsis</i>
Ribwort plantain	<i>Plantago lanceolata</i>
Kumarahou	<i>Pomaderris kumeraho</i>

Sedative (relaxes nerves)

Hops	<i>Humulus lupulus</i>
Chamomile	<i>Matricaria recutita</i>
Oats	<i>Avena species</i>
Lemon Balm	<i>Melissa officinalis</i>
Vervain	<i>Verbena officinalis</i>

Syptic (stops bleeding)

Nettle	<i>Urtica urens</i>
Yarrow*	<i>Achillea millefolium</i>
Shepherd's Purse	<i>Capsella bursa pastoris</i>
Horsetail	<i>Equisetum arvense</i>
Witch Hazel	<i>Hamamelis virginiana</i>
Mullein	<i>Verbascum thapsis</i>
Oakbark	<i>Quercus spp.</i>

Tonic (energises and tones the body)

Cleavers	<i>Galium aparine</i>
Curly Dock	<i>Rumex crispus</i>
Nettle	<i>Urtica urens</i>
Yarrow	<i>Achillea millefolium</i>
Echinacea	<i>Echinacea purpurea</i>
Borage	<i>Borago officinalis</i>

Vermifuge (expels or destroys worms)

Wormwood*	<i>Artemesia absinthium</i>
Garlic	<i>Allium sativum</i>
Thyme	<i>Thymus vulgaris</i>
Tansy*	<i>Tanacetum vulgare</i>

* Use with caution – inhibits milk production and induces abortion

NB. Goats hate goat's rue, they will not eat it!

This is not an exhaustive list. These are simply varieties which are widely available, and easy to prepare. Look around you, and talk to other farmers who may have knowledge of remedies from the local bush.

Warning:

The herbs recommended are all old well-used remedies with minimal side-effects, except to pregnant or lactating animals. There are herbs here that are considered to be safe if used in the right way, but we do not recommend the administrations of concentrated tinctures or extracts or oils without professional medical or veterinary advice.

Treating with herbs

There are a number of ways we can administer these healing plants to our sick animals: fresh, dried herbs, teas, poultices and ointments.

Fresh

- Fresh is always the best.
- Grow them around the pasture, in shelterbelts, and herbal leys and allow the animal to graze them. Note: be sure to avoid planting herbs where there may be concerns about toxicity.
- Further information is available in the Pasture and Herbal Ley Sections.
- Cut them fresh and offer them to the animal. Herbs such as comfrey are more digestible wilted so try both ways.
- Animals are superior to humans, in that they search quite effectively when given the opportunity to find their own medicine.

Drying Herbs

- Gather when dry.
- Pick in the morning, after the dew has dried, approx 10a.m.
- Dry in a warm airy place out of the sunlight, preferably in a dehydrator at no more than 35°C. An alternative is the lowest heat in the oven. Too much light reduces the colour, and heat evaporates the oils.
- Dry in a hot water cupboard, definitely not in the microwave.
- Store in brown paper bags or airtight dark containers.
- Store as whole as possible.

- Place in a dark place with as even a temperature as possible.
- Use silica sachets to keep the moisture out.
- Grind the herbs just before processing.

Herbal Teas

- The quickest and simplest method of application. Of course, the animal won't use your best china, but a drench gun is quite suitable.
- For soft herbs
 - shred fresh herbs finely
 - infuse herbs in boiling water 15-20 minutes
 - strain liquid and store in fridge for up to 3 days. If bubbles or fermentation appear, throw it out and start again. If you wish to keep your brew longer or out of fridge, use cider vinegar as a preservative. Refer to the section on Cider Vinegar for directions
- For woody herbs such as roots or bark
 - simmer 1-2 hours until soft.
 - chop or grate finely before simmering.
- Dosage. The standard dosage for people is: 1 tsp of herb to one cup of water, a standard weight being 55kg. Dosages for animals will be adjusted accordingly, with a 550kg animal receiving 10 cups of herbal tea or 2.5L.
Repeat dosages for two to three days until symptoms disappear.
- Administration
 - Drench for acute illnesses
 - Put in the trough for the animal to get the essential elements. This will pollute the trough which will need cleaning later.
 - Add to their feed or molasses.

Poultices

- Poultices can be made easily.
- Use oatmeal, cornflour, or any other starches you have in your pantry to mix with the herbs to aid drawing and adhesion.
- Linseed: Stir ground linseed into sufficient boiling water to make smooth dough. Add olive oil to keep it pliable. Spread on warm cotton or muslin, wrapped up and applied to the area needed. Ensure poultice is not too hot.
- Herbal poultices: Cook comfrey root until it is soft enough to mash. Add other infused herbs to the mashed comfrey roots. Apply directly to wound.
- Consult a herbal book for appropriate herbs.

Ointments

- There are many herbs which can be made into ointments, depending on the problem, eg manuka, plantain, chickweed, aloe vera. In a double boiler, stir your herbs constantly for 30 mins with 600 mls cold pressed olive or almond oil. Allow to cool. Strain through a muslin cloth to remove all vegetable matter and extract all the oils and activity from the herbs. Return to double boiler, return to heat and add 60gm beeswax. Melt the beeswax carefully with-

out overheating. Add friar's balsam as a preservative if required. Pour into sterile jars and seal.

- The key element here is a double boiler to ensure the material is never boiled.
- Alternative ratios for smaller amounts: 80ml oil and 10gm beeswax.

Growing and collecting your own herbs is the cheapest and freshest option. Some bulk herbs are available through equestrian suppliers and health food stores, but are usually imported, so are more expensive.

Don't overlook traditional uses of New Zealand natives also. manuka, harakeke, and kawakawa are just three in modern usage.

More information on herbs can be found throughout the Animal Health chapter, including the following cider vinegar segment.

Suggestion: Get yourself a detailed homeopathic and/or herbal handbook that has a materia medica section in it, so you can learn the actions of these plants and remedies and lots of ideas for treating the problems you encounter. There is never one single answer. An alternative to this is to find a good homoeopath and/or herbalist to help you.

Cider Vinegar

- Made from steeped and fermented apples
- Aids in a healthy pH balance for the animal
- Aids in resistance to illness
- Has antiseptic and antibacterial properties
- Can be drenched and put in troughs
- Good as preventative or carrier for herbs

What is it?

Cider vinegar is made from apples, steeped and fermented to a certain stage. The methods can vary from factory to factory and as a result the end product also varies.

As a stock drench cider vinegar has a reputation for aiding the return of the digestive, lymphatic, and cardiovascular systems to their healthy pH balance which aids the body in building resistance to infections, parasites and viruses. It contains more than 30 important nutrients, a dozen minerals, over half a dozen vitamins and essential amino acids, and several enzymes. Plus it has a large dose of pectin for a healthy heart.

How do I use it for stock?

As a stock drench cider vinegar has a reputation for aiding digestion, building resistance to parasites and infections, scours, helping to prevent and cure mastitis, grass staggers and anaemia, lowering SCC, maintains fertility in bulls and cows, and increasing wool yields and milk production.

Monthly doses help to keep your stock in prime condition.

Where stock condition has deteriorated, extra doses will assist in your stock recovery.

Be aware when using a drench gun.. If an animal inhales at the wrong time during drenching, it goes down the windpipe and it can cause an irritation to the windpipe and airways. If this is too severe it can kill. Note, this applies with the application of all orally administered drenches. If you are unsure, dilute the cider vinegar 1:1 with water.

Cider Vinegar can also be sprayed on hay, added to drink troughs (1 litre per 100 cows) and combined with medicinal herbs and is also an excellent tonic for humans.

Recipe for herbal stock drench

Use 1kg of fresh herbs to 20 litres of organic cider vinegar.
Brew for at least 2 weeks in a warm place, stirring daily.
Strain and store in a dark place – it will last indefinitely.

Recipe for daily tonic/drench for dairy goats and/or sheep

An excellent daily tonic to maintain health and assist with worm management.
10 cloves garlic – no need to peel
Handful fresh fennel leaves or 1 tablespoon fennel seeds
5 whole cloves or ¼ teaspoon ground cloves
Handful of fresh thyme leaves
1 dessertspoon seaweed/kelp granules or 1 cup liquid seaweed tonic
½ cup molasses
2 teaspoons cod liver oil
4 cups cider vinegar
4 cups hot water
If available also add some comfrey leaves and/or stinging nettles to the mix.

Place the dried and fresh herbs in food processor with ½ cup cider vinegar and process until shredded. Put into bowl

and add 2 cups hot water, leave to steep for 4-6 hours, then strain out solids. Add rest of water, cider vinegar, molasses and cod liver oil to make 2 litres of drench. Mix well and give 10-15 ml as a drench per goat daily or mix into food. The solids can be added to food rations.



Daily drench recipe using proprietary products

600 ml liquid seaweed tonic
600 ml Cider vinegar with garlic & honey
600 ml molasses
60 ml cod liver oil or flax seed oil
10 drops essential oil of cloves or thyme
10 drops essential oil of fennel or anise
10 drops homeopathic worm remedy, eg Vermis or Worm Combo (optional)
Give each goat or sheep 10 ml daily

Other treatments

Internal Parasites: wormwood (*Artemisia absinthium*), tansy (*Tanacetum vulgare*), pumpkin seed, nasturtium, stinging nettle (*Urtica urens*), garlic (*Allium sativum*).

Tonic: plantain (*plantago spp.*), dandelion (*Taraxacum officinale*), chickweed (*Stellaria media*)

Calming: (before transportation) chamomile (*Matricaria recutita*), valerian root

Note: Some herbs can be extracted with cider vinegar, but it is not an effective extract in all cases.

Mineral Nutrition

The other major dietary consideration for pastoral organic farming is adequate trace minerals; none of the biological systems can work without the correct mineral balance. They play vital roles in producing vitamins, enzymes and physiological precursors.

A pro-active approach is important and good mineral nutrition will assist in managing animal health issues. Trace mineral nutrition is important during all stages of the animal's life and starts during pregnancy. A balanced mineral diet of the mother will be important for the performance of its offspring, particularly during weaning. If the nutrition is inadequate, even animals bred with resistance will be susceptible to disease.

Trace minerals should be balanced in the long-term through the pasture. Trace elements such as copper, selenium can be added to fertiliser (Soil Fertility section). However, stock can't always get all the minerals they need from the soil via pasture, simply because that particular soil might be deficient in particular mineral.

Sometimes, rebalancing particular (trace) minerals through the soil is uneconomical as it could have a low recovery in stock. Mineral supplements might in that case be a better route, either as a bought in approved lick, or as a home-made mix formulated to your own particular pastoral needs.

Certifying agencies generally prefer you to address any Short-term mineral deficiencies through licks and salt

blocks, so the animal has a choice as to whether they take them or not.

The long-term approach, of course is to have a long-term plan through your fertiliser programme. It is most important you are conversant on these matters if you wish to become certified, as this is where most people stumble.

Trace element deficiencies

- Initial problems can occur while adjusting to organics
- Identify deficiencies through testing and samples
- Ongoing deficiencies can be dealt with using accepted management plan
- Speak with your certifying agency first
- Weeds and plants are good indicators
- Remedies are available

There should be a multi-pronged approach to dealing with trace element deficiencies.

Identify the problem through:

- Tests: liver biopsy, blood, soil and herbage tests
- Observing your animals and pasture (especially weeds)

5 parallel actions:

- Fertiliser plan
- Use of liquid fertilisers etc to fine tune biological activity
- Immediate animal treatment for acute cases
- Prevention
- Balance your grazing

Liver samples are the current preferred indicators for:

Selenium (Se), Copper (Cu) and Cobalt (Co)

Blood samples are the current preferred indicators for:

Zinc (Zn) and Iodine (I)

Fertiliser plan

- It is important that this problem is addressed in the 2 aspects to enable all round balanced stock.
- Identify your mineral imbalances and needs through soil and herbage tests, as well as any other tests you may need.
- Remember, it is important to have a balance of elements. (See the Soil section of this manual)
- Seek good advice on products that are available.
- Draw up a short and long term plan for fertiliser.
- When doing your plan incorporate the time strategy for certification.
- The certifying agency must give permission before use. This could be given only where deficiencies can be demonstrated by soil and blood tests, and less soluble forms are preferred if they are available. If you are planning on taking some time to achieve certification, it may be best to overcome this while still moving towards organics. The sooner the better is the key.
- Do not forget to include liquid fertilisers, biodynamic preparations, compost teas etc to fine tune and help the biological activity of the soil.

Immediate animal treatment

- Administer the trace elements.
- For certification, drenching and injections are allowed on a restricted basis and can be used for specific animals with an obvious deficiency only.
- Bolus treatments are NOT allowed.
- If in doubt, contact your certifying agency.
- Always remember all minerals must be balanced with the other minerals. Consult your vet, if in doubt.
- Mineral chelates can be an option. Check the details with your certifying agency first.
- You may need to consider culling or selling animals that have repeated problems, as they are probably struggling with the organic system, and may always do so.

Prevention - long term

- Be proactive, and wherever possible, anticipate these problems, as many occur at certain known times of the year. (Usually stress times or mating time for the cows)
- Administer preventative treatments to your herd if you have acute cases, because if one cow is sick it is quite likely the others may be having similar, but less obvious problems.
- Try and use methods where stock can take what they need individually, eg licks, in water troughs, and through feed troughs.
- Use tonics such as cider vinegar, liquid seaweed (as a stock drench), and molasses.
- At all times keep your animals as healthy as possible, well fed, and their immune systems in top form so

they can move through stressful times more comfortably.

- Talk to older farmers who farmed before the 1960's and try to find alternative remedies and methods. Pass new findings on so we all get to about learn them.
- If going for certification, check your certifying agency rules to ensure the substance you plan to use is allowable. If in doubt, please check with them directly before commencing.

Balance the grazing

Many pasture species, weeds, herbs, and trees have the ability to produce more of one specific mineral, minerals that are lacking in the soil and pasture.

Many plants have the ability to absorb and store higher mineral levels than others.

A mixed pasture including some of these plants can be used to improve the nutrient levels of grazing animals. Some weeds will grow in a particular area because of certain soil characteristics – for example low or high nitrogen levels, poorly or well drained areas, with certain mineral levels. This is nature's way of healing the soil. For example, the thistle indicates a lack of copper there (it does have a balance of other interacting minerals too). Nature is telling that plant to grow there; die and the copper that is in the leaves will rot into the topsoil and rebalance the soil.

Therefore look at your weeds and combine this with all the other information you have built up and you will get a picture of your farm. You may also note that animals prefer a certain weed at a certain time of the year and yet leave the same weed at another time. They know what they need and when they need it, if they are available. This is the main reason to have a mixed pasture for feeding your livestock.

Some weeds or herbs can be used as foliar sprays, or in teas or tinctures to help animals overcome deficiencies and can be sprayed on or put in troughs (or drenched if acute). The recipes are at the end of this section. Please make sure before using, that the herb is not poisonous or has the ability to abort animals. A good herb book should tell you this. It is best however, to make them available through your pasture.

We could also apply the same theory to trees when we are considering planting shade and shelter or fodder trees. Flax is another native good all rounder and if available, cows will nibble on it when they have the need.

Deep rooting plants, such as chicory and plantain, will also absorb the minerals from the subsoil and make them available to the animals. There are some legumes that are also deep rooting and grow well in summer and have high mineral content, e.g. birdsfoot trefoil (*Lotus corniculatus*) and Caucasian clover. Maybe a specific crop could offer a short-term answer to a mineral imbalance.

The use of biodynamic preparations 500, 501 and especially the compost preparations (502-507) allow the soil to rebalance at a faster rate, and then maintain that balance through yearly application. The compost preparations are processed through a medium before applying to the land, using a compost heap, cow pat pit, liquid fertiliser brew, or effluent pond. Further details on this are in the Soil section.

Some suggested treatments

- Cider vinegar
- Native flax: Good general tonic for nibbling when needed
- Liquid seaweed as a drench or in trough. (good overall source, especially of iodine)
- Fresh seawater (10-20l) straight from the sea in trough or made available to the animals (watch for excess chloride)
- Herb teas: Pour boiling water over the herb/weed steep for up to 12 hours. Drench animal with it or put it in trough. This will only keep up to 3 days

A further breakdown on herbs used for specific illnesses follow in this section.

Specific deficiencies & their treatment in animals

(See also trace element section in Chapter 3, Soil Fertility)

Cobalt

- Herbivores need cobalt to synthesise Vitamin B12
- Young stock are more susceptible, especially after weaning
- Poor appetite, general ill thrift; also called 'bush sickness'
- Lots of plants and trees contain cobalt
- Moisture and liming is a factor limiting cobalt availability

Cobalt is a component for Vitamin B12 production. Its deficiency will show up as loss of appetite, poor growth, weight loss, anaemia, wasting and in severe cases death. The eyes have a watery discharge. A cobalt deficiency is associated with an increase in infertility and metabolic diseases.

New Zealand's native bush has many species, which have very high concentrations of cobalt and other trace elements. One of New Zealand's native bushes called Rangiora (which is a large leaf bush - also called 'bush man's friend') has a very high content of cobalt, as do gorse seedlings!

Treatment

- Administer cobalt solutions (1/2 tsp cobalt sulphate per 150 cows in water supply weekly and/or Vitamin B12 short term). Get permission first.
- If you are administering cobalt sulphate or B12 injections, check the rulings with your certifying agency beforehand.
- Long term give homeopathic Cobaltum 1m and Cobaltum Chloridum 30c once a week for 3 months to stabilise the element in the cow's system.
- Plants such as red clover, juniper, dandelion, trees such as mahoe (*Melicactus ramiflorus* – also known as whiteywood), contain higher levels of cobalt. There are others.

Selenium

- Deficiencies can be recognised by white muscle disease in lambs (lame) and infertility problems in cattle (retained membranes)
- Selenium is vital to the immune system
- Specific plants and trees contain selenium

Selenium deficiency is also known as white muscle disease and causes ill thrift in young growing animals. It also causes infertility, reduced milk flow and retained after birth in cows. Ill thrift can occur in all ages with a selenium deficiency. Selenium is vital for enzyme systems and with Vitamin E is an anti-oxidant. It is important for the immune system too (See the mastitis section). Excessive amounts can poison an animal.

The rushes that grow in wet areas on the farms accumulate selenium, which would tend to suggest that the element is in fact present in the soil or at least has been washed there. The mahoe tree (whitey wood) is one devoured by goats, sheep, deer and cattle alike and is also high in selenium. The farming industry generally is aware of selenium deficiency and animals are boosted in a variety of ways. The best option is to get it into the soil so that plants get it too.

Some native trees such as coprosma are high in selenium. Deep rooting plants contain selenium, e.g red clover, horsetail grass. Cider vinegar contains selenium. Selenium deficiency can be rectified through your fertiliser, but talk to your certifying agency about your options, and present soil/herbage/blood tests as evidence of a shortage.

Copper

- Copper deficiency is indicated by faded harsh dull coats, scours, poor growth
- Young and pregnant stock are more susceptible to copper deficiency
- Excess zinc causes a lack of copper
- Antagonistic with a number of elements

Affected animals look starved, even though there is an abundance of feed around. Their coats are faded and harsh. They are scouring and the young animals are poorly grown, with ill thrift. Lack of copper increases susceptibility to worm infestations.

Copper in animals, is essential for catalytic conversion of iron into red blood cells and it assists in tissue respiration. Copper deficiencies are becoming more of a problem in many types of farmed animals in New Zealand. There are several reasons for this but one of the major causes is the use of high doses of zinc used to protect stock against facial eczema damage.

Specific plants that contain copper are red clover and yarrow. All thistles are indicators of a deficiency.

Treatment

- Vet help may be needed and if necessary permission from your certifying agency. To help the body utilise the copper available naturally, use homoeopathic *Cuprum Met 30c* in the trough once a week.
- Cut up a copper hot water cylinder or pipe and put

some in each trough. Alternately put a huge section in your main feeder tank.

- Plants that contain copper are chickweed, chicory, cleaver, dandelion, fennel, garlic, sorrel, yarrow.
- Use mineral licks with copper added (permission must be granted).
- Check with your certifying agency before using copper bullets or routine injections.

It has been identified that goats generally have a higher copper need than sheep or cattle. In their natural browsing pattern they would eat leaves and branches with high copper levels, eg coprosma and seek out weeds such as thistles and ragwort.

If solely on pasture they may require a supplementary lick to maintain health.

Pat Coleby in her book: *Natural Goat & Alpaca Care* gives the following recipe:

- 6 parts dolomite
- 1 part elemental sulphur
- 1 part copper sulphate
- 1 part seaweed meal

Mix all together and allow goats free access to the lick. If reluctant at first sprinkle a little grain on top. Keep dry or the copper will be neutralised by the dolomite.

Zinc

- Zinc is a trace element that is needed by animals for skin and hoof integrity
- Herbs and weeds contain zinc
- Supplementation can cause other imbalances
- Excess of zinc can cause a lack of copper

Zinc deficiency is not usually a problem in NZ soils or pastures. Therefore there are few problems, except in the facial eczema season when more zinc is needed.

Treatments

- Dandelion, garlic, cider vinegar, rosemary, shepherd's purse contain zinc.
- Zincum Met can be used in the trough once a week to help the body metabolise the zinc it takes up.
- Other treatments from the vet containing zinc (such as zinc oxide) can be used, but check with your standards first and if you are still unsure check with your certifying agency.

Iron

- Iron deficiency causes loss of appetite, and anemia
- Occurs with cobalt deficiency
- Stinging nettle is high in iron
- Homoeopathy can help

Lack of iron often occurs with a cobalt deficiency but can also occur with other illnesses and be a cause of them. Indicators are a loss of appetite, weakness and anaemia.

Treatments

- Plants such as stinging nettle, blackberry and raspberry, garlic, chicory, dock, groundsel, parsley, vervain, watercress, and nasturtium contain iron.

Homeopathic remedies

Ferrum Met 30c to allow body to utilise available iron

Chincona 30c anaemia arising

Nat Mur 30c helps eliminates salts etc

Trinitrotoluene 30c helps haemoglobin to produce

Vitamin C

- Usually not a problem in healthy animals
- Can also be used to detoxify after eating poisonous plants

All our healthy domestic animals (excluding guinea pigs) synthesise their own vitamin C so in theory do not suffer deficiency symptoms. Vitamin C levels increase in animals (except guinea pigs) when an infection is being fought. There is not good evidence to support the need for Vitamin C treatment, although it is being used by farmers.

Mineral sources from plants

Common name	Botanical name	Mineral sources
Anise	Pimpinella anisum	Phosphorous
Asparagus		Iodine, iron, phosphorous, silicon
Borage	Borago officinalis	Potassium
Chickweed	Stellaria media	Copper, phosphorus
Chicory	Cichorium intybus	Calcium, copper, iron
Cleavers	Galium aparine	Calcium, copper, iodine, silicon, sodium
Comfrey	Symphytum officinale	Chlorine, iron, potassium, sodium, vitamin B12
Dandelion	Taraxacum officinale	Calcium, copper, iron, magnesium, silica, potassium
Dill	Anethum graveolens	Phosphorous, sodium
Dock	Plantago spp.	Calcium, magnesium
Fennel	Foeniculum vulgare	Copper, potassium, sodium, sulphur
Honeysuckle	Lonicera caprifolium	Potassium
Horsetail	Equisetum arvense	Silica
Marigold	Tagetes spp.	Phosphorous, sulphur
Nettle	Urtica urens	Calcium, iron, potassium, vitamin K
Plantain	Plantago spp.	Calcium, potassium, sulphur
Red Clover	Trifolium Pratense	Magnesium, calcium, copper, selenium, cobalt
Sorrel	Rumex acetosella	Calcium, phosphorous, copper
Sow thistle	Sonchus oleraceus	Calcium
Wormwood	Artemisia absinthum	Iron, potassium
Yarrow	Achillea millefolium	Copper, Manganese

Mineral sources from trees

Common name	Botanical name	Mineral sources
Apple	Malus domestica	N, P, Co, Io, Mg, Mo, K, Se, Zn (fruit)
Elderberry	Sambucus nigra	Calcium, potassium, phosphorus
Loquat	Eriobotrya japonica	Ca, Cu, Fe, Mg, Mn, K, Zn (Fruit)
Mulberry	Morus alba	Magnesium, calcium, phosphorus, potassium, sulphur
Olive	Olea europaea	Calcium, phosphorus
Peach	Prunus persica	Co, Mo, Zn (Leaf) Bo, Ca, Cu, Mg, P, K (Fruit)
Poplar	Populus	Molybdenum, Zinc
Willow	Salix spp.	Calcium

Contributed by Ian Henderson from various sources

There are more, especially with trees. Check various publications and websites for these.

Specific health problems

Despite the benefits of good organic farming, animal problems and issues do occur from time to time. It is important that we deal with them as they arise. In this section, we have tried to cover the most likely problems that would occur, giving a brief insight into describing the problem and its causes, prevention treatments and treatments for acute cases. These range from management suggestions to homoeopathic and herbal treatments. The homoeopathic remedies are indicated by a potency (e.g. 30c or 1m) after the name of the remedy.

We have listed every possible treatment known to us, with the aim of informing you of a range of options. We stress that what you ultimately decide to do is your responsibility, and we do suggest you make further enquiries to your vet or your certifying agency and do further research if you are unsure. The Veterinary Guide is a good resource to help this process.

Above all else, we must remember to uphold the 5 Freedoms of the Animal Welfare Act; the fifth one being "Protection from, and rapid diagnosis of injury and disease." This means we cannot let an animal suffer and if necessary, conventional medicines must be used.

IFOAM Organic Principles and Recommendations (2005) for Veterinary Medicine

General Principle - Organic management practices promote and maintain the health and well-being of animals through balanced organic nutrition, stress-free living conditions and breed selection for resistance to diseases, parasites and infections.

Recommendations

Operators should maintain animal health and practice disease prevention through the following techniques:

- a. Selection of appropriate breeds or strains of animals;
- b. Adoption of animal husbandry practices appropriate to the requirements of each species, such as regular exercise and access to pasture and/or open-air runs, to encourage the natural immunological defence of animal to stimulate natural immunity and tolerance to diseases;
- c. Provision of good quality organic feed;
- d. Appropriate stocking densities;
- e. Grazing rotation and management.

Operators should use natural medicines and treatments, including homeopathy and acupuncture whenever appropriate.

When illness does occur, an operator should determine the cause and prevent future outbreaks by adopting appropriate management practices.

Important: Although the products recommended in this manual were consistent with the organic standards at the day of print, organic standards change constantly, and it is important that you check any product that you plan to use meets your certifier's requirements before using.

Internal parasites

Adapted from: Organic Management of Parasitic Worms (roundworms - nematodes) in Sheep, OANZ

One of the most difficult problems to deal with in an organic system is internal parasite control. When sheep arrived in New Zealand they came with a range of stowaways, amongst those twenty-nine species of internal parasites. Ever since, internal parasites have been providing New Zealand farmers with the greatest challenge in maintaining stock health, not only for sheep but for other livestock as well.

Regular or strategic use of chemical de-wormers/anthelmintics is not permissible in a certified organic system. However, emergency treatments are permissible upon agreement with the certifier. Treated animals have to be quarantined and may lose their organic status.

Understanding worms

Several different types of worms live inside sheep, goats and cattle. Here we concentrate on round worms (also call nematodes) that live in the gut and are commonly referred to as 'worms'. These worms live in the animal's stomach and intestines. There are several types and species – varying in size, location in the host and lifecycle.

Types and species of worms that infect cattle do not usually have sheep or goats as their host and vice versa, although they might appear to have the same name.

The following table shows the worms causing the most problems in sheep, goats and cattle in New Zealand.

Common internal parasites in New Zealand sheep, goats and cattle:

Sheep & Goats - Stomach (Abomasum)

1. *Haemonchus* (Barber's Pole), 20-30 mm, blood sucking worm – more prevalent in the North
2. *Teladorsagia* (was *Ostertagia* or Brown Stomach Worm) – 10 mm can remain dormant in wall of stomach for several months
3. *Trichostrongylus axei* (Stomach Hair Worm)

Sheep & Goats - Small intestine

1. *Trichostrongylus colubriformis* (Black Scour Worm)
2. *Nematodirus* (Thin Necked Intestinal Worm) – prevalent in the South

3. Cooperia (Small Intestinal Worm) – prevalent in the North

Cattle - Stomach (Abomasum)

1. Ostertagia (Brown Stomach Worm) – most significant worm for New Zealand cattle
2. Trichostrongylus (Stomach Hair Worm)

Source: modified after Wormwise (2007)

Lungworms are another type of roundworm that lives in the airways of the lungs where they can cause irritation and inflammation. They are less important for animal health than those in the gut, but can be a problem in young stock, particularly cattle. In addition, lambs and kids commonly get tapeworms. They generally have little effect on lamb or kid growth rates but may contribute to diarrhoea which in turn may promote fly strike (see Fly strike)

General lifecycle and development of round worms

The common roundworms of sheep, goats and cattle go through three stages in their life cycle: egg, larvae, and adult.

The adult stage, the actual worms live in the gastrointestinal tracts (gut) of the animal. They sexually mature in the gut on average in around 21 days and female worms start laying eggs which are then released with the faeces the animal is dropping.

An immature worm, the larvae, hatches from the egg in the dung pat or droppings. Usually it develops through 2 larval stages in the dung pat or droppings till it becomes the L3 infective larva which moves out into the soil (top 1-2 cm) and onto the vegetation (mostly only up to 5 cm high). Heavy dews and rain assist the movement of the infective larva from the dung pellet. The development from the hatching egg to the infective L3 larval stage in the pasture can take between 1 – 10 weeks depending on environmental conditions. The optimum temperature for larvae is 20 – 25 °C. At higher temperatures the larvae tend to start dehydrating and die. Hot and dry weather kills most developing eggs and larvae. Less dense pastures expose the larvae more to UV light and create conditions that will speed up dehydration. Most eggs are killed during periods of below 10 °C; however some larvae can survive the colder winter time.

It is the infective larva (L3) that is the hardest. The infective L3 larvae can survive for long periods, sometimes more than a year. Once the infective larva has moved up on blades of grass or stalks and leaves of other plants it can be ingested by a grazing animal. Once eaten by an animal the L3 stage moults into the fourth larval stage which quickly moults again and matures into a mature adult worm.

Infective larvae need to feed in order to survive but can only do so once taken up by an animal and having ended up in the animal's gut. The harder a pasture is grazed the higher is the chance that animals will take up infective larvae. On pasture they can only survive for a period of time. The longer the pasture has been left free of grazing animals the less will be the number of infective larvae.

The climatic conditions are usually responsible for two peaks in the numbers of larvae on pasture over the year: late spring/early summer and early autumn. The seasonal pattern of worms inside animals is the result of the levels of infective larvae in the pastures they are grazing on. The levels of infective larvae are generally highest in autumn.

Young animals first encounter worms when they start grazing. They have no specific immunity to worms, meaning that worms can easily establish and reproduce. The young stock can become a major source of pasture contamination. Both cattle and sheep develop full immunity to worms by 18 – 20 months of age (Wormwise, 2007). However, goats never develop immunity, although individual resistance varies greatly.

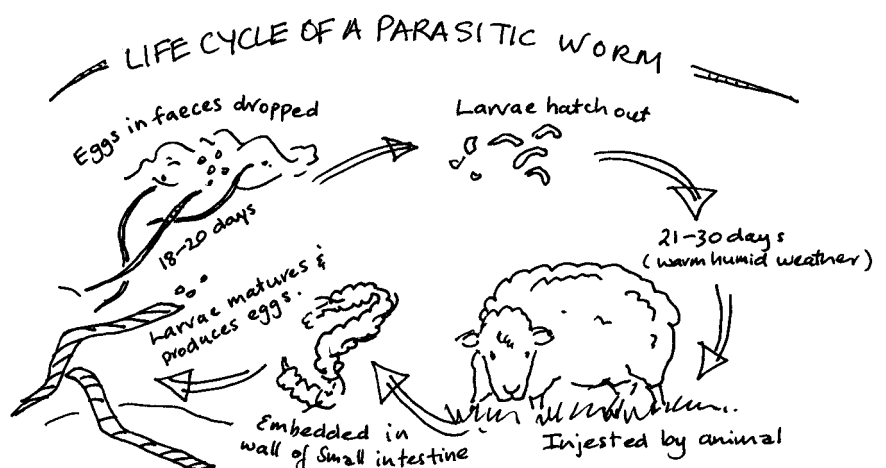
At mating time, during late pregnancy and around lambing, kidding and calving, animals are under stress and immunity levels can decrease as a result. This can lead to higher worm burdens and higher egg outputs as the drop in immunity allows the worms to reproduce more freely. Come weaning time the animal's immune system has recovered and the egg outputs begin to drop again.

Signs and symptoms

Worms can cause any of the following effect either singly or in combination

- Partial or a complete loss of appetite
- Damage to the gut lining and inflammation when masses of worms are present
- Interference with the production and absorption of digestive juices
- Dehydration through scouring
- Blood loss by sucking from the gut wall

There is a range of symptoms and stock may show some or all of them



- General ill-thrift and looking tucked up and lethargic ('looking wormy')
- Poor performance – nil live weight gain and weight loss
- Diarrhoea (scouring) instead of well-formed faecal pellets
- Mucus from the gut lining in the faeces
- Pot belly and low body condition (skinny)
- Anaemia leading to death
- Swelling under the jaw (bottle jaw-barber's pole worm)
- Wheezing with persistent dry cough, especially after activity (lung worm)

Principles of organic worm management

In order to keep the worm pressure on the stock low, a successful strategy will look at creating worm free or low worm pastures (in the first place by reducing contamination with worm eggs shed by infected stock) and reducing the uptake of infective larvae by susceptible stock.

There are a number of tools and techniques available. Each farm is different and will require its own unique mix of appropriate management and interventions. The first step is to find out what is happening with worms on your farm.

The majority of a worm population is actually outside the animals on the pasture. When conditions are favourable, about 5 – 15 percent is living inside animals, whereas 85 – 95 percent is on the pasture as eggs and larvae. Good internal parasite management needs to take this into account. Treating the animals for worms they carry inside is only a small part of a management strategy.

FECs (faecal egg counts) are strongly recommended, as is keeping a close eye on stock condition and monitoring stock production and body condition. This way you can get an idea of what your starting position is, whether or not your management strategy is having results and when you may need to take additional action.

Note: FECs are a good measure of parasite burdens in sheep and goats; blood test for the stomach enzyme pepsinogen gives a better indication for cattle over 6 months of age.

In an organic approach there is no single solution to controlling worms in livestock.

A strategy is required that seeks to develop a whole organic system that interferes with the lifecycle of the parasites at several stages, strengthens the animals and creates a situation where there is a healthy balance between all organisms of the system.

Diversity within organic production units is a useful tool in internal parasite control. Consideration should be given to the mix of animal and plant species, the ratio of cattle to sheep and goats, cropping practices, and the use of fallow. The whole farm could be viewed as an entity (or organism) requiring a balance of practices to maintain optimal health of that organism.

Don't forget that:

- All healthy animals have worms and always will – eradication is not an option
- Worms have less effect on well fed animals than on animals under stress
- Mature animals are generally less susceptible to worms than younger ones. This means that at times they can be used to reduce the number of infective larvae on pastures
- Some animals are more susceptible to worms than others (genetic variability)
- Most of the year there are more worms, in various stages on pasture than inside the animals

Pasture Management for worm prevention

- Keep the pasture cover relatively long, especially during times of high infective larvae numbers in the pastures (remember, most infective larvae are in the bottom 2 cm of the soil and up to 5 cm of the pasture).
- During hot, dry and high sunshine periods the pasture cover can be opened up and grazed shorter as the conditions are unfavourable to the worm larvae, infection risk is low and a high proportion will die.
- Consider making hay or silage from infested paddocks and close them up for 3 months afterwards (or graze with non-susceptible livestock). However this is frequently not an option and even after 90 days there will still be some larvae surviving.
- Consider the species composition of your pasture; tannin rich sources of plant feed will help reduce worms inside animals (see also next section: Nutrition and Worms)
- Modify the pasture to include species less habitable to worm larvae. Some tests artificially 'seed-ing' swards with worm eggs have regularly removed substantially more larvae on ryegrass/clover than on swards with either chicory or lotus in them (Worms in low input sheep, 2008).
- One way of preventing the uptake of larvae is to have animals graze herbage that slows down the migration of the infective third stage (L3) of larvae. It has been demonstrated that lucerne, clover and chicory amongst others do just that (Sykes and Coop, 2001)
- Keep the soil life active. Dung beetles, earthworms and nematophagous (nematode eating) fungi will help reduce the numbers of eggs and larvae by either destroying/eating them or burying eggs so they cannot hatch, Waller, 1997). Consider compost teas, foliar sprays and biodynamic preparations to boost soil life.
- The longer manure stays intact on pastures the longer parasites will survive there. Factors that reduce manure integrity, such as scratching by chickens or breakdown by insects will reduce parasite larvae survival. Don't force grazing to close to manure. Parasitic larvae generally will migrate not more than 30 cm from a manure pile.
- Fodder crops and renovated, newly sown pastures after cultivation will be low in worm eggs and larvae

and can be considered worm safe.

- Keeping young stock off (either spelling or grazing with non-susceptible livestock) for 3 months or longer will significantly reduce risk. However, re-contamination of pastures can occur between 1 to 5 weeks, depending on stock and weather.

Stock Management for worm prevention

- At high risk times and on high worm pastures consider lowering the stocking rate. Worm problems are closely connected to the density of grazing animals.
- Start with low worm pastures and graze with young ahead of older stock.
- Rotate sheep or goat grazing with non-susceptible species of livestock, e.g. cattle and deer (but not goats) for at least 3 months; you will need between 30-50 percent of the stock units in cattle.
- Older animals will start to develop some degree of age resistance to worms, but not goats, and needs, to some degree, a worm challenge. These older animals can be used to prepare worm-safe pasture for younger animals. Graze for at least 3 months.
- Shift young stock off weaning areas before autumn. Those weaning paddocks will have acquired high levels of worm eggs and larvae (check FECs) and need to be cleaned up. This will also be the case for lambing, kidding and calving areas. Young stock should not graze on these areas between March and May.
- Consider leaving young stock on their mothers for a longer period to assist the immune system. Don't wean stock before the length of the gestation period (for lambs and kids this is 5 months). This means that the immune system is more mature and able to cope with an animal health challenge when it occurs. Stock also has a better body weight when weaned later.
- When emergency drenching, make sure that it is really worms that you are dealing with, and not another health issue. Keep treated animals in a clean/safe pasture afterwards
- Organic certification agencies vary in their approach to the use of de-worming products. Prevention strategies are encouraged as an alternative to reliance on any type of de-wormers. Certification requirements associated with the use of Ivermectin and other dewormers for emergency treatments may vary. In most cases the treated animal will lose its certified organic meat status for life and its certified organic milk status for the next 12 months. Consult with your certification body before using any de-wormer or medications.

Breeding for worm resistance and resilience

Resistance (immunity) = Resistant animals have defensive barriers that prevent parasites from thriving and they resist infection. The immune system selectively eliminates or adversely affects the fecundity of worms, i.e. fewer eggs are produced and shed. Resistance has a heritability of 20-30%

Resilience = resilient animals have the ability to survive even with parasite load and keep producing well. It is less heritable than resistance. Resilient animals can still produce high FECs.

As a breeding objective it pays to select for resistance rather than resilience. Breeding out the problematic, susceptible genes can pay off. Research has shown that approximately 80% of worm problems will come from 20% of your animals.

Some breeds and individuals are more resistant or harder than others. Wiltshire, Perendale and Texel sheep are generally more resistant, hardy and low input sheep. Boer goats are also generally more resistant than other breeds. But you have to be careful about picking a breed just on the basis of worm resistance or hardiness - there is typically as much variability within a breed as between breeds.

Sheep or goats that have been selected for resistance over several years regardless of breed will be a better bet than unselected sheep or goats of any hardy breed.

Nutrition for worm management

- It has been demonstrated that increased nutrient levels in feed result in decreased worm burden. Managing pasture and feed for high nutrient content will help reduce the parasite load. It is also important to provide stock with access to a balanced mineral ratio as this will assist with developing a stronger immune system and parasite resistance. A well fed animal is much stronger in fighting off worms.
- Good nutrition in early pregnancy increases the fat stores and has been shown to increase the immune response to parasites. Increased protein levels during late gestation will produce an increased ability to fight parasites (Padgham, 2008).
- Protein levels in the feed and effective protein utilisation is even more important than the energy content when it comes to supporting the immune system. Condensed tannins found in legumes are known to decrease protein degradation, either by altering the forage proteins or by inhibiting microbial proteases, thus increasing the efficiency of protein uptake (Broderick, 1995). Also note the importance of having good intake of true protein rather than high nitrate pasture.
- Significant amounts of Lotus spp. (in particular *L. corniculatus* [birdsfoot trefoil] – this species needs inoculation with rhizobia) in the sward helps protein absorption due to the presence of 'condensed' tannins which help the protein escape degradation in the rumen so that it is available for assimilation from the small intestine. These same plant substances have some ability to inhibit the hatching of worm eggs (Worms in low input sheep, 2008). Other plants with condensed tannins are chicory (*Chichorium intybus*), young plantain (*Plantago lanceolata*) and sulla (*Hedysarum coronarium*) (Smith and Burnett, 2006). Also dock, echinacea and raspberry canes and roots contain tannins (Padgham 2008). Flaxes and most trees and shrubs, are also important sources of tannins.

NOTE: excessive tannin uptake can lead to too much protein protection in which case too much protein leaves the gut, reducing the protein uptake.

There is also research that shows that when the phosphorus levels of the diet was at a level of 0.28 % P dry matter, the weight gain of lambs infected with parasites was increase by 40 % over those lambs fed on a low (0.18%) P level diet (Barrel, 1997). Improving the P levels in soils or correcting the P:Ca levels might improve the phosphorus intake of the animals and result in achieving healthier animals.

Worms in calves were a problem for one farmer:

His vet offered the following management system to reduce this, which has now been successful for 8 years.

Rear your calves in a different paddock each year (like rotational grazing) and this will avoid any build up of worm eggs. As a result a moveable half-round hutch and portable trough were purchased. A paddock that needed resting was chosen and split into two using electric fencing.

At four days to one week old the calves are transferred from the calf shed to the paddock. They are fed 3-4 litres blood warm milk in the paddock twice a day and also offered hay and silage. Groups are kept to small numbers (no more than 25). Once a month, after the full moon, when the calves have expelled intestinal worms onto spent pasture the calves are shifted to the other half of the paddock.

The worms expel themselves from the animal 12-24 hours before the full moon. After gradual weaning, the calves are all put as one mob and moved each day ahead of the cows. If necessary they are drenched for worms.

He also finds grazing them on plantain dominant pasture just before and on the full moon is a good pick-me-up for the calves.

Some worm treatments

Some common botanical de-wormers include garlic (pills, powders, fresh, tinctures), wormwood, wild ginger or snake root; goosefoot, conifers (pine, spruce or fir), mustard, squash or pumpkins seeds, carrot or fennel seeds, pyrethrum (plant extract from chrysanthemum). Other products used include diatomaceous earth and charcoal. These are often added to a grain rotation.

In the following we list a number of alternative or natural remedies that some farmers have successfully used.

Drenches

Drench animals, hold them in the yard for 12 – 24 hours to clean themselves out and expel the worms; and then move them on to clean pasture to avoid build up of worm numbers on the pasture and reinfection. Modern biodynamic farmers are finding that drenching 12 - 48 hours before the full moon helps the effectiveness of worm treatments.

Natural drenches with a mix of cider vinegar, olive oil and garlic:

- 1 kg garlic crushed and steeped in 10 – 20 litres cider vinegar. Seaweed can also be added. Steep for up to 30 days before use (can be used after being steeped overnight but the longer the better) Strain. Add 1 litre olive oil for every 10 litres just before drenching. 48 hours before full moon bring animals in and drench 100 mls per calf. Leave 2 hours and drench with another 100mls. Leave in yard to empty out. Put on fresh paddock. Store unused drench in container in dark place for future use. This remedy can vary in amounts and it does not matter. Molasses can also be added.
- Garlic juice – 1 teaspoon per sheep in autumn
- Mix of vegetable turpentine (10-50 drops; not mineral turps), linseed oil (25 mL), and garlic plus some ground ginger. Amount for one single drench for a lamb or small animal. For adult sheep up to 80 drops of turpentine and 50ml of linseed oil (Fisk, 2003).
- The following herbs should be steeped in cider vinegar for 1 –3 weeks, then strained and used to drench animals or put in their trough. The vinegar draws out the properties of that herb and adopts it. It is also a natural preservative. If time does not allow it, these herbs can be made into a tea by pouring boiling water over them and steeping them for at least 12 hours before use. Details on using herbs are found later in the Health section.
- Steep wormwood or tansy in cider vinegar and drench 100 mls. Both these have abortive properties, due to their volatile oils, so it is recommended to not drench pregnant animals with this. They could also be toxic in high doses.
- Pumpkin seed - ripe and as fresh as possible. Crushed and steeped in vinegar.
- Thyme steeped in cider vinegar or used as a tea. (tonic and cleanser)
- Stinging nettle - the leaves and roots (a tonic rich in minerals)

Herbal worm drench

This herbal remedy has been successfully used for goats over many years both on a small lifestyle herd and a 200 dairy goat commercial herd, but is equally good for sheep.

Starting 2 days before full moon each month administer 3 doses of this drench, plus a spray of homeopathic 'Vermis' or 'Worm Combo' ie 1 dose of each for 3 days.

Drench Recipe

Makes about 2 litres, but quantities of herbs and garlic can be increased for larger herds

10-12 tansy leaves

6 sprigs wormwood

6 large garlic cloves

1 medium-sized aloe vera leaf

1 cup molasses

1 litre cider vinegar

2 cups boiling water –approx.

Chop up tansy, wormwood, aloe vera and garlic in food processor

Add ½ cider vinegar and mash again for few seconds

Put mashed herbs into bowl and pour on 2 cups boiling water

Cover and leave to steep overnight or for at least 8 hours

Strain out liquid, add molasses and rest of cider vinegar, stir or shake in container until molasses dissolved

Give each adult goat or sheep 40 ml and kids and lambs up to 6 months 20 ml per dose. Mix the leftover mashed herbs and garlic through their food ration for the next 2-3 days

NOTE: Omit tansy and wormwood in pregnant does for first 3 months as they may cause abortion, add extra garlic and a thyme tea or 1-2 ml thyme oil instead.

This drench is also suitable for cattle and horses, just give them larger quantities diluted with warm water. They will usually drink it readily.

Diatomaceous Earth (DE) is often promoted as a natural dewormer. The sharp edges of the fine particles are supposed to inflict damage to the outer protective layers of insects and worms which causes their death. There are feed additives made from DE.

Adding bentonite, a very fine clay containing up to 70% silicates, might also help as a dewormer.

It is said that feeding of hay or chaff develops the rumen system. The result is a healthier and more resistant calf.

Homeopathy does not eliminate all worms, allowing the host to continue developing resistance. Homeopathy may therefore be useful for maintaining satisfactory welfare and health status of the animals in terms of preventative medicine, rather than being used as a treatment for clinically ill animals.

Homeopathy is said to play an important role in achieving parasite control through stimulating nature to work more effectively both at farm and animal level. Parasite burdens in sheep treated with a homeopathy compound in Britain were reduced by 81% (Lowman, 1990).

Homeopathic Cina and Santonia 30c in the trough once a day for three consecutive days, then once a week can help build a resistance. Others: Filix Mas, Arsenicum 30c. There may be others. Check the homeopathic section for more information on this subject.

An old remedy for lungworm is to put animals in an enclosed shed and burn sulphur. The inhaled smoke kills the lungworms.

External Parasites

Lice

- Need warmth and blood to thrive
- Work from head to tail via backbone
- Pick on weaker animals and those that don't fit in to herd
- Endemic during transition
- An indicator of herd health
- Observe your animals frequently

What is it?

There are two types of lice; biting lice and sucking lice. Sucking lice have mouthparts adapted for piercing the skin and sucking blood. Biting lice live on skin and hair debris, dried blood and scabs.

Initially you will see them as small whitish things moving about the hair. Later, it appears as a darkened area on the skin, and the skin appears to be oily. Later, there will be hair loss usually around the neck. The animals are itchy, always finding something to rub on. The lice focus in on warmth, knowing this is a source of blood. It will never kill the animal, but could create a secondary condition that could kill. That is because they need their host alive for blood. The animal does tend to lose vitality and condition loss.

Lice are picked up through body contact. They can stay dormant in cold weather and appear in warmer wetter weather. The adult lays the egg, which is glued to the hair. It hatches in 5-6 days and develops over 28 days to an adult, constantly feeding on its host. As a result there are always overlaps of different stages present on an animal. The eggs cannot be destroyed. Adult lice tend to move from the head of the animal to the tail along the backbone.

Lice will also only go for weak animals and can sense the ones that are struggling emotionally or unable to fit into the pecking order. This leads to the fact that in a transitional organic system, the animals that tend to have a problem with lice are the unhappy ones. During transition to certification it will probably be animals that cannot cope with an organic system. These animals need to be considered, and if they do not improve should be culled, as they will never overcome their problems.

Prevention

The most important thing is to remember there are four main strategies.

- 1) Most treatments only make the environment an unpleasant one for the lice so they leave.
- 2) Lice do not like strong healthy animals, so keeping their blood and immune system strong through feeding and management is paramount. Keep stress to a minimum.

- 3) Treat sick animals both internally and externally.

Something to think about

Close contact allows lice to spread and increase more quickly. E.g. mob stocking in winter dry period. Lice numbers should fall and obvious signs of lice disappear as animals are given a bigger area and feed better. This has the effect of less stress as well.

Some treatments

- An old remedy from a farming book:
Dissolve 250gm soft soap, in 4.5 litres boiling water. Stir in 500ml kerosene (soft soap is a form of natural insecticide and pesticide). Add enough cold water to make up to 20 litres. Apply to affected areas with a brush, thoroughly soaking the hair. Keep the animal out of the sun, as it will cause skin damage. Repeat 2 to 3 times over 3 to 4 days.
- Brew tobacco powder, flaked garlic, and leaves of geranium in 4.5 litres cold water. Simmer 2 minutes. Allow to sit and brew for a minimum of 6 hours. Do not strain and rub well into body of animal. Apply every few days until the skin is clean.
- 2tsp eucalyptus oil to 4 tsp ammonia mixed in 500ml tepid water and rubbed into the affected area, especially the neck.
- Rub the neck and backbone well with a mixture of vegetable oil and teatree oil. You could probably steep tansy or wormwood or pennyroyal in the oil for at least a week in the sun before applying to get their insecticide properties as well.
- Spray using pure pyrethrum (without piperonyl butoxide synergist). Note, very toxic to humans and animals.
- Neem oil could be worth investigating. Spray 3 times 9-10 days apart.
- Ask your homeopath to make a nosode if you can get some of the lice off and into a bottle or container. Dose the main water tank monthly or in troughs 1x a week most of the year, so the animals develop immunity to them.
- We have had success with elemental sulphur sprinkled down the back from the head to the tail. If lice are bad sometimes a second treatment is needed 2 weeks later. It is thought that lice might be an indication of low soil sulphur levels so work on correcting those also (do not get this in your eyes!!).
- For sheep; shearing twice a year.
- A high protein/sulphur diet is thought to be useful e.g. Brassica's.
- Seawater as an external wash.

Homoeopathy

- Ledum 30c for puncture wounds made by the lice.
- Nat Mur 30c.
- There are other remedies, check with your homoeopath.

Herbs

Herbs with insecticide properties work well. Steep them in cider vinegar and drench at 100-200mls. They may be abortive, so be aware.

- Tansy
- Wormwood
- Pennyroyal
- Garlic

Other skin conditions

- Ringworm: lemon juice, Baccicillum 30c
- Mange
- Scabies

Ticks

- Linked to water and warmth
- Use animal blood to breed

Strategies:

- Keep your animals healthy and strong.
- Use a teat spray with Teatree oil in it to deter them in milking cows (recipe in mastitis section).
- Keep grass short.
- Top rushes and long rank grass.
- Avoid grazing on wet areas.
- Watch the weaker animals.
- Make sure your grazing patterns and herd management are as natural as possible to the animals.

What is it?

With our climates getting hotter and wetter in some places, ticks are becoming more of a problem. Similar to lice, they rely on a host animal and their nice warm blood to enable them to multiply.

They are linked to watery aspects of our environment and need warmth and moisture to survive. Their life cycle is 4 staged. They go from larvae to nymph to adult while living in the grass. They then move up the grass to hop onto their host and settle on them for a week, gorging themselves on blood. After a week when they are nice and fat, they drop off to lay their eggs in the grass. All this happens around November and December and during the summer if there are outbreaks of rain. Their host can survive if there are only a few, but if it is a constant invasion the animals tend to become anaemic, have sores from the damage caused by ticks latching on, lose weight and have ill-thrift. As with lice, if the tick has a choice they tend to invade the weaker animal.

Treatments

- The sprays and drenches for lice in the previous topic should work.
- If it is a problem try getting a nosode of ticks from your own property made up by a homeopath.
- Homeopathic Ledum 30c
- Homeopathic Nat Mur 30c

Spray the animals with neem oil: spray when there is evidence of ticks on the animals. Spray, the whole animal, especially the underbelly at a rate of 0.7% - 2%, with water depending on the concentration of the neem. Neem oil is currently allowed under certification. Neem oil also interrupts the breeding cycle of ticks. If in doubt, check with your certifying agency.

Flystrike

What is it?

Flystrike is a painful condition caused by blowflies (Diptera, Calliphoridae) that lay their eggs on sheep and fibre goats. The fast growing maggots burrow into the flesh and poison the sheep with the ammonia that they secrete. The animals show signs of irritation during the first two days after eggs are laid. Maggots burrow into the dermis and the normal skin structure collapses. Once fly strike has been initiated, further flies are attracted to the strike site and the animals can be eaten to death in 3 to 6 days from the onset of the first strike (Morris, 2000).

Prevention

Flystrike should be prevented as much as possible. Keeping your animals well fed is key as is monitoring the weather. Blowfly strikes tend to occur after periods of heavy rain followed by warm weather, or during periods of high humidity.

- Minimise scouring. Dry, clean wool minimises the risk of flystrike. Pasture species with condensed tannins will reduce the amount of faecal output and can result in drier dags. Lush feed and ryegrass with endophytes should be avoided if possible. Give roughage to provide extra dry matter. See also worm management.
- Shearing and crutching once or twice during the summer during the fly season is often necessary. Some fleece types, such as merino or merino crosses and angora goats create ideal conditions for blowfly strike.
- Blowflies do not fly in high winds, so keeping animals in breezy areas will also help to reduce a change of attack.

Rearing calves

- Rear calves as naturally as possible
- Treat problems early
- Prevention is essential
- Worms and lice can be problems (see external parasites)
- Calf health is a good indicator of an organic system

Keep this procedure as natural to the calves as possible. It is said that animals that can run and jump around after feeding develop stronger bones. They need colostrum for 4 days, and preferably their own mother's for at least the first 48 hours, to absorb antibodies, which leads to the development of their immune system. They then need fresh whole milk (preferably your own organic milk) for a minimum of 3 months. Some farmers mix either yoghurt with acidophilus, aloe vera or cider vinegar in with the milk to prevent scours.

They also need access to grass and a paddock to run in. Keep them warm and give them shelter. Keep the milk supply constant. There are many methods of rearing calves and they all have their merits. Meal can be fed, but it needs to be a special brew to avoid the antibiotics and preservatives etc.

Always remember to ask and get a signed statement with ALL the contents of any brought in feeds for certification. Other farmers avoid this and give them good hay, chaff or silage to help develop the rumen system. It does not matter so long as the basic requirements are present and the animals are healthy and happy. Once weaned, they must be given good pasture to avoid a check in growth, and possible health problems.

Scour treatment

The calf must have electrolytes to maintain hydration – 2 litres twice daily. Those containing sodium citrate work best. If it cannot or will not consume enough by mouth, your vet can give fluids intravenously.

Maintain body temperature – a heat lamp is good for this but be careful not to allow the calf to get too hot. As the calf recovers, milk can slowly be reintroduced and the electrolytes cut back. Do not mix milk and electrolyte (the milk won't clot in the calf's stomach) – instead feed little and often with at least a two hour gap between milk and fluids. A dose of vegetable rennet (5 ml) immediately after the milk feed will assist clotting and help get the digestive system used to milk again.

Homoeopathic nosodes are available to help the animal fight it.

Green slimy: Calc Phos 30c

White: China or Aconite 30c

White/change of feed: Arsenicum 30c

Yellow/colic: Colycinthis or Bryonia 30c

Abdominal pain/green/cold: Veratrum Alb 30c

Stop diarrhoea: Slippery elm powder (available from Healtheries), or flax (Phorium tenax) leaves; or

Bio Pec (available from your vet clinic) has natural

products. Check the label for restricted materials before administering.

Also permitted but some are restricted (Check with your certifier), chalk products, electrolytes, and iodine.

Rotavirus

Rotavirus causes scouring in calves of up to 4 weeks of age (usually around the 10 day mark). The virus is carried by adult cattle that show no symptoms. Shedding by the cow in its dung is likely to occur at calving since there is a short, temporary decline in immunity at this time. A calf may be infected during the first 24 hours with the cow and be incubating the disease when you bring it into the calf shed. It then spreads through the rest of the mob. Death rates have climbed dramatically in recent years. Once calves are 4 weeks old, they are naturally immune.

Signs

Pale yellow watery scour and marked dehydration (off milk, dry nose, lethargy, sunken eyes, a tent of skin pulled up is slow to return). In terminal stages the calf cannot stand (or even sit up), feels cold and has a weak or absent sucking reflex.

Treatment as for scouring

Prevention

Isolate sick calves. Ideally, if your set-up allows, healthy animals should be removed from sick ones (rather than the other way around) and placed in a 'quarantine pen' for a week. If they're still healthy after a week, they'll be OK.

An infected calf excretes huge quantities of virus. Try not to spread it around on boots, hands, feeding utensils etc. Check with your certifier on what cleaners and disinfectants you can use. If you operate an all-in all-out system with pens containing no more than 2 – 30 calves and the pens have solid walls (eg plywood), this will increase your chances of confining the disease. Leave a pair of boots and leggings in a tray outside the infected or quarantine pen for use only within that pen. You can reduce the amount of virus in the environment by steam cleaning the walls of the pen (don't try to steam clean the bedding!) and topping up the bedding with a good layer (6-8cms) of new material.

A note on steam cleaning: remember you're killing the virus with heat not pressure. Excessive pressure may aerosol live virus into other pens.

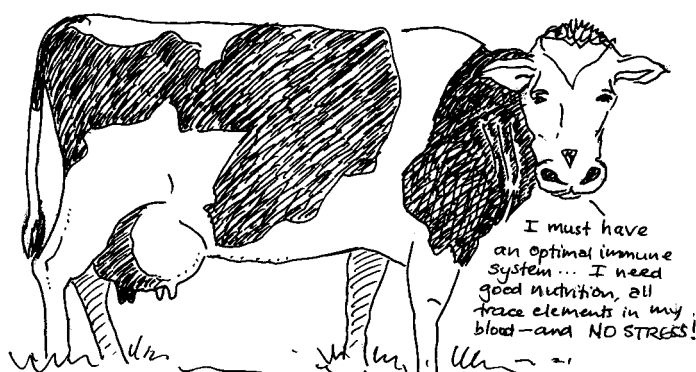
At the end of calf rearing, scrape out all the bedding (makes great compost) and thoroughly steam clean the shed.

Vaccination

If there is a demonstrated need, your certifying authority will allow vaccination. The cows are vaccinated 4 weeks before calving (timing is critical) and antibodies are passed in the colostrum. They are 'contact antibodies' so at-risk calves need to be fed it every day. Thus it is essential the colostrum from vaccinated cows is stored.

Other suggested treatments for calf conditions (mainly homeopathic remedies)

Calving trauma	Arnica and Bellis Perenis 30c(bruising/swelling)
Coccidiosis	Mercurius 30c or a Coccidiosis nosode
Others	
To help develop strong bones	Calc Phos 30c
Weaning	Ignatia 200c
Mothering-up	Sepia 30c
Pneumonia	Bryonia 30c
Navel Ill Diseases	
Nosode	Streptococcus 30c
Early stages	Aconite Nap 12x/Pyrogenum 200c
Hock and tendon swelling	Benzoicum Acidum 6c
Fetlock inflamed	Ruta Grav 1m
Swollen and hot joints	Bryonia 30c
Shoulder and fetlock swollen	Ledum Paustre 30



Mastitis

- Mastitis is multi-factorial – a holistic approach gives the best results
- The two most important bacteria are the environmental organism *Streptococcus uberis* and the contagious organism *Staphylococcus aureus*
- The non-availability of dry cow therapy means staphs tend to be more important on organic farms
- Prevention focuses on maximum hygiene and health of all cows at all times
- With a few modifications SAMM (seasonal approach to managing mastitis) plan forms the basis of control

What is it?

Mastitis is an inflammation of the mammary gland. This leads to a response caused by the cow's body releasing white blood cells to fight the inflammation in the mammary glands (udder). It is an efficient immune system that is working to destroy or neutralise the infections and related toxins, so the mammary gland can go back to a normal function.

There are two main stages:

1. Subclinical – the most common with no outward signs.
2. Clinical – which may appear as:
 - a. Subacute - abnormalities can be seen with changes in milk (flaky, watery, and stringy) and a slight swelling udder.
 - b. Acute - has a sudden onset, swelling and pain, milk is foul, and cows may show other signs of systemic infection. Eg. temperature, pulse, off food etc
 - c. Chronic - long lasting infection. Can be both clinical and subclinical.

Somatic cell counts (SCC)

Somatic cells are a normal constituent of milk as they are cells that make the first line of defence when pathogens (bacteria etc.) invade the udder. Elevated somatic cell counts are an indication of the presence of subclinical and clinical mastitis and are a measure of the inflammatory response mounted by the animal.

In general an indicator from a bulk sample test SCC is (Source: www.dexcel.co.nz);

At:	Indicates:
400,000	40% of your herd is infected
250,000	25%
100,000 *	10%

If your herd is constantly at this level, a sudden jump to 129 –140,000 indicates 1 new clinical case. Higher daily cell counts do not indicate this.

The reason why high SCC get penalised is because they may reduce product or processing yields, and they affect the flavour and shelf life of dairy products.

Goals

Reducing the incidence of mastitis in a herd to low levels requires significant effort and may incur substantial short-term costs with benefits only appearing in the medium to long-term. The degree to which control is applied is a matter of personal choice and will vary somewhat between farms. Additionally, every farm is different and people's approach over the years has likely evolved in response to their particular environment, their cows and the bacteria involved.

Bacteria spread through contamination:

Spread from cow to cow during milking by hands and liners. More likely to create mild subclinical infections.

<i>Staphylococcus aureus</i>	Rapid onset swollen & purple udder. Clots, systemic signs.
Coagulase Negative <i>Staphylococcus</i> (CNS)	Once considered not to be significant but can cause elevated SCC.
<i>Streptococcus agalactiae</i>	Mild fever for 24hrs only.
<i>Cornibacterium pyogenes</i>	Summer mastitis. Thick cheese-like. Smelly secretions. Can burst through outerskin. When burst, contaminates others.

Environmental bacteria: Increases with heat and humidity, dampness, mud and yarding. Harder to control.

Coliforms	Thin yellow flaky milk. High temperature. Systemic signs.
<i>Streptococcus uberis</i>	Fever. Severe swelling quarters and abnormal milk.
<i>Streptococcus dysgalactiae</i>	
<i>Enterococcus faecalis</i>	No symptoms
<i>Norcadia asteroides</i>	Hard lumps in the udder. Will not respond to antibiotic treatment.
<i>Pseudomonas aeruginosa</i>	Extremely sick cow. High temperature. Mastitis severe, brown and watery discharge, lumpy udder. May also have severe diarrhoea.

Principles of control

Prevent infection and if infected, prevent spread and mitigate SCC.

It sometimes helps to know which organism you're dealing with. Although it's probably not worth culturing every odd case, always take a sample and freeze it (it will last a month or two). If a problem develops, you've then got a bank of samples ready to go. A sampling protocol can be found in the appendix.

Strep uberis

Critical to control is a clean environment around calving and drying-off – most infections occur at these times. *Uberis* is a normal gut resident in many cows so where there's muck, there's mastitis! Sunshine and dry conditions kill the organism quickly but prolonged cool, wet periods can lead to high levels of contamination of paddocks and races. Keeping calving paddocks as mud-free as possible is obvious but particularly important also is the last 100 metres or so of race before the yard – adequate drainage here will prevent the build-up of dung which would otherwise be walked around the farm. See Lameness info sheet for more on race construction. Spraying effluent will also result in contamination – most organisms will have disappeared after 30 days even with cool and wet conditions, but to be safe, it is not advisable to calve or dry-off on effluent paddocks.

Teat spraying (while maintaining teats in top condition) and management of open teat canals close to calving are important. This particularly applies to heifers since most have no teat plugs. If cows in the springer mob are observed dripping milk, they should be milked and teat sprayed. Freeze some of the colostrum for their calves.

Careful feeding to avoid excessive bagging-up means balancing the amount of fresh grass (which tends to promote bagging-up) versus the amount of supplement fed to springers. Don't feed salt at this stage, especially to heifers. Teat spraying heifers when they are being trained for the shed pre-calving will help. One farmer runs the springer mob through the shed every day, which makes removing cows with calves easy, trains the heifers and gives the opportunity to teat-spray.

At drying-off, minimising build up of dung on paddocks is important. Fill them up with low quality hay so they're not walking up and down fencelines creating a mudbath. Keep them moving onto clean grass and check visually in the paddock for any obviously swollen quarters. Run them through the shed 8 - 10 days (no earlier) after dry-off day and again 3 weeks later to palpate all udders. Don't disturb any teat plugs unless you have to and take the opportunity to teat spray.

Staph aureus

The main risk period is mid spring onwards and teat spraying is vital to prevent spread. The spray must cover the entire teat. To check this is happening, use a small square of paper towel or tissue just big enough to cover your hand; grasp the teat immediately after spraying and look at the pattern on the towel – it should be more or less square with no gaps.

Emollient (eg glycerine) helps keep teats in good order. Teat skin does not have oil glands, which is why teats dry out so easily under adverse weather conditions. A dry, cracked teat is almost as prone to infection as a damaged one.

Vigilance in detecting new infections and regular monitoring of existing ones (using the RMT or an electronic detector) is needed to develop a picture of mastitis in the herd. Clinical cases must be separated. Ideally, all infected cows (including subclinicals) should be run as a separate mob and milked last, although there are practical limitations to doing this! However, splitting the herd along age lines may have other benefits and help minimise the risk of older

high cell count cows passing their infections to heifers and second calvers.

If high cell count cows are known, the bulk cell count can be mitigated simply by removing those cows from the bulk supply at times when there is a risk of grading. Hand stripping high cell count quarters after the cups come off will reduce the count from those quarters at the next milking. This is only of very short-term benefit but is useful when necessary to get the bulk count down fast. In any case, counts from chronically infected quarters often vary considerably from day to day. Note, gloves should be worn and disinfected between each cow.

These are common strategies but there are two risks: firstly an under-estimation of the problem may result in a grade anyway and secondly that this may prolong the presence of infected cows which are a risk to others in the herd.

Teat Spray Recipes

Commercial teat sprays are reliable and proven but there is pressure to phase them out. Here are a couple of suggested recipes. On paper they should work fine but have yet to be proven under farm conditions.

- 5 L stock iodine 2.5% (FiL), 6 L water, 2 L glycerine (Ecolab) or fish oil (Biosea)
- 50 ml tea tree oil (True Blue Organics), 1 L fish oil, 20 L water. Halve the amount of water at times of high risk.

Whatever you use, the general recommendation is not to mix up more than you can get through in 4 or 5 days, and always use high quality water.

Other considerations

With a holistic approach, the following should always be explored. Space precludes a detailed discussion but further information is available, especially via the DairyNZ website.

Milking machine monitoring and maintenance: twice yearly checks are recommended but a good indicator of performance is what the cows' teats look like immediately after cups come off. Change liners every 2500 milkings and watch cup alignment.

Culling: ability to cull on mastitis is related to reproductive performance (see the InCalf programme, DairyNZ website or ask your vet).

Breeding for resistance: heritability is low but significant progress can be made if the selection pressure is strong enough. Low SCC bulls are available.

Feeding and mineral levels: underfed cows are more prone to disease. Feeding is not just about quantity – a quality balanced diet (meaning a variety of pasture species fed at the right stage of the growth cycle and sufficient dietary fibre to stabilise the rumen and prevent diarrhoea) appears to have significant health benefits. Metabolic problems around calving can be associated with mastitis – attention to magnesium/calcium at this time is important. A severe shortage of selenium will result in more mastitis. Certified selenium Chip® applied with fertiliser or Moana chelate sprayed on pasture keeps selenium levels adequate.

Stress: there are three components:

- Feed (see above)
- Behavioural
 - cow-to-cow interactions (eg heifer bullying, overcrowding)
 - human/cow interactions. Gentle handling and good facilities are necessary. See also Lameness info sheet
- Climatic. Attention to shade and shelter.

Mastitis in dairy goats

A major ongoing study done in conjunction with the NZ Dairy Goat Co-operative (NZ) Ltd., published in the April 2010 issue of *Dairy Goat News* has found that the incidence of clinical mastitis in dairy goats in NZ is very low (less than 3%) It also found that less than 2% of dairy goats had major pathogens like *Strep uberis* and *Staph aureus*.

But testing also showed that 20-50% of goats surveyed on farms developed at least one subclinical infection during the season. Most of these occurred in the first 2 weeks after kidding.

All the points raised in the section above about stock health and hygiene apply equally to dairy goats.

Treatment options

Farmers in the first two years of conversion may continue to use antibiotics as a treatment (twice the withholding time is applied) but not as a preventative. Selective dry cow therapy may be used and approved teat sprays are also allowed. However, this conversion time needs to be used to put strategies in place to ensure there is no necessity for routine antibiotic use by the start of the third year.

Note: Organic regulations require that if any animal needs to be treated with antibiotics after the start of the third year of conversion on welfare grounds, it must be treated. It then must be quarantined during recovery before it is removed from the system.

Stripping (as often as practical) and massage are the prerequisites for all cases of clinical mastitis. This is particularly successful for *Strep uberis* if swelling is no more than moderate. Flunixin (an anti-inflammatory) is allowed as a restricted product - it may be useful for hard quarters and is definitely indicated for an animal that's off-colour. Another restricted product is Furosemide which may assist with the udder oedema typically seen in heifers. Reducing the oedema makes a case of mastitis easier to strip. Both these products have withholding times (3 and 4 days respectively).

Homeopathics are extensively used. Products vary with the severity of clinical signs. *Phytolacca* and *hepar sulph* are popular as is *SSC* (silica, sulphur and carbo veg). Specific or more general nosodes are available for trough treatment at times of high risk. Check your homeopath for the appropriate remedies, potencies and methods of administration.

Tonics such as apple cider vinegar, seaweed extract and aloe vera (drenching or trough treatment) are commonly used as preventative or supportive therapy for both clinical and subclinical mastitis.

Herbs that can be steeped in the cider vinegar

Garlic, sage, marjoram, lemon balm, curly dock, red clover, *Echinacea*, nettle.

There are probably many more. Check your herb book and the actions you are trying to promote in the cow eg suppuration, circulation, blood purifier, infection etc.

Intramammary medical grade manuka honey (5 – 10 ml, Cambridge Bee Products) is reasonably successful on clinical cases with minimal swelling of the udder and high SCC quarters if the infection has not been established for long.

Tea tree oil and herbal remedies are sometimes used. Hard quarters may be treated with a mixture of *phytolacca* (herbal extract) *echinacea* and *devils claw* (Ethical Extracts) and good results have been reported for a mixture of celery seed and *phyllanthus*.

Note: USFDA regulations specifically prohibit the use of intramammary aloe vera.

Farmer-reported success rates are reasonably consistent at around 50 – 65 %, although without testing, it may be difficult to distinguish between a clinical cure (which means only cessation of clinical signs, bacteria may still be present) and bacteriological cure (where the bacteria are eliminated). Even with bacteria no longer present, the cell count may.

Bloat

- Bloat is caused by a build up of gases in the rumen from fermented grass
- Occurs on lush, damp pasture with high legume content and specific crops
- A tendency to bloat is inherited
- Prevention focuses on pasture management and drenching

What is it?

Bacteria in the rumen produce methane and CO₂ gases as they break down feed. Proteins from clover combine with the gas to form a stable foam which results in the build up of pressure in the rumen. As bloat develops, the animal's breathing becomes laboured and they grunt and groan. The cow's abdomen becomes enlarged and the animal may try to lick its flanks. If serious enough the cow will go down and can die rapidly.

A cow gorging on damp pasture that is lush, has grown quickly, and is clover dominant may develop bloat. This type of pasture tends to have low levels of fibre, which is needed to stimulate the production of saliva that helps prevent foam formation.

Bloat often occurs when overnight temperatures drop, after the morning milking, when the cows go on fresh pasture. Heifers are most susceptible to bloat as they haven't learnt when to stop eating.

The tendency to bloat is inherited – a breeding programme is an option to help reduce the problem. Anti-foaming agents are present at higher levels in saliva from cattle with low susceptibility to bloat (Wheeler et al., 1997).

Pasture management for bloat prevention

The main problem areas appear to be associated with new grass paddocks where clover may be dominant. A well run organic farm should not have clover dominant pastures. Ideally pastures should be a mix of 80% grasses and herbs with 20% clovers on average over the year.

Crops such as lucerne and other legumes may also cause bloat if cattle gorge themselves or the crop has grown rapidly. Grazing management to prevent excessive gorging focuses on not allowing hungry cows free access to bloat-prone pasture. Strategies such as break-feeding or pre-mowing the paddock can minimise the bloat problem. Feeding quality hay will stimulate saliva production.

Earlier research (Carruthers and Henderson, 1994) has shown that bloat-free farms are those with:

- Lower proportion of rye grass
- Higher proportion of other grasses
- Higher herbage mass after grazing

It has been suggested that high pasture potassium (K) levels are associated with poor uptake of dietary sodium and an increase in the incidence of bloat. The effect appears inconsistent but it may be an important factor on some farms.

The K:Na ratio (or Bloat Index) may explain some of the geographical and seasonal variations found with bloat,

along with the relationship with particular soil types (Turner, 1981). A narrow K:Na ratio (less than 20:1) corresponds with a reduced incidence of bloat, while a K:Na ratio of below 10:1 is recommended.

- Supplying a salt lick or seaweed meal assists with the dietary intake of sodium

Options for bloat prevention

- Drench with fish oil (15ml/cow) and consider adding bicarbonate of soda (baking soda) if potassium levels are high
- Homeopathics: Colchicum and Carbo Veg to assist with digestion
- Biodynamics: Preparation 501

Other preventative measures

- Homoeopathic chamomile 1-2 weeks before 1x a day for 3 days then 1x a week, stepping up to every day if the presence of bloat is a possibility
- Cider vinegar in trough regularly
- Garlic, nasturtium and cider vinegar drenched to animals
- Once the clover starts to flower the bloat season is usually over because of the high tannins in the flower

Emergency bloat treatments

- Drench with 100-150ml fish oil (plus bicarbonate of soda if there is time) shaken up in warm water
- Homeopathics: Colchicum and Carbo veg. Check with your homeopath for other remedies.

Other bloat treatments

- Vegetable oil (linseed oil preferable) or liquid paraffin or fat (85-118 mls diluted in water). Check on paraffin and fat with certifying agency.
- If beginning to sway and be bad, use a bloat knife for a rumenotomy.
- Mild cases - get them walking especially towards an up hill position.
- Post trauma – linseed tea (flax seed boiled in water and steeped).
- Powdered charcoal or crushed charcoal tablets given with milk to remove any lingering gases
- Teas of fennel, dill, peppermint, German chamomile, ginger, or lemon balm to sooth. See the previous herbal section on how to make teas.

Goats sometimes exhibit signs of 'frothy bloat' or may actually regurgitate green, smelly partially digested material. They will generally be very uncomfortable and will let you know by loud bleating. As for cows, quick treatment is needed to prevent unnecessary discomfort. Any of the treatments mentioned above are equally effective for goats. Homeopathic Nux Vomica may also be helpful.

Facial eczema

- Caused by fungal toxins on pasture
- Warm humid weather and decaying litter are factors
- Affects the liver
- Prevention is the only cure

What is it?

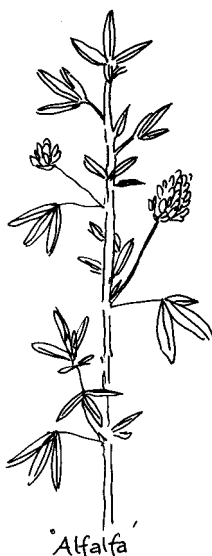
Facial eczema is caused by toxins from the spores of the saprophytic fungus known as *pithomyces chartarum*. It is important to the breakdown of ryegrass and lives in dead vegetative material in pastures, especially ryegrass.

It rises up and multiplies between January and May when the weather becomes warm, wet and humid. Light rain or dew, warm nights and litter in the pasture are usually the most common triggers. Overnight grass minimum temperatures have to be warmer than 12 degrees C for 2 to 3 nights or more. The youngest spores are the most toxic and a spore count above 60,000 is considered dangerous.

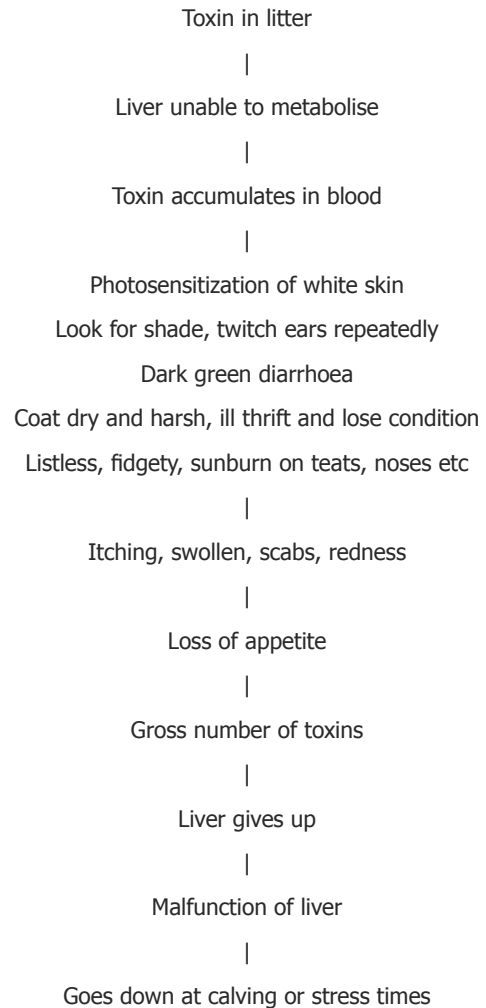
The spores are soil-born, so they live in the lower areas of the pasture on dead ryegrass litter. Often there is a mineral or bacterial imbalance in the soil. This then allows the fungi to become more dominant and create an imbalance.

Spores can not survive in hot dry temperatures or cooler temperatures. Heavy rain will wash the spores down the plant making them unavailable to be taken in by the animal.

The toxin, sporidesmin, that is produced, is one that the animal's liver cannot metabolise. As a result the toxin accumulates in their blood supply and photosensitising occurs. Symptoms appear ten to twelve days after ingestion. Photosensitization occurs especially in non-pigmented skin (white areas of the udder, ears or nose). Facial eczema affected animals may survive the initial attack, but because their liver is damaged, the animal may succumb to feed stress or metabolic diseases at some late stage.



Facial eczema chain reaction



Facial eczema does not seem to be a problem on organic farms where they have developed healthy soils and good mixed pastures. There are a few indications that liming pastures might reduce the number of facial eczema spores (Grierson, 2007). Organic pastures are not so ryegrass dominant, any litter is broken down and incorporated into soil organic matter quickly and generally animals are not grazed as hard as on many conventional farms. A combination of these factors can explain the situation on organic farms. You will notice they do not have the litter on the ground for these spores to live in.

Prevention is the best cure – the effects are not easily reversed.

Organic certifying agencies recognise the problems associated with facial eczema and allow remedies to be used as prevention. It is best to begin earlier rather than later.

Homeopathic Zincum Met 30c in the trough will also help the animals utilise the zinc.

Other considerations

- Reduce the spore intake by having a forage crop e.g. brassicas, or a supplement, e.g. silage as part of the summer programme. These allow higher grazing residuals and are very useful to help prevent FE (facial eczema) in young stock.

- If the risk is rising, put zinc sulphate in troughs daily. There are interactions between zinc, especially copper and selenium; farms deficient in these trace elements should consult their vet before using too much zinc sulphate.
- Give them shade, especially affected animals.
- Affected animals should be fed well and have no stress to enable them to recover.
- Be aware when topping prior to a possible dry period, as this can cause litter. Maybe it might be better to leave that grass standing up. An alternative may be to keep those paddocks out of the round in December, and have it as a mature pasture or standing hay when the flush of grass appears, break-feeding it off. This also has the added advantage of restocking pasture species and giving the paddock a rest.
- Lime regularly as part of your fertiliser programme
- Don't forget your young stock – they are more prone.
- Identify your paddocks that have the potential for the toxins. Avoid them, and use later as standing hay or use it as a small portion of daily feed with a crop or silage.
- Exposed windy paddocks have fewer spores.
- Cull early to reduce pressure on grazing.
- Check how much dead litter you have in the base of your pastures.
- Remember the lower the animals graze the more likely they are to pick up the spores.
- Paspalum and low fertility species such as poa, brown top, sweet vernal, danthonias, lotus major, flat weeds is a safer pasture. Ryegrass seems to be the problem.
- Avoid extremes of grazing – from dry pasture to lush, fresh pasture or under-supply of feed to over-supply. Try and graze animals on matured pastures and give them a constant supply. Supplements are a good alternative. Try brassica crops.
- Use your local newspaper (the climate or rural section), MAF or consulting officer or check on the websites for up to date counts if you're unable to monitor them yourself.

Source: www.fencepost.co.nz

Treatments for facial eczema

Use at the first signs of irritation or skin damage – you will usually see the cow irritated days before you see any damage.

- Homeopathic: Contact your homeopath for remedies.
- 2 cups cold pressed linseed oil/cow for 2 days; 1/2 cup linseed oil/calf for 2 days (too much is poisonous) Also check with your certifying agency first.
- Drench the animal with 1/2 cup castor oil, 1 tablespoon linseed oil, 1/2 teaspoon olive oil and 1/2 teaspoon cod liver oil. This is good for recovery and provides the fat soluble vitamins needed.
- Access to willow bark and green leaves, – contains aspirin and helps alleviate symptoms, i.e. cut down

branches and let cows browse – they will go for them.

- A lick with seaweed, zinc sulphate (check this is allowed), vitamin C and cider vinegar mixed together.
- Access to honey locust pods.

Help the skin and wounds from further sunburn with ointments:

- Zinc ointment
- Charcoal or soot mixed with Vaseline or lard
- 30ml zinc oxide mixed with benzoated lard 120ml. Benzoine is a tincture used to preserve and stop fungus from growing and can be purchased through the chemist.
- Spray aloe vera on the skin, then cover with a zinc ointment/peanut oil paste. This stays on quite well compared to some ointments.
- If the animal develops lice, these must be treated before treating the eczema.
- Manderson's Mixture.

This mixture is recommended when you have a cow/heifer or calf that has been affected by facial eczema. The white areas of the animal's skin can crack and peel and this mixture of oils can be given orally to assist the skin healing process. This mixture can also be used in cases of 'spring eczema' which has a slightly different aetiology, however, the resultant damage to the skin is the same.

Manderson's mixture is available from Dominion Chemicals, East Tamaki, Auckland or you could source the raw ingredients yourself and mix your own.

The dose recommended is 85ml per adult cow (reduce proportionally for younger cattle) and repeat in 2-3 days as required.

- 1/2 cup castor oil
- 1 tablespoon linseed oil
- 1/2 teaspoon olive oil
- 1/2 teaspoon codliver oil

This dose is for a cow. Smaller doses would help a sheep to recover.

- To help with itching alternate the following solutions on the affected skin (Waterman, 1980):
15 ml Boracic acid and 240ml water
30ml Creolin and 1 litre water
When a healthy scab has establish use:
30ml Creolin and 500ml sweet oil
- Peach tree leaves and bark are a source of zinc. You could make a tea out of them by pouring boiling water over them, steep for up to 6 hours and then add to trough or drench.

Milk fever (Hypocalcaemia)

What is it?

- A metabolic disease resulting from low blood calcium levels
- Usually affects cows 5 + years old, especially Jerseys

Milk fever can occur from 2 days before to 2 weeks after calving although highest risk is the day of calving and for the next 3 days. A contributing factor is a dietary imbalance of calcium and magnesium, especially if excessive levels of potassium and nitrogen are involved. The sudden demand for calcium at the onset of lactation may not be met by the diet and the hormonal control of blood levels is inefficient at this time.

Calcium blood levels are controlled by a small gland in the neck called the parathyroid. The gland produces a hormone that boosts blood calcium by various mechanisms, but especially by resorbing it from bone. It normally takes a few days after calving for this mechanism to function fully, which is why we usually see milk fever at that time. The gland needs good levels of magnesium to work properly, so milk fever is sometimes also associated with low magnesium intake. However, we can get the gland up and running a bit earlier either by acidifying the diet of the springers and/or feeding them something with low calcium and potassium content, for example maize (see below).

Susceptibility to milk fever can be inherited, tends to affect high producing 5 year and older cows and those with Jersey in their ancestry. Over-conditioned animals fed a low fibre diet with inadequate magnesium are most at risk.

Most fully certified organic farms have a low incidence of milk fever due to the grass being in better balance through more consistent growth.

Clinical signs

- The signs we see with milk fever are due to paralysis. It affects all body systems including the gut plus any gland that produces fluid.
- First signs are restlessness and disorientation, followed by weakness in the hind legs, staggering and recumbency.
- Initially the cow is able to sit up. The neck assumes an S shape but the head eventually folds around to lie against the flank.
- Body temperature drops. Eyes become glazed and the nose becomes dry.
- Eventually she can sit up no longer and lies flat out on her side. Bloating may then occur as her gut becomes paralysed. This is a dangerous situation. Excessive bloating may cause vomiting which, due to paralysed swallowing reflexes, often results in stomach contents finding their way into the lungs
- Even without bloating, untreated milk fever can lead to coma and death within a few hours.

There is a test available (using fluid from the eye of a freshly dead animal) to get accurate information on calcium and magnesium levels at the time of death. Ask your vet for details.

Prevention - before calving

- Manipulating the diet of the springer mob helps reduce the incidence of milk fever. First and foremost is ensuring adequate magnesium levels in the cows by careful supplementation. Feeding them something with low calcium and potassium content (maize, hay) also helps.
- Ensure the diet is not high in potassium (K) which interferes with magnesium absorption. Don't calve on effluent paddocks - high K levels (and Strep uberis)
- If there is a high risk of milk fever, acidifying the diet of the springers (thus lowering the DCAD) by adding magnesium chloride or sulphate to the system is an option. Chloride probably works better. The only problem is getting enough into the cows: 120 - 150 g/cow/day. The best way is to dissolve it in water and pour onto the supplement but unless that supplement is maize, something to disguise the taste is usually needed - molasses is good. If this still does not provide quite enough magnesium (see 'Grass Stagers' below) a little Causmag can be added as well.

Note: This should be done with the springer mob only. If the diet of dry cows is acidified, they get used to it after 3 weeks or so and it won't work. Once cows have calved, you can switch to Causmag only.

- Calcium should never be supplemented before calving as this slows the response of the parathyroid gland. Be careful with autumn lime application on volcanic soils as this may boost pasture levels significantly.
- Vitamin D helps absorption of calcium from the gut and helps prevent milk fever when given a week or so before calving but currently there are no safe preparations certified for use.

Prevention - after calving

- Drench at-risk cows with an oral preparation for a day or 2 after calving. Make up a mix of lime flour (a couple of handfuls), Causmag (a handful) and fish oil and shake it up in warm water. You could also add apple cider vinegar and/or molasses (molasses helps absorption).
- Consider adding lime flour (40 - 100g per cow) to supplement fed to the colostrum mob. If you're feeding maize after calving, lime flour is essential.
- If in doubt, have some cows blood tested before calving (to check magnesium levels) and after calving (to check calcium levels).
- Weekly doses of homoeopathic Cal Phos and Mag Phos in the trough the first 4 weeks of lactation to help the animal metabolise both.
- Feed hay that contains a good percentage of clover. This will increase the calcium content, while at the same time through the extra chewing, increase the amount of saliva reaching the gut and therefore helping to stabilise ruminal pH.

Treatment

(1) Oral

No commercial oral preparations are certified but you can make up your own mix.

Suggested recipe: dissolve calcium chloride (around 150g, but no more than 200) in 200ml of warm cider vinegar. Make sure it's properly dissolved before adding a similar amount of oil (note – fish oil is not permitted for certified organic farms – use vegetable oil), then add 50g Causmag and make it up to 5 - 600 ml with molasses. Shake thoroughly – it's important to ensure the oil is well suspended as it helps protect the gut against irritation due to the calcium chloride. Note - calcium chloride absorbs much quicker than lime flour so is better as an oral treatment. However, it is quite irritating and can cause stomach ulcers if used repeatedly so it is not recommended to give more than three treatments with this product. If prolonged treatment is required, replace calcium chloride with lime flour.

This mix is only suitable for cows that have swallowing reflexes! That means cows that are still on their feet or have only just sat down but can still hold their heads up. Even so, be VERY careful with these cows - make sure the stuff is going down the right way!

(2) Intravenous

- Check with your certifier which CBG products are allowed. You need to get them written into your management plan. Note they are for intravenous use only – once the cow is sitting up and has regained her swallowing reflexes, follow up with an oral drench.

If she still won't stand up:

Common sense with any downer cow is to warm the cow up. Parallel to treatments is the importance to get her out of the wind and off wet ground. Put her in the barn on a soft surface, pack hay around her with a cover on top or whatever you have to do to get her warm. It's vital to ensure blood circulation through the back legs is maintained while she is down so move her from one side to another at least 4 times a day. Periodically tip her on her side and vigorously bend and straighten both back legs for few minutes. (Don't stand behind the legs when you do this – she might still be capable of booting you). Provide feed, water and oral drenches. If there's no progress after a few days, your vet can carry out a blood test which will estimate her chances of survival.

Other suggestions from farmers:

- Do not milk the cow out completely for 2-3 days; alternatively, leave the calf on the cow for 36 hours. Watch for mastitis – cows not milked fully are more at risk.
- Plants rich in calcium – watercress, crushed nettles, molasses, chickweed, comfrey, alfalfa, willow twigs and boughs, root crops, poplar, tagasaste, birch, barberry, plantain, red clover, raspberry, rosemary, shepherd's purse. Many have a balance of calcium and magnesium. Plant them or make a tincture with cider vinegar when they are growing to drench the animals with at calving.
- Immediately give calcium and iodine rich drench

with 2 handfuls powdered seaweed mixed with 1 kg molasses. This is then mixed with warm water or milk to make it runny, drinkable consistency. Repeat this hourly.

- 1 cup molasses, 4 tablespoons linseed oil or meal, 2 tablespoons salt, 2 tablespoons Causmagor dolomite. Give as a lick on feed.
- A salt lick recipe used:
 - 10 litre bucket of seaweed powder
 - 10 litres cider vinegar
 - 10 litres water or molasses
 - 20 litre bucket of salt
 - 1 sack of dolomite

Mix all together in a concrete mixer, liquids first then solids. Epsom salts can be added or can replace the salt to add more magnesium.

Check with your homeopath for milk fever treatment remedies.

Remember: always check with your certifier before giving any homemade remedy.

Milking goats can also get milk fever in the first few days after kidding and will display the same symptoms as cows. Treatment is similar in proportion to their size.

Grass staggers (Hypomagnesaemia)

- A metabolic disease resulting from low blood magnesium
- Wide variation in clinical signs
- Sudden stress can trigger an extreme episode
- May occur along with milk fever or ketosis
- Prevention prior to calving is best

What is it?

Magnesium is held in the muscle and used by the muscles and nerves. It has a rapid turnover in the body and there are no stores on which the cow can draw. High producing cows are most at risk due to obligatory loss of magnesium in the milk thus a tendency to this illness can be inherited.

Grass staggers can occur up to 12 weeks post calving in the spring when the grass is short and growing rapidly and may also be seen in the autumn. Excessive potassium (K) in the diet suppresses magnesium absorption from the rumen. Young grass is generally rich in protein and potassium and low in magnesium. Mature grass is normally much more balanced but a key indicator is often soil temperature – until temperatures reach a consistent 12 – 14 degrees in the late spring, rapidly growing grass is a risky diet. Be particularly aware of magnesium problems when going into the second grazing round.

High potassium (K) will be an issue for many farms still in the conversion process and/or on soils with a naturally high available K. Also heavily manured farms and farms using effluent will be more prone to grass staggers. However, as

the organic system develops, the risk of metabolic disease should decline.

Clinical signs

- Irritability in the shed is often the first sign of a herd problem. Magnesium can also have a very significant effect on production (up to a 20% drop in deficient herds).
- In individual cases you may see nervousness, irritability, twitching eyelids, anti-social behaviour, eyes glaring, frothing at the mouth, aggression (be careful, although they don't usually have the co-ordination to get you).
- This may progress to staggering and high stepping.
- Collapse with an epileptic-type fit, eventually coma, leading to death. Brain damage can result. This may occur with no warning. It's due to a sudden drop in magnesium levels in the CSF (the fluid that bathes the brain) and is most likely in cows that have had low blood magnesium levels for some time. The sudden drop in CSF levels is usually triggered by sudden stress (such as cold weather or coming on heat) but the stress factor may actually be quite minor. They commonly occur in the yard at milking.

NOTE: Hypomagnesaemia can often be a complication of milk fever or ketosis. They all occur at the same time of the year. Cows which have been low in magnesium and then subsequently get milk fever as well are often much more difficult to treat. They tend to be the cows that are down for longer periods.

Prevention

Prevention should start at least 2 weeks prior to calving for good insurance. There's a big variation. Some parts of the country and some farms need to start earlier and finish later.

Strictly speaking, any minerals (apart from licks) need to be fed on supplement so this means having sufficient hay or silage in reserve for the risk period. In any case, a bit of fibre in the diet through mid-spring can only be of benefit. It doesn't have to be much – half a kilo is fine, so long as every cow has the opportunity to get some.

Magnesium products are all restricted and need to be written into your management plan:

- Causmag: also known as calcined magnesite or magnesium oxide. Note 'calcined' means heat treated – it has nothing to do with calcium. Causmag is alkaline. Magnesium content – 55%
- Magnesium chloride: acidic Magnesium content – 11%
- Magnesium sulphate (Epsom salts). Acidic. Magnesium content – 12%

Note the differences in magnesium content. The bitterness of chloride and sulphate means the cows may not take enough in without using something to disguise the taste (see also the section on acidifying the diet to prevent milk fever). As a guide, 10 – 30g of elemental Mg per cow per day

is required through the risk period. However, it depends on the risk – some farms can get away with just small amounts of Epsom salts. Others, especially those on volcanic soils at altitude, need lots of Causmag. Also, every season is different. If in doubt, have some cows blood tested.

Causmag needs to be applied wet onto hay otherwise the cows will shake it off. Mix it up with plenty of water – if there's too little water, it'll get hot and turn to concrete. Pour it onto the cut edge of small bales or onto (but not through!) a round bale once it's rolled out. Adding a bit of molasses will also help it stick.

Self-help systems on their own are generally less effective at keeping magnesium levels up, but can be quite useful as an adjunct to supplementation. For example:

- Mineral licks before and after calving. Make sure they are OK with your certifying agency. Don't feed anything with salt to springers (excessive bagging up, especially heifers).
- Home made mix: 25kg Epsom salts, 25 kg Causmag and 8 litres molasses.
- Homeopathic Cal Phos/Mag Phos and Kali Phos 30c in trough weekly 2 months before and after calving. This can be done in conjunction with the above suggestions.

Other considerations

- If you need to lime, topdressing with dolomite will help boost pasture magnesium. Dolomite has calcium and magnesium in it. Check its heavy metal levels first. **Note:** dolomite works faster and releases more magnesium than serpentine.
- Avoid sudden feed changes. Try to 'ease' the herd onto second-round grass. If this is not possible, increase the amount of hay or silage to 1kg per cow. Put cider vinegar in the trough each day.
- Spray pastures with biodynamic preparation 501 during the ascending phase to bring light into the pasture and strengthen it.
- Give the animals sheltered paddocks in cold and stormy weather.

Emergency treatment

- For a cow in the stage of epileptic-type fitting, options are limited. Intravenous magnesium is required but the only safe way to administer it without killing the cow is in combination with calcium to protect the heart. Using a 60ml syringe, inject 3 syringe-fulls (180ml) of 20% magnesium sulphate into a bag of calcium via the little short tube with the rubber plug in the end. Run it into the vein as quick as it will go through a needle but don't squeeze the bag. If you need to give a second bag, run it in slowly. Once the cow has settled down, you can follow this with a bag of dextrose. Also as a follow up, magnesium sulphate can be given as an enema (absorbs quicker than if given under the skin) – you may wish your vet to do this. If the cow continues to fit after intravenous treatment, call your vet who may decide to anaesthetise her.
- For a cow still on her feet, make up a mix of Causmag (2 handfuls) plus Epsom salts or mag chloride (1 handful), molasses or sugar and apple cider vin-

egar shaken up in warm water. Grass staggers cows are excitable – be careful when drenching or it may go onto the lungs. Stop pouring every few seconds to make sure she is swallowing it.

- Homeopathically: To help them recover and limit the damage to the central nervous system give Mag Phos 30c plus. Ask your homeopath for other treatments.
- Keep them warm, quiet and avoid loud and sudden noises.

Ketosis (acetonemia or 'acidosis')

This can be confused with grass staggers or milk fever. It classically occurs 4 –10 weeks post-calving and affects high producing cows which calved in excellent condition. More commonly it is a secondary disease associated with anything which suppresses appetite.

Ketosis is an energy crisis where the dietary intake of energy is insufficient for the proper breakdown of fat. Instead the level of blood ketone by-products rises accompanied by declining production and a rapid loss of body condition.

High protein, highly digestible feeds, shortage of feed, poor quality feed especially during late pregnancy, metabolic disease, stress and/or adverse weather can set the scene for Ketosis.

Clinical signs

Note: Always check for the presence of another disease

- Poor appetite, rapid condition loss, declining production (may be sudden)
- Acetone smell on breath
- In extreme cases, nervous signs, especially aggression. Extreme cases are quite rare and may be confused with grass staggers. Be **very careful** with these cows. Unlike with grass staggers, these animals are still fully co-ordinated and are quite capable of nailing you

Your vet can do a blood or urine test to confirm Ketosis.

Treatment options

- Intravenous glucose (dextrose)
- Drench with 250ml glycerine and 250ml molasses.
- Cider Vinegar (500ml) as an energy source and to aid digestion.
- Homoeopathic Lycopodium

In the near future, we may be allowed to use injectable vitamins, in which case a shot of vitamins B1/B12 will aid recovery.

Infertility

- Can be a multitude of reasons
- Learn to understand the process of oestrus
- There are some good practices to follow
- Close observations are important

What is it?

Infertility is the inability of an animal to conceive and/or produce a full-term calf. These animals are regarded as 'empties' when pregnancy testing is carried out, and are often culled at the end of the milking or rearing season, depending on your regime. If you are calving year round, or split calving, there is a chance she may get pregnant at the next round of mating. This, in turn can be a factor in breeding infertile animals if it is not monitored well.

Infertility seems to be a problem with herds both conventional and organic. There is no obvious reason why but there are many possibilities. The main reason is under feeding and the under nourishing of animals. Another is a history of focusing in on production, rather than longevity and fertility, resulting in a strong push to breed high producers, which are so busy producing milk; they have no reserves left to begin oestrus. Others are temperamental factors, early abortions, and 2 yr olds teething. Endocrine dysfunction is another cause and this includes silent heats, anoestrus,, cystic ovaries, frequent returns, uterine and genital infections, and persistent corpus luteum.

Artificial insemination is used widely, and it is reliant on the cows in the herd to produce the stimulation in preparation for mating.

Natural mating sees the bull insert a small amount of semen with high density of sperm into the vagina. One of the cow's responses to the smell of the bull is to bring on heat and the mating itself. The contractions from a stimulated cow through lots of foreplay, enables the hormones to be interacting fully, rhythmically helping the sperm to move towards the uterus and begin fertilisation.

Organic goat farmers generally use natural mating by either letting the buck run with the herd at mating time,



"Mark on your calendar in bold 60 days prior to the first day of mating. Make sure you never let your cows go hungry from that day until the end of your mating programme."

or closely observing the does for signs of oestrus and then letting them 'visit' the buck. In New Zealand goats respond naturally to the shorter days of autumn by starting to come into season around March. Unless successfully mated, oestrus will be approximately every 3 weeks until about June for most does, although some could be later. There appear to be few infertility problems with goats and a very low incidence of abortions. Gestation period for goats is the same as for sheep (between 145-154 days).

A hypothesis:

Sometimes one of the problems during Artificial Insemination (AI) that can occur is when a technician places a small amount of semen through a tube into the uterus. Because there has been no stimulus and foreplay from the bull, the hormones are not in full gear and have not switched on the mechanisms to assist with fertilisation. Therefore the uterine identifies this semen as a foreign body and pushes the semen away, rejecting it.

If injury by the technician occurs, blood is an effective spermicide, rough or insensitive handling by a technician can also lead to reverse peristalsis. Long-term use of AI may develop a sterile cow in terms of fertility, because of the suppression of behaviour patterns associated with mating. Through the lack of natural patterns, the cow is unable to or reluctant to come into heat, resulting in anoestrus.

This is more fully explained in *Biodynamic Perspectives – Farming and Gardening* (Henderson, 2001).

What is Oestrus?

It is when a cow comes 'in season'. It lasts approx 15 hours for cows and 10 hours for heifers.

There are 3 stages:

1. Coming into heat
 - a. Aggressive, restless
 - b. Disturbs other cows – 'I want your attention'
 - c. Or stands alone or away from other cows – 'I feel different'.
2. Approaching a standing heat
 - a. Holds milk, vulva swollen
 - b. Smooching up to other cows
 - c. Paws ground and frequent urination
3. Standing heat
 - a. Stands to be ridden – 'I want to play'
 - b. Front mounts other cows
 - c. Mucus near vulva
 - d. Hair rubbed off tail base
 - e. Raised tail and arched back

Ovulation occurs 14 hours after the end of oestrus.

The Five Stages of the Oestrus cycle:

- 1) Pro-oestrus – the Graafian follicle grows leading to follicular fluid
- 2) Oestrus – the period of excitement and desire, the ovary is matured.
- 3) Metoestrus – the day after, leads to the rupture of the follicle and explosion of ovum.
- 4) Dioestrus – the uterine walls thicken and the uterine glands are active. If pregnancy happens this continues. If not a new oestrus cycle begins.
- 5) Anoestrus – inactivity period. If the animal is healthy this lasts 21 days.

Good practices and things to know for efficient mating:

Cows

- Mark on your calendar in bold, 60 days prior to the first day of mating. Make sure you never let your cows go hungry from that day until the end of your mating programme.
- Keep good records of oestrus/heats and mating.
- The first heat usually occurs within 40 days of calving and then every 18 – 24 days.
- The animals must be in good condition – score 4.5 (well covered backbone) to 5 (well covered back and hip bones) and on a rising plane of nutrition.
- Fat cows and skinny cows usually fail to conceive.
- Check cows that have had difficult births. You may need to help them clean their uterus.
- Watch your 2nd calvers. They are usually the hardest to get in calf.
- Lessen stress: look at your herd size and make up. Maybe the group need to be smaller.
- Late oestrus is usually due to lower protein levels in the grass early spring because of the lack of nitrogen fixing by clover. Because of this it may be wise to allow mating to last 3 months.
- Put your non-cycling cows, especially your skinny ones on once a day. Get a vet in to diagnose the problem.
- Treat cows post calving that have had damage during calving or post calving infections.

Bulls

- Check bulls for testes and feet.
- Have 1 bull to every 25 heifers.
- It is a good idea to change the bull regularly, say every 2-3 days depending on how busy things are.
- With chin ball markers, check their marker every 2-3 days. Have a different colour for each bull.
- With teaser bulls, keep a close eye out for heat detection. Change the bulls every 4-5 days. Have 3-4 bulls for 100 cows.
- Tail painting and heat detectors are the most com-

mon methods used to check for cows ready for mating.

- If hand mating, give the bull 1-2 cows at a time to avoid wastage of semen. Restrict the bulls to 8-10 services a day.
- Fat bulls are not very fertile, as their sperm becomes infertile.
- Using virgin bulls on your herd helps eliminate most of the risks that opponents of natural mating bring up.

Artificial insemination

- A 65% to 70% AI conception rate is considered acceptable.
- If there is little activity close to AI, put the bull in for a few days, just to remind the cows it's mating time again.

General

- Sunshine and warm weather has a big effect on oestrus. More cows come into season on those days. Oestrus lasts longer in sunshine days than in wintry days.
- If trying to mate when weather is not so kind, especially cloudy weather, try putting liquid seaweed in the trough or drenching them with it. This has iodine in it –essential for hormonal activity.
- High energy molasses in low sunshine periods increase energy levels of the diet and help. Pasture growing in extended low sunshine is lower in energy than when there is adequate sunshine.
- Another herbal help is cider vinegar.
- Mineral imbalances in the grass and the animals can be a factor of anoestrus. Selenium is most important. Checks on copper, iodine, and vitamin B12 (cobalt) help to identify overall health, which is important for this situation. Check with a blood test.

Homoeopathic Treatments for Anoestrus

A good general remedy is Sepia 200c. Unless recommended otherwise, give only once. Folliculinum given 1xday for 3 days is helpful.

Ask your homeopath for other treatments.

Calving

- Good management is important
- Aim to have fit and healthy cows
- Keep things as natural as possible
- Several herbal and homeopathic remedies are available
- Make up a calving kit of remedies

This should be straight forward if you have fit, healthy cows. At times, however, problems do crop up.

Strategies to make calving easier

- Choose a bull from easier calving lines. Look at him carefully – his shoulders, rump. Check his temperament.
- Give your cows a walk every 3 days to keep them fit.
- Dry off 8-12 weeks before calving depending on condition and grass availability. The udder goes through a period of involution, getting ready for calving. The cow needs a minimum of four weeks dry.
- Cows should be a score 5 one month before calving. It is important they have a layer of fat on the hips, ribs, backbone, tail base and rump.
- Skinny cows may need to be dried off earlier and given unlimited grazing, and fed hay or good silage until 3-4 weeks before calving to build up condition.
- In the final 3-4 weeks prior to calving there is an active development of the foetus and excess grazing will only result in a bigger calf for calving time.
- Break-feed rough mature grass and hay the last 3-4 weeks before calving. Block graze them so they do not over indulge. The shape of the break influences the amount of walking and therefore potential for mud/soil damage, especially in wet weather; i.e. a square is better than a thin long rectangle.
- There is much controversy over the best method of feeding the week before calving from all hay to lots of grass to develop the udder. The rule of thumb is usually to ensure the cow gets grazing on pasture. Feed pasture and hay the first few days after calving to avoid metabolic problems.
- Don't forget about milk fever and grass staggers prevention. Check these sections for information.

Tip: If you want cows calving during the day rather than at night, move them onto their fresh break in the afternoon rather than the early morning. This is an old practise, which is dying out but seems to work.

Drying off

Drying off should occur at least four weeks before the cow is due to calve again. The udder goes through a period of involution, cleansing, and preparing for calving again.

Below are some treatments. Feed management should ensure energy and water intake is maintained but protein is reduced. So replace some of the diet with hay and do not feed high quality crops, such as brassicas and young grass while drying off.

- Peppermint, ginger and asparagus help slow milk flow.
- A dose of Epsom salts - 28gm - every 2 days. Check you are allowed to use this under these circumstances.
- Homoeopathic Lac Canium 30c in trough after final milking.

- Check for any individual mastitis cases 1 and 2 weeks post drying off and treat accordingly.

Pre calving

- Cider vinegar in trough. Others – aloe, seaweed, seawater.
- Herbs to steep with cider vinegar or make as a tea:
 - i. Garlic, stinging nettle, chickweed (general health).
 - ii. Fennel, promotes milk flow and let down – use 1 week prior & 1 week post calving.
 - iii. The native shrub Pate helps with parturition.
 - iv. Red raspberry leaves (fresh or dried) promotes healthy uterus.
- 2 weeks prior to calving could give laxative once or twice to suspect cows: pulped carrots, bran mash, and ground oats, linseed meal.
- Homoeopathics
 - i. Toning uterus: Caullophyllum 30c in trough 6 weeks, 3 weeks and 1 week prior to calving and 1x post calving
 - ii. Easing delivery and preventing calving paralysis: Arnica 30c 1x a week in trough
 - iii. To help bring calving on: Caullophyllum 200c
 - iv. Heifers starting but not progressing: Gelsemium 30c

Threatened abortion

Give a concentration of vitamin C. rosehip juice, blackberry, black currant, strawberry, and hawthorn all contain Vitamin C.

During and post calving

Several procedures have been described in books. Mother nature usually allows a cow to calve with no problems and then lets her lick her young and then the calf will suckle her. All these processes are important to allow the glands, muscles and nerves to perform as they should, to allow a natural state.

Ask your homeopath for homeopathic remedies during and post calving

Paralysis

- Keep her constantly warm.
- Give her fresh food and water each day and lift her up. Change the sides she lays on each day.
- Fast the animals, giving only water or water, milk, molasses the day after calving to allow the body to put everything right.
- Watch for uterine infections as the cows can't empty their bladders properly.
- 250gm Epsom Salts 1-2x a week as a drench to action the bowels (check Epsom salts are permitted with your certifying agency).
- Plus 112gm ground gentian root, 112gm saltpetre, 112gm nux vomica (helps the body remove toxins).

Mix, give 1 tablespoon in slop 2x a day.

- Rub loins and hips 2x a day with heat salve.
- A drench with cayenne pepper will get the organs moving again.
- Ask your homeopath for homeopathic remedies for paralysis and pain relief

You will still need to do what you normally do to a cow in this state, as these remedies are only an aid to that process.

Bladder problems

Herbs and grasses that are helpful – raw carrots, parsnips, yarrow, charcoal, shepherd's purse, linseed tea, cleavers, raw peas, parsley, comfrey, seaweed, cherry stalks and twigs, heather, fennel, chicory, couch grass.

Dead foetus not expelled

These often go rotten inside the animal. Douching twice daily with clean water, teatree oil, along with echinacea by mouth and belladonna homoeopathically. Cider Vinegar and rosemary is another remedy.

Retained membranes

It is important to allow the calf to suckle and be licked by her mother to stimulate the nerves of the cow's uterus and allow removal of the membranes. If a heifer is reluctant to lick, put molasses on the calf.

- 2.5 litres beer, 500gm brown sugar (or molasses), 56gm nutmeg, cider vinegar. Drench the animal with this as needed.
- 3:1 of raspberry leaves and feverfew in 1 litre of water and mix with 500gm molasses.
- 2 litres tansy tea, 500gm Epsom salts, 56gm ground ginger, 1/2 litre own cows milk. Two days later give linseed oil to remedy the effects of the Epsom salts.
- Cider vinegar with tansy or rosemary or thyme leaves. These herbs could also be used as a straight tea and drenched.
- Thyme or rosemary leaves made into a tea and drenched.
- Check the herb section for other possible remedies.
- Homeopathic remedies: ask your homeopath.

Metritis (infection of the uterus)

It can be a cause of infertility and even death through blood poisoning. It begins with healthy but whitish pus discharging from the vagina. Leads on to loss of appetite, high temperature, brown or yellow pus if not dealt with.

- Give a laxative 500gm Epsom salts and repeat half doses in two days if the effects of the first dose are not quite marked (check with your certifying agency re Epsom salts).
- Mild cases, a douche of antiseptic solution (teatree oil) into the uterus.
- Homeopathic remedies: ask your homeopath.
- If nothing works, do not linger. Use antibiotics and deal with certification issues.
- Side effects of this illness can be things such as pneumonia, peritonitis, enteritis, meningitis, nephri-

tis. They have to be dealt with in their own way if they occur.

- These animals will need lots of building up to get them cycling again. Cider vinegar, molasses, nasturtium and stinging nettle etc.

A hypothesis on calving problems

(de Bairacli Levy, 1991)

There are three theories on these:

The cow's emotional condition during the whole reproduction process. This also indicates lack of fitness.

The low vitality of the cow means the nerves and uterus are not toned - another indicator of fitness.

Sometimes through AI there is an incomplete fertilisation process.

Kidding

- Most does kid easily without any assistance or problems, but always be aware which ones are due to kid and observe their behaviour and progress. An indication that a doe is about to start kidding is when she starts 'talking' to the unborn kid. In their natural state does would find a place to quietly hide from the herd and give birth. If possible, ensure that the doe can find a quiet spot in the paddock or shed. The others will naturally leave her alone. A doe usually has 2 kids, although 3 and 4 are not uncommon.
- If the doe does not progress quickly check for the following:
- 2 kids coming at once – one will need to be manually pushed back
- Abnormal presentation, e.g. breech, 1 leg backwards – the kid may need turning slightly or a gentle pull
- Extra large kid for small 1st kidder- homeopathic Arnica for pain may help

- As goats are a manageable size and usually people friendly, firstly try assisting the doe yourself, before calling the vet. However, do not wait too long or let the animal suffer.
- Always be very careful about strict hygiene practices if you have to intervene.

Udder problems

Cracks

- Clean teats
- Apply ointments or udder grease to keep moist

Chaffing

- Vaseline
- Udder cream
- Slow parts to heal use zinc oxide in an ointment

Sore teats

- Mix hypericum and marigold (50/50) with honey and use for all sore and cut teats
- Calendula cream or oil

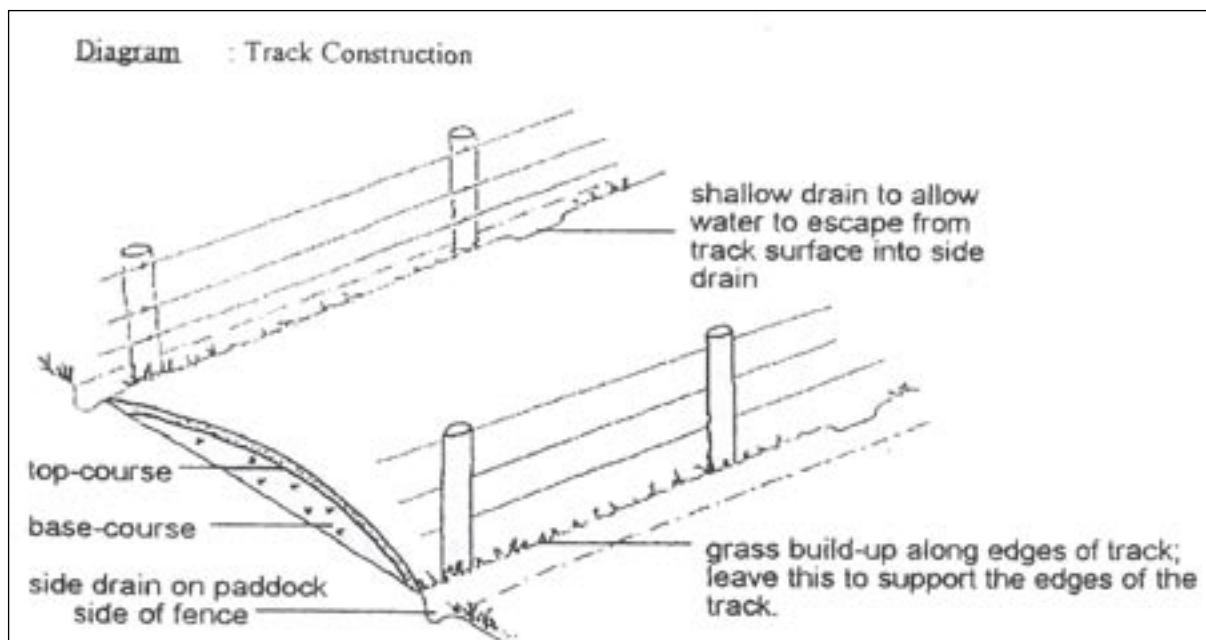
Homeopathic remedies

- Consult your homeopath

Cow pox

This infectious disease spreads by contact during milking. Usually oval shaped lesions occur on udder and teats. Allow the animals to develop and immunity if there's outbreak.

- Dose with garlic and cider vinegar.
- Elder and watercress is good fodder.
- Bathe with a brew of elder and dock leaves (2 handfuls of each), cut finely and steeped in 1 litre of water. This will also cure large open ulcers.



Alternative to above brew is flaked garlic root.

- Maybe teatree oil could be used.
- Responds well to active manuka honey.
- Homeopathic remedies: consult your homeopath.

Lameness

- Most lameness is caused by traumatic injury to the foot followed by bacterial infection
- Most lameness can be prevented by careful handling of cows on races and yards along with a good standard of maintenance of races, especially close to the shed
- Early treatment of lame cows is critical to ensuring a good outcome

Common types of lameness

White Line Disease - Occurs when a cow is shoved sideways by other cows or is forced to turn sharply on a hard surface. The resulting shear force across the hoof splits the white line allowing mud and small stones to pack in. The wedge of mud works its way behind the hoof wall setting up an infection which may subsequently break out at the heel or the coronet. Usually seen on the outside hind toes of cows and the inside front toes of heifers.

Bruising - Especially common in heifers if their soles are worn thin from walking long distances or standing on concrete for extended periods. Also occurs in mature cows if they are forced to walk through mudholes containing stones or if they track stones onto concrete yards.

Sole penetrations - Something sharp (usually a stone) has pushed all the way through the sole into the soft tissue underneath. Seen especially in animals with thin soles.

Footrot - A break in the skin between the toes allows bacteria to get in and set up an infection. A fissure develops and the infection may spread up the back of the leg. Usually associated with wet conditions (which soften the skin) and the presence of mud with stones.

Toe abscess - This is White Line Disease right at the point of the toe. Often the initial crack is tiny and hard to see. A small but very painful abscess develops in the soft tissue under the crack – a gentle squeeze with a pair of pliers will produce a strong reaction from the cow.

Axial Groove - This is the groove that angles up the inside of the hoof. A stone trapped in this area can cause a weakness and subsequent cracking as the hoof grows. A pocket of pus may develop under the crack.

Proud Flesh - A blob of tissue growing out of a hole in the hoof preventing healing – due to pinching of the soft tissue by the edges of the hoof around the hole. Most likely to occur on the inside hoof wall, between the toes.

Prevention

A cow is more likely to go lame if: she is a heifer or an older cow, she has white feet, she has been underfed (and/or is mineral deficient) during winter or she is exposed to wet conditions. A farm is more likely to have a lameness

problem if the tracks are narrow, in poor condition and cow flow is interrupted by congestion points.

BUT, the critical factors involve how people and cows interact.

Cows walking will maintain enough distance from each other to enable them to move with their heads down. This allows them to watch where they are placing their feet and avoid stones or obstacles. The speed of a herd of cows on a race is determined by the dominant cows which are usually spread from the front to the middle of the mob. If those cows slow or stop, so will the entire herd. At that point, pushing the mob from the rear will merely result in a concertina effect on the cows at the back, forcing them to lift their heads. Foot damage is then much more likely.

The yard entrance is often the most important congestion point but the same effect may also occur once in the yard if it is too small or especially if cows are pushed with the backing gate. If cows are not flowing through the shed easily in the spring, there is a reason. Such reasons may include: not enough room in the yard for cows to rearrange themselves into their preferred milking order, poor design of bail entrance, impatient milkers, plant defects, low magnesium levels, stray voltage. Recommended yard size: 1.3m per 2 Jerseys to 1.5m per 2 Friesians.

So: preventing lameness means NO HEADS UP, anywhere, anytime.

Treating lameness

October tends to have the highest incidence of lameness. No matter how careful you are, bulling cows and wet conditions usually result in a few cases.

White Line Disease - The most important action is to remove all under-run hoof. Fitting a cow slip to the normal toe takes the weight off the sore one and speeds healing. Many vet clinics run courses on lameness, including how to pare a hoof. These are highly recommended.

Bruising - Rest is the only treatment – close to the shed, milk OAD. Arnica may help in the early stages. If only one toe is involved, a cow slip may speed healing. Most recover quite quickly, but as the bruise grows out, that area of hoof may be weak and subsequently crack open – always lift the foot and have a quick look, every couple of days and again a couple of weeks later.

Sole penetration - The area must be pared back and drainage established. Ensure mud can't pack into the hole by fitting a cow slip.

Footrot - Check there are no stones jammed in the fissure and flush mud out with a hose. This must be tackled early. If the infection starts spreading up the back of the leg (can happen very quickly), treatment will need to be somewhat extended. Options: see below.

Toe abscess - Nip the front point of the hoof off with hoof cutters (about 5mm) and have a look. The crack may now be obvious. Cut a notch with the cutters or a hoof knife to release the pus. Fill the hole with copper ointment.

Axial Groove - Follow any cracks with a hoof knife. If a crack goes all the way through the hoof, there will be infection underneath. Be careful to smooth off hoof edges and minimise bleeding in this area – it's very prone to developing proud flesh.

Proud Flesh - Slice off the blob of tissue (it has no nerve cells so the cow won't feel it, the tissue underneath will be quite tender though), smooth off the edges of the hole to prevent pinching and apply copper sulphate daily for a few days. Sometimes the area can be sprayed without having to lift the foot. Bad cases may need a bandage, in which case a Shoof copper sachet placed against the exposed soft tissue is useful.

Soft tissue infections - options

All of the above can result in infection of the soft tissue under the hoof, or in the case of footrot, between the toes.

Copper and zinc sulphate are both antibacterial and serve to harden up tissue. Where the infection is superficial they will speed healing. If the infection is deeper, drainage is essential. In these cases copper will help prevent proud flesh formation (which tends to block drainage) but at the same time overuse of copper may seal the infection in. Applying (Australian) tea tree oil, aloe vera or iodine first, followed by copper sulphate as ointment or a 1 in 10 solution as a spray should control infection without impeding drainage.

For a nasty footrot, saturate the area with tea tree oil or aloe vera, cover with a layer of saturated medical swabs (or something non-stick, not cotton wool) and bandage. If the fissure is deep a small syringe may be needed to get the medication right in. The bandage will need to be changed daily. For more superficial footrot, copper sulphate ointment or as a 1 in 10 solution (without bandaging if the weather is dry) or plantain bandaged on, can be used.

Homeopathics are commonly used (Hepar Sulph is popular) or contact your homeopath for advice.

Other treatments

- Clean between the toes with cider vinegar, then put active manuka honey up between the toes, along with fresh plantain leaves and hold it in place with insulation tape. Change it daily for 3 days (more if needed) as well as treat with Homeopathic Pyrogenum. The infection usually stops getting worse straight away, but swelling can take up to 10 days to go down.
- Mixing Stockholm tar and copper sulphate to pack a wound (check these remedies with your certifying agency first).
- Comfrey poultices, plantain poultices, warm linseed meal poultices, epsom salt poultices work well on severe cases.
- Nosodes for footrot are available if it is a constant problem. Talk to your homeopath.
- Couch grass and dandelion are high in silica which strengthens the feet.

If there is no recovery, and the animal is in pain and is suffering, you will need to call your vet and you may need to treat the animal with antibiotics.

Note on bandages: Unless changed daily, they tend to impede drainage and trap mud and moisture. They are really best used only on cases of footrot or intractable proud

flesh. Sometimes a poultice incorporating dock or plantain with manuka honey is used to assist drainage – once again, it needs daily changing. Elastoplast or Vetwrap are great durable materials but expensive and unnecessary if being changed daily. A cheaper option is a thin gauze bandage (such as in the Shoof refill kits) overlaid with duct tape.

Note on cow slips: They must only ever be fitted to a normal toe. If you're not sure there is a problem in a toe, squeeze it with (preferably) hoof testers or pliers. Check the front of the hoof, then the middle and then across its width. There are cheaper alternatives to cow slips – they tend not to stay on as long, but if a short period is all that's needed, they work fine.

Footbaths and footmats

These tend to be of limited use but may help in some situations. Zinc sulphate is best – it's cheaper than copper and doesn't remove galvanising from pipework. 1 part zinc sulphate to 9 parts water; add about a third more zinc if it's the heptahydrate form. It can be used to help harden up hooves or to limit a footrot outbreak. An outbreak situation is uncommon but should it happen, it is essential for the zinc solution to fully contact the skin between the toes. If using footmats, this means topping them up every 100 cows or so.

Races

Building a race is like building a road – it needs a solid base, properly compacted (preferably with a vibrating compacter), and a crown to shed water. This is particularly important close to the shed since it gets the heaviest traffic. So long as water can move off the race, build up of dung (and *Streptococcus*) is minimised. If water is allowed to pool, it will eventually seep down and undermine the base. A mudhole rapidly gets worse as cows tend to stop while considering how best to negotiate it – they then add their dung to the mess. The slope on the crown is a compromise between shedding water and still giving the cows a comfortable surface. 6 – 8 degrees is probably ideal. Drains should be on the other side of the fence. Grass growing up under fencelines helps stabilise the side

of the race but will impede drainage – the answer is to clear a channel through the grass every 10 or 20 metres to make sure the water can get away. Bridges need to be wider than the race and have sides that form a visual barrier (e.g. plywood). Material used as a top course will vary with locality. Crushed lime rock is a very good capping material, especially near the yard - it does a great job of trapping stones so they won't get walked onto the concrete. It must be rolled and properly shaped though; otherwise it can scour out with the first downpour, and is probably not suitable for more than gentle slopes.

Recommended race width: Up to 250 cows – 5.5 m. Add another 0.5 m per 100 cows.

Footrot and scald in sheep and goats

From: Best practice to control footrot and scald in sheep (www.footrotinsheep.org)

The bacteria (*Dichelobacter nodosus*) that cause footrot live on the feet of infected sheep and goats, which may or may not be lame. Under optimal conditions it is estimated that *D.nodosus* can survive for a maximum of 7 –10 days on pasture and for up to 6 weeks in hoof horn clippings. The organism survives best in a warm (>10 °C), damp environment. Infected sheep and goats are therefore the main source of infection to other sheep or goats, although transmission of the bacteria from one sheep or goat to another will always occur via the surface that they are standing or walking on.

The usual route of infection is via the skin between the claws (interdigital skin). The first stage of the disease involves another bacterium, *Fusobacterium necrophorum*, which invades the surface layers of the interdigital skin following damage by moisture (damp conditions underfoot) or frost and/or mechanical damage from long grass, thistles, etc. *F.necrophorum* live in the gut and hence the faeces of sheep and goats and are in the environment of every farm. Faecal contamination of feet helps the colonisation of *F.necrophorum* on the surface layers of the interdigital skin. If the footrot bacterium *D.nodosus*, is not present the superficial lesions and slight inflammation heal rapidly and causes little or no lameness.

If *D.nodosus* is present then it can super-infect feet with scald in a very short period of time. This causes a deeper, more destructive invasion of the skin that will still look like scald. However, during the next stage of the disease *D.nodosus* eats away at the tissue between the horn and the flesh and separates the hoof horn. This under-running of the horn presents as footrot.

Whether or not scald cases (infection of the skin between the claws) progress to become footrot cases (under-running of the hoof horn) depends on

- Whether *D.nodosus* is on the farm
- The virulence and dose of the *D.nodosus*
- The susceptibility of the sheep or goat
- Whether the sheep or goat is treated promptly before separation of the hoof horn occurs

The first signs of footrot or scald are limping, holding limbs above the ground, grazing on knees and reluctance to walk.

Treatments for scald are generally by using zinc or copper sulphate footbaths. Footrot is caused by anaerobic bacteria and treatment is based on the introduction of oxygen to its environment by keeping the hoofs trimmed and clean. After trimming, soak the animal's hoofs in a footbath of zinc or copper sulphate. Be careful when buying stock and always quarantine upon arrival (Susan Schoenian, 2010).

An effective treatment for scald in goats is to soak a small pad in a calendula oil and tea tree oil blend and place it between the claws. Apply a bandage held in place with insulation tape and then a plastic wrap, again held with tape. Leave for two days, then remove. Also give a homeopathic footrot nosode. In most instances the scald is better after one treatment.

To make the oil blend soak calendula petals in olive oil for about 2 weeks, then drain off the oil. To each 100 ml. of oil

add 1 teaspoon of tea tree oil.

For more on diagnosis, treatment and preventions of footrot and scald in goats and sheep go to www.aces.edu/pubs/docs/U/UNP-0087.

Black leg (entero-toxaemia)

Blackleg is one of the clostridial diseases of farm animals. Pulp kidney, red water and other clostridial diseases. Clostridia are found in the soil and in animals. Blackleg will grow rapidly when offered the right conditions. Bruising and wounds are often related to outbreaks of clostridial diseases. Blackleg often affects the most rapidly growing animals which have been grazing high protein, low fibre, moist pasture. The kidneys are unable to handle the clostridial toxins and death often follows quickly.

- If it is an on going problem, apply to get permission to vaccinate for it.
- Some vaccines are GE and combination vaccines (5 in 1 etc). Check with your vet before vaccinating what you are using and ensure the vaccine has not been genetically engineered. Ask for a certificate stating this.
- Watch the grass you are putting the animals on. If necessary, keep giving them some fibre, such as hay.
- Keep animals in a healthy and fit condition.
- Homeopathic remedies will help but will not cure. Ask your homeopath.

Salt poisoning

Salt can be poisonous in large doses.

Avoid uncontrolled access to agricultural salt. Some cows develop a real liking for it and poison themselves.

Give the animal warm water and linseed tea – as much as possible.

Give the heart a stimulus – strong coffee, brandy.

Homeopathic are available.

Pinkeye (conjunctivitis)

Pinkeye is an eye infection (*Moraxella bovis*). Predisposing factors include dust, bright sun, flies, and environmental irritations (thistles, ragwort, rye grass seeds). *Mycoplasmas* may also be involved. It occurs in summer and autumn. It can be hereditary and it is contagious.

The four stages are:

1. tears streaming
2. blinking frequently
3. the eye showing signs of infection
4. opaque cornea indicating possible permanent damage

Treatments

Eye washes:

Boracic acid.

2-1/2 % solution of zinc sulphate in water. (28gm zinc sulphate dissolved in 1 litre water)

Eyebright tincture in water.

An old remedy for pinkeye is to put a few drops of cod liver oil directly into the affected eye twice a day until clear of infection.

Homeopathic Euphrasia is also helpful

Homeopathic remedies: ask your homeopath

Woody tongue

Woody tongue can be caused by either a bacterial infection (Actinobacillosis), or by a fungal infection (Actinomycosis), of the soft tissues around the tongue and mouth. If serious enough it can infect lymph glands. Most infections start with cuts or scratches in the mouth or on the tongue. The tongue becomes hard and swollen, making it hard to eat. The animal dribbles just like after you have had an injection for dental treatment.

Prevent access to material that might cause mouth lacerations (boxthorn, barberry) and avoid damaging animal mouths while drenching. Isolate any infected animals and treat any clinical cases.

Treatments

For the whole herd, increase your seaweed intake for iodine.

For individuals:

- 1st give an internal cleansing using 250gm Epsom salts as a drench.
- 2nd drench with 500gm powdered seaweed (or liquid seaweed) in molasses and garlic.
- 3rd massage the hardened area with 1 pt vinegar and 3 pts seaweed and 1 dessertspoon paprika.

Note: Check with your certifying agency if Epsom salts is permitted.

- Drench 250ml cider vinegar with 4 tablespoon seaweed granules a few times a day.
- Homeopathic remedies: ask your homeopath

Wounds

- Clean using cold water, salt and a disinfectant healing herb (e.g tea tree oil).
- Rub some of the herb leaves and cider vinegar into the wound (see Herbal section).
- For inflammation, rub with cider vinegar and plantain

- Old wounds, use aloe vera juice.
- Dose internally with garlic to strengthen healing process.
- Check the Herb section.
- Infected, honey and plantain poultice along with Homeopathic Pyrogenum 30c.
- Active manuka honey is remarkably good on many infections
- Hepa Sulphur and Silica are both important remedies in healing, especially in infections. Ask your homeopath what to use and when.

Leptospirosis

There are three types of leptospirosis that can infect cows. All of them can infect humans resulting in a debilitating illness, which may last for months. In some people it periodically recurs. NZ is rather unique among dairy farming countries in that there is a high risk of leptospirosis infections in unvaccinated animals and the people that work with them.

The organism is highly infectious. Although it is killed by sunlight and desiccation, it can travel quite some distance in water, certainly from one farm to the next.

Hardjo is the 'normal' cow leptospirosis. Most non-vaccinated herds carry it and usually effects on cows are minor, although humans are at risk. If a vaccination program is halted, after a year or two hardjo often returns and abortions can result.

Pomona is the 'normal' pig leptospirosis and effects on pigs are minor. However, if it spreads to unvaccinated cows, a serious abortion storm is likely. It also produces redwater in calves resulting in a lot of sick animals and some deaths. I try to discourage pigs on dairy farms. If you must have one, it should be vaccinated.

Copenhageni is spread by rats. It is uncommon on dairy farms. It's the one leptospirosis that can affect dogs (death rate is close to 100% in unvaccinated dogs) and it can kill people as well. Effects on cows are minor.

The standard leptospirosis vaccine protects against hardjo and pomona. If there is copenhageni in your district, it would be advisable to use the vaccine that includes this.

With the ACC ruling, you will probably need to vaccinate, especially if you have others in your shed from time to time. It is not worth the risk.

Check the vaccine that is being used is straight leptospirosis vaccine (there are combination ones) and that it is GE free. Get a certificate stating this. Remember after the shot it is too late! Check with your certifying agency for permission first.

There are nosodes available but are not recognised by vets.

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Chapter Six: The Environment

The environment you are trying to create on the farm is a woven tapestry with its individual identity and the many factors intermingling to create a unique, sustainable, living piece of work.

Some factors are external influences, such as the weather, the influence of the moon and the planets, regulations as laid out by the law makers, and previous inputs into the farm. Other factors that enable your farm to be unique, and may take some time to achieve, are planting of trees, diverse species in your pasture, crops, and a farm that enables ease of operation and minimum stress for the animals and the people who work there. This in turn, will create a diverse, balanced environment with bees, birds, healthy animals and happy humans. All materials on farm should be used and minimum external inputs should be the organic farmer's goal.

In this chapter we will briefly discuss the external effects ,influences of the weather, climate and the impact of climate change on farmers. We will also discuss the various ways trees can be used on farms, and the importance of clean water.

IFOAM Organic Principles and Recommendations (2005) for Environmental Management

General Principle - Organic farming benefits the quality of ecosystems.

Recommendations

Operators should maintain a significant portion of their farms to facilitate biodiversity and nature conservation. A farm should place appropriate areas under its management in wildlife refuge habitat. These include:

- a. Extensive grassland such as moorlands, reed land or dry land;
 - b. In general all areas which are not under rotation and are not heavily manured: extensive pastures, meadows, extensive grassland, extensive orchards, hedges, hedgerows, edges between agriculture and forest land, groups of trees and/or bushes, and forest and woodland;
 - c. Ecologically rich fallow land or arable land;
 - d. Ecologically diversified (extensive) field margins;
 - e. Waterways, pools, springs, ditches, floodplains, wetlands, swamps and other water rich areas which are not used for intensive agriculture or aquaculture production;
 - f. Areas with ruderal flora;
 - g. Wildlife corridors that provide linkages and connectivity to native habitat.
-

Climate and weather

Climate refers to the long-term average of rainfall, temperature, sunshine hours, wind and so on that we experience over time. Climate can refer to monthly, seasonal or annual averages.

For longer-term record keeping the World Meteorological Organisation use a standard 30-year climate period, which New Zealand conforms to. Weather is what we experience on a day-to-day basis, or even within a day – we’ve all heard the expression “four seasons in one day”.

The climate in New Zealand is inherently variable and is the result of our South Pacific location and our small, but mountainous land area.

The benefit of our geographical location and landform is a very moderate climate. Westerly winds dominate the climate, due to our location in the mid-latitudes of the southern hemisphere.

Climate change

This is a summary from: *The Dairy Exporter Great Farming Guide to Climate Change* (2010).

One thing that farmers are increasingly aware of is climate change, partly through the media but also through on-farm observation and record keeping. Our climate can change naturally over timescales ranging from decades to millennia. The relatively stable climate since the most recent the Ice Age, 10,000 years or so ago, has allowed human civilisation to flourish and agriculture to develop.

The onset of the Industrial Revolution, around 1750, has led to rapid economic and population growth, and widespread deforestation, which resulted in a significant increase in greenhouse gases (GHGs) such as carbon dioxide, methane and nitrous oxide. It’s these increases in GHGs concentrations that are considered to be the principal cause of the warming of the earth’s atmosphere over the last century. Over the past 100 years the average temperature on earth has increased by more than 0.5°C globally (up to 0.7°C in New Zealand) and the 1980s and 1990s were the warmest decades on record.

There is often confusion between climate change and climate variability. Climate variability can refer to the weather patterns and events that we experience. There are also fluctuations such as El Nino and La Nina events and a 20-30 year cycle called the Interdecadal Pacific Oscillation, which leads to patterns of higher or lower rainfall in New Zealand.

With climate change the changes that will be most obvious are not so much the averages but the increased climate variability and the frequency and intensity of extreme events, such as floods and droughts.

The climate of New Zealand is likely to become more subtropical in the north, wetter and windier in the west, drier in the east, with a milder, more temperate climate developing in cooler and southern regions of the country.

This will provide a combination of treats and opportunities to the New Zealand agricultural sector:

- Drought and water resources: droughts will increase

in frequency and severity in regions already drought-prone. This will not only increase pressure on water resources, but also heighten the risk of fires in rural areas, particularly in areas prone to strong north-westerly winds.

- Intensification and increased frequency of rainfall events causing flooding, storm surges and erosion.
- Farm infrastructure, such as land drainage, flood protection, culverts and bridges, water schemes, farm dams, erosion control, water reticulation and irrigation, all will be affected by high intensity rainfall events.
- Insect, plant pests and biosecurity: Higher temperatures can cause an increase in the number of pest plants in the north and encourage a southward spread of some species.
- Temperate pasture responses will vary throughout New Zealand. The warmer and wetter conditions could lead to a yield increase.
- Subtropical grasses such as kikuyu and paspalum are already widespread in the North Island and will become more so. This will have a greater negative impact on dairy producers than sheep and beef producers.
- Animal health effects could include increased heat stress on dairy cattle in the hotter, drier areas. Warmer, wetter areas could see an increase of internal parasites, while most of the North Island and the warmer parts of the South Island will see increased incidences of diseases such as facial eczema. On the other hand, stock will benefit from warmer winters with less stress and better reproduction rates.
- Crops: in general better conditions for maize production in the North Island. Wetter conditions in some areas could increase diseases, while in drier regions crop production could be constrained by the availability of water.

There are two main responses to climate change:

- Mitigation or reducing or offsetting the emissions of GHGs
- Adaptation or actions to deal with the effects of climate change

Pragmatic farmers tend to respond by making their businesses more resilient and sustainable.

There are pros and cons for the organic farmer in dealing with the vagaries of climate. On the positive side, with increased soil organic matter, and increased plant and animal diversity, the organic farm develops a greater ability to buffer against climatic extremes over time. Through increased diversification coupled with good management and planning, including applying the age-old wisdom of using times of abundance to set store for times of shortage, the organic farm has the potential to be developed as a very resilient farming system. However, on the negative side the organic farmer has fewer options for dealing with shortages than the conventional farmer, who is able to change grazing patterns, bring in feed or graze animals off the farm, or use strategic applications of fertilisers for short-term shortages.

Moon and Planets

The moon and the planets have a big influence on the earth and touches all living beings, e.g. the tide going in and out, more rain near the new moon, days when the air feels damp despite full sun, vice versa. Planets move across and are present in our sky on a regular basis. They affect nature and influence our plants.

The moon has the biggest influence, however. It is a fascinating topic and can become a life long passion when you start observing and finding patterns and effects.

Trees

Before humans arrived on Aotearoa most of the land was cloaked in forest, although large areas in the dry east were regularly burned by natural fire (Grant, 1997). In the south, the forests were mainly dominated by species of southern beech (*Nothofagus* spp.) which are adapted to high rainfall and low temperature conditions. In the north there was a predominance of podocarp (totara, rimu, matai, miro, and kahikatea) and broadleaf species, and further north, on the poorer soils of higher rainfall areas, the kauri was king.

Our forests, like forests all over the world had, and still have, vital ecosystem functions to perform. Two very important functions of relevance to the farmer are the regulation of air and water flows. When you walk into a forested environment from exposed farmland one of the first things that you notice is shelter from wind. An important influence of forests is the moderation of windspeed within the forest canopy and on the lee side of the forest. Forests also moderate the amount of water reaching the ground from rain, dissipating its force, and by water uptake hold much of it in their trunks, branches and leaves as well as in the soil around their roots, which is why water run-off from forests is far less than from land cleared of trees. This water is released slowly, and the shade from the branches keeps the air under the canopy cool, reducing evaporation, and so more water is retained in the soils around trees during dry periods.

Our forests also have a role to play in building and conserving our soils, in retaining minerals and other nutrients in the soil, as well as in storing them in their own tissues. Trees are major carbon stores, which is a vital function with current concern about global warming (see the earlier section on climate change).

Another vital function of forests is to provide homes and food for a myriad of other forms of life, and thus they contribute significantly to biodiversity. Trees are structurally very diverse, and so provide lots of nooks and crannies, and feeding opportunities for other creatures and plants to take advantage of. Thus we find that each individual tree in a forest tends to be a little mini-ecosystem all of its own, rather like a high-rise building in a city. When trees are present we also tend to get beneficial insects and birds, which help maintain a balance by providing the predators for potential pest species. On the negative side, in New Zealand, trees also provide a home for major pests such as possums, which have to be constantly managed.

Trees on farms

On the farm you'll be looking at the multiple benefits that trees provide as part of your whole farm environment picture. Here are some things to consider when looking at planting trees (use this as a starting point to make your own list of the pros and cons of where you might want to plant trees and for what purpose):

1. Look at your farm landscape to identify areas suitable for trees:
 - Erosion prone areas
 - Bush remnants
 - Areas where scrub persists (e.g. gorse, manuka)
 - Exposed sites where shelter and shade would be beneficial
 - Areas of low productivity
2. Think about what you can afford
 - How much land are you willing to convert to trees (some NZ farm foresters have up to 20% of their farms in trees with no loss in production and the added benefit of potential income from harvestable trees)
 - Consider the costs involved, which include fencing costs, cost of trees, the cost of your time to plant and manage the trees
 - What are the likely returns on your investment? – to identify the likely returns you need to consider the tree species you intend planting and the benefits they will provide. Note: Many of the benefits of trees may not be immediately apparent. The best thing to do is to spend some time talking with experienced farm foresters, and visiting their farms.

Use the information from your checklist to make up a long-term programme. Here are some things to think about in setting your goals and developing a long-term programme:

- Maintaining your existing bush and planting trees are important considerations when thinking about sustainability and organics.
- Identify what you want to plant trees for (see the checklist below) – keep in mind that trees can support all parts of your farming system eg. fodder, compost, firewood, they stop erosion and pollution, provide shelter and shade, and biodiversity.
- Plan your tree cover for maximum animal and human comfort.
- Protect your trees as they are growing. They are expensive, and will become a valuable asset long-term

Keep things simple to start with so that you get a good sense of what you can cope with. Begin planting and persist with your goals. Once you start seeing the trees grow and the benefits they provide your enthusiasm is likely to grow. You will find that tree growers learn along the way, and adopt and adapt to new technology to their own advantage. It is probably a good idea to join the local Farm Forestry Association branch. There is a wealth of information amongst their membership, which can help you greatly in avoiding the mistakes of others.

Checklist to assist in identify the trees that you want on your farm

	What do I want to plant trees for?
	Shade – important with increased skin cancers on farm animals
	Shelter - to reduce wind velocity and therefore heat and moisture loss
	Tree cropping – orchard or nut trees
	Fodder trees – for browsing by livestock or pollarding during a drought
	Firewood – coppicing
	Aesthetics and well-being
	Protection of waterways and riparian zones – protection of water quality from excess sediment and animal waste
	To off set carbon emissions (ETS or similar schemes)
	Agro-forestry or forestry
	Erosion and run-off control
	Providing a habitat for native birds and other pest predators and food for birds, bees and other pollinators
	Provide corridors to encourage wildlife diversity
	Protection from spray drift

How to plant?

When planting in a farm situation, techniques need to be relatively simple and cost effective, but they do also need to be able to withstand considerable rigours, eg. browsing. Try to envisage the conditions in which they can thrive, and recreate those as best you can. Trees need shelter, they generally need a reasonable depth of soil, they need adequate water, and they need to be protected from being eaten.

The other thing to bear in mind longer term is adequate space for the roots to grow (the roots spread as far underground as the canopy does above) and the height and width the branches are going to spread to.

Warning when planting near power lines:

The Horticultural Regulations of 1986 are quite specific:

Trees should be planted far enough away from the lines so the lines are outside the falling distance of the trees. This includes a mature tree. Remember, trees do grow and wind does blow!

Anyone needing to work within 4 metres of a power line (trimmers, forestry workers etc) need a permit from the local Power Line Company.

Another future consideration will be anyone felling trees near power lines will need a unit standard in Forestry Advanced Felling Trees or the like.

If a tree or branch lands on the line, you are liable for costs incurred.

Site preparation

If your site has impeded drainage or compaction problems and machines can access the site, it pays to have it ripped first, then plant at the intersection of the two cuts.

If planting into a grass sward this will need to be removed or checked in some way, either over the entire site or around each tree.

The tree will also need to be mulched or treated to reduce competition from weed growth once planted.

Keep stock out. It is usually wise to fence before planting rather than leaving it until afterwards and leaving the trees exposed to possible attack.

Put up any wind-cloth or other shelter that you intend to use for the site.

General planting tips

- Tree roots should never be permitted to dry out.
- Plant at the appropriate time of the year when the ground is moist. The ideal time to plant evergreens is in the autumn and bare rooted deciduous trees should be planted in the winter.
- Frost tender trees need to be planted after the danger of frost is over. They should be protected from frost for at least the first two to three years.
- Ensure they are protected against stock.
- Remove the pasture.
- Plant the tree carefully - can dip or spray the roots with the Bach remedy called Rescue Remedy and/or seaweed.
- Water/fertilise if necessary.
- Put down open wads of newspaper for mulch/weed control - four sections - overlapping slightly with the tree in the centre where the corners of the four sections meet. Plain un-coloured cardboard boxes may be opened out and used as an alternative. Moisten the paper/cardboard – always use a wet mulch. Do not use magazines (toxins). An alternative is weed mat.
- Put tyres down - one or two if there are problems with rabbits and hares (will hold the paper down) - this will provide up to 6 months protection from pasture invasion.
- Apply rabbit deterrent paste (see later section).
- Put up tree guards - electric fence or posts and rails, or wire frame, plastic shield etc.
- If necessary, protect it from the wind using wind breaks and stakes.
- If using stakes, attach them low so the stem can still flex, otherwise there is a risk of atrophy of the stem, leading to later problems.
- The root to stem ratio of 1:2 is the ideal nursery presentation for high chances of survival and rapid establishment.

Trees for shelter

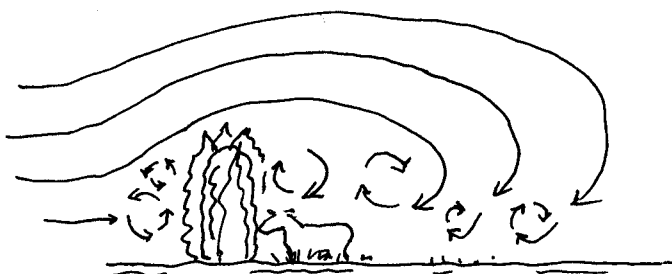
Taranaki, Manawatu and Canterbury are traditionally the windiest areas of the country, although anywhere near the coast can also be tough. This article is written with cold wet winds in mind, although the principles can also be applied to hot dry conditions as experienced in the South Island.

The value of a good shelterbelt for the protection of animals from wintery winds has long been recognised. What has not been generally realised are the likely positive effects on pasture growth. Unfortunately, many farmers have been slow to appreciate the benefits and most existing shelter is inadequate. Hedges typically cut wind speed for only 2 – 3 metres into the paddock.

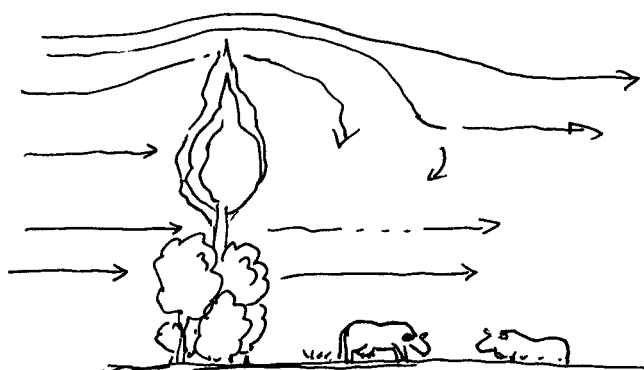
Cows bunching together and walking along hedgerows create a mudbath. Over-mature trees that have not been looked after are wet underneath, shade races and cause fertility transfer due to animals camping under them. In high winds they represent an injury risk to animals, a damage risk to fences and, in the case of macrocarpa, an abortion risk to in-calf cows.

Characteristics of a good shelter belt

The idea is not to form a solid barrier to the wind as this creates turbulence and down-draughts on the lee side - the belts must be permeable. Properly planted and maintained shelter growing to a height of say, 15 metres, should cut wind speeds to tolerable levels (where cows will not actively seek shelter in all but gale force winds) for at least 4 times the height of the shelter – in this case 60 metres into the paddock.



Above: Airflow over an impermeable object (a hedge).



Above: Airflow through a permeable shelter belt. Wind is slowed, turbulence occurs well above ground level.

Benefits for animals

On higher altitude farms wind-chill factors of -10° to -15° are not uncommon in exposed areas. The effect on animal health and production is well known by those who regularly experience it. What may not be appreciated by those at lower altitudes is the less dramatic but still very significant stress placed on animals by adverse conditions, especially the combination of cold and wet.

Benefits for pasture

Less pugging due to:

- fewer cows walking and gathering in one spot
- better stabilisation of soil moisture (trees suck moisture out of the soil when it's wet and slow winds down when it's dry)
- warmer soil temperatures in spring

A preliminary study carried out in South Taranaki a few years ago suggested improved pasture growth rates in the middle of sheltered paddocks more than compensated for reduced growth on the south (shaded) side of well designed shelter belts.

Design

A well-designed belt consists of tall trees pruned to 6-8 metres, growing to 15 – 20 metres in height at 4 to 6 metre spacings. Around the base is an understorey of smaller trees and shrubs. The tall trees may eventually be felled for a timber crop so a variation may be to plant a second lot of seedlings half way through the rotation between the more mature ones and set back $1\frac{1}{2}$ metres. This allows periodic harvesting without all the shelter suddenly disappearing.

Consider planting in a T shape to allow shelter for 2 paddocks and from different wind quarters. This way you do not have to plant a shelterbelt the whole length of the paddock.

Natives vs exotics

Unfortunately, most tall native trees do not handle wind very well until mature. The exceptions in some places may be kahikatea or totara, but totara needs an awful lot of work and kahikatea does not like it dry. Neither withstand salt particularly well. In a natural forest young native trees grow with all light excluded from the sides, a difficult situation to replicate in a shelterbelt. If they are planted in the open, they straggle and develop multiple leaders which may cause the tree to eventually split down the middle. Tall natives are much more suited to a woodlot – that scrubby hillside or gorse-filled gully is perfect – just plant them in light wells and watch them go.

Smaller natives, however, are the best for understorey planting. Check out what grows easily in your area but mahoe (whiteywood), karamu, five finger, makomako (wineberry), tarata (lemonwood) and other pittosporums do well just about anywhere. They grow fast, self-seed, attract birds and act as wildlife corridors. Mahoe in particular makes a good emergency cattle feed and purportedly accumulates selenium. You can fill gaps with flaxes and toetoe (not pampas) if it declared a noxious weed in your area. The cows will keep it trimmed but if it all starts to straggle over the fences out of reach of the cows, it can be controlled using

standard hedge cutting equipment. Stay away from karaka, ngaio, rangiora and possibly kowhai unless you can be sure that they or their fruits cannot be reached by the cows.

The classic tall shelter tree is radiata and it does a very good job in a wide range of environments. It's relatively easy to maintain, has a short rotation (around 28 years) and there's a large established market for a timber crop

However, if you really can't stand the thought of planting them on your property, consider some alternatives:

- Norfolk Pines will flourish despite the most salt-laden of winds and may be the tree of choice in coastal areas. The timber is very good (although subject to insect attack) and there is a small market for it. Pohutukawa makes a good understorey where there's a lot of salt.
- Cypruses (lusitanica, lawsoniana, torulosa) all produce a top quality, easy milling insect-resistant timber with an established market. Rotation length is around 35 years. Pruning can be hard work. Canker-prone varieties, such as C macrocarpa or avosomana, should be avoided. Canker disease kills or deforms most trees in most of New Zealand today.

American conifers

All American conifers produce a toxin in their leaves called isocupressic acid which can cause abortion in cattle during the last 3 months of pregnancy.

On average, macrocarpa leaves tend to contain higher levels than other species, but there is a lot of variation between different varieties and even individual trees. It should be relatively easy to breed an 'abortion-free' cypress sp. but as yet, no one has done it. The risk should be put in perspective. Considering the number of grossly over-mature macrocarpa still growing on dairy farms around the country, the number of attributable abortions is quite small.

You can reduce the risk further by pruning on time and taking care the cows cannot reach the prunings.

- **Poplar.** Fast growing. Excellent for soil stabilisation and for bringing deep minerals to the surface. You need to plant one of the possum-resistant varieties. Deciduous, so it casts less of a shadow in winter but also a less effective wind-break. Once mature, poplars can be prone to wind throw. There is a small but not particularly consistent market for the timber. Difficult to mill.
- **Eucalypts.** There are so many varieties adapted to different environments, there is one for your farm. 30 – 35 year rotation. Require careful pruning. Prone to wind throw in areas with a high water table. May be prone to new diseases suddenly introduced from Australia. Excellent timber varieties are available but milling requires expertise. There is an established and growing market in high value grades. Timber is generally insect resistant, some varieties are ground-hardy. Eucalyptus are great, but not for the faint hearted, as great disasters must be expected from time to time.

- **Cedrus deodara.** The ultimate shelter tree for windy and dry conditions. It does not like salt wind, however.

Some other species to use:

Natives:

Cabbage Tree
Flax
Kanuka
Karaka
Karamu (Coprosma)
Koromiko (Hebe)
Manuka
Pittosporum spp.
Pohutukawa
Puka
Totara
Erislima littoralis
Akeake
Oleria

Non-natives:

Banksia integrifolia
Casuarina spp (warm climates)
Leyland Cypress
Norfolk Island Hibiscus
Southern Mahogany
Tagasaste
Callistemon spp
Feijoa
Acacia spp

Seedling selection

When planting timber trees in a belt, you don't have the luxury of thinning to the extent you do in a woodlot so good seedling selection is critical. If aged cuttings are available in the species you want to plant then that's the way to go. Cuttings have a better survival rate and grow much more evenly.

Maintenance

Protection of seedlings from pests (hares, possums) may be necessary. Releasing and pruning the timber crop trees are tasks that must absolutely be done on time if you want to gain maximum value from the trees both in terms of timber and shelter. If you've got extensive plantings and minimal time, consider employing a contractor, especially for the higher pruning lifts.

Not only birds will love your shelterbelts – possums and stoats will move in too. Control is particularly important if you are in a TB endemic area.

It will occasionally be necessary to trim overgrowth away from electric fences, although the cows will mostly do it for you if the bottom wire is high enough.

This is a brief summary of things to consider when planting shelter. For more detailed information and to find out what works best in your area, contact your local branch of the NZ Farm Forestry Association.

Protecting and enhancing existing bush

The first thing to consider is whether there are any areas of native bush or manuka/kanuka scrub existing on the property, in gullies, or on steep slopes, that could be retired without any significant loss of grazing. Very often, the amount of grazing achieved from these areas is negligible, especially if it is compared to the overall and long-term economic benefits to the health of the farm, as already described above.

A small reduction in stocking density may be required in the short term, but it is likely to be more than compensated for by the overall improvement in stock health and performance, as well as a reduction in other costs on the farm.

One of the most significant losses when considering retiring land to forest regeneration can be loss of sheltered winter holding areas, especially on exposed beef and sheep farms. This can be taken into consideration by retaining part of the bush area for this use and retiring the rest, until such time as alternative shelter can be provided.

Excluding stock from existing areas of bush or scrub is the cheapest, easiest, and fastest way to re-establish and maintain tree-cover.

Although it may seem that the presence of the stock isn't affecting the existing tree-cover, what it is doing is preventing any tree seedlings from getting established, so that once those trees die, the forest dies. It also reduces the forest biodiversity significantly by the action of grazing the understorey tree, shrub and herb species.

In areas of teatree, the manuka and kanuka have already done all the hard work for you of colonizing the bare ground, and they are the natural precursor trees for our native bush.

To minimize the cost of fencing look for areas that can be cut off easily by just a short connecting fence, triangular shapes are often the most cost-effective, cutting off corners of scrubby or marginal land or existing bush. Just do a little bit each year.

Trees for shade

- Many trees that grow high with a large canopy can be planted individually for shade.
- Deciduous trees are ideal, as they give the shade when you need it and allow the sun when it is needed in winter.
- They can be planted in the form of shelter belts or as individual trees.
- Check your sites out before planting. Stand in the area and see what direction your shadow leans and work out where they are best planted so the animals get the shade at the right time of the day.
- Planting deciduous trees on the western sides of races with spaces for the wind to get through, provides some comfort for the milker and cows on the way to the shed.
- Putting trees next to a fence between paddocks enables shade in two paddocks. It also does not interfere with topping and cropping.

- If near a fence, use 2 waratahs to make a square out from the fence. Then attach wires so the animals can only lean under to graze the grass around the tree, but cannot reach the tree itself. This keeps the weeds down as well.
- Tree protectors are another option.
- Clearing the trunk of branches allows shade to move in an arc during the day, away from the base.

Protection from spray drift

- If spray drift is going to be a problem choose quick growing trees with thick foliage, growing successfully in your area.
- Try and incorporate this into your initial plans for planting.
- A thick canopy of trees will stop, or at least slow down, any accidental spray drift.
- Plant trees around the perimeter of your boundary. Then look at planting so the wind continues to move upwards.
- You may need to consider lower growing plants such as flax etc to keep it blocked.
- Always keep good communications with your neighbours.

Trees for erosion control

This is a vast topic. The aims generally are to retire areas with poor grazing ability, eg steep slopes or unstable land. The Farm Forestry Association has a variety of skills and knowledge in this area, as well as all the topics covered in the tree section of the manual. They have branches and keen members all over the country.

Most regional councils in New Zealand have erosion control programmes and are a useful source of information and support. Many have schemes to help with the cost of establishing trees for erosion control and for protection of waterways (see below).

Trees for protection of waterways

Trees, along with shrubs, grasses and herbs, should be planted along waterways and the riparian strip, in conjunction with fencing off to keep stock and effluent and runoff out of waterways. This is all part of farmers' responsibilities to protect and improve the environment and provide access for maintenance. Check your regional council for information.

We will discuss this topic more fully under the Wetlands section.

Tree planting around ponds, dams, and effluent ponds

Trees and shrubs around ponds, dams, and effluent ponds improve appearance, pond performance, reduce the smell for neighbours, reduce water pollution, and attract wildlife.

Ideally any pond not used for animals to drink directly from should be fenced off and this will maintain clean water with minimum pollutants. Allowing animals to drink from dams is often the only way to provide water for animals. However, it can create problems of its own with their dung in the water and cross contamination of worms and other parasites. It is best to have an alternative, if at all possible.

By planting around these ponds it will enhance things greatly. There are some things to be aware of, however:

- Do not plant tall species on the northern side to assist sunlight penetration.
- Allow spacing to enable some wind flow over the pond for oxygenation.
- Avoid trees that have roots that grow sideways to reach for water, e.g. willow.
- Grass the banks with grasses such as phalaris, rye, clover, timothy to hold the banks.
- Plant trees and shrubs only between the bottom of the bank and the fence.
- Do not plant species that like water and may invade the actual pond, e.g. reeds, flaxes. These belong in wetland areas instead.
- Leave access room for future cleaning of ponds and dams.
- If animals are going to graze the banks for grass control, make sure there is a fence at the edge of the pond and before the tree plantings.
- Choose plants for what you wish to achieve. Plants with berries and flowers will attract the birds, shrubs and low bushes will also attract insects, birds and ducks. High trees will provide shade and shelter. Some could be fodder for the animals.
- Plant in clumps of either mixed species or groups of similar species to create special environments.
- Plant the hardy, vigorous ones first and then the more delicate, special ones when the former can provide protection.
- Keep the area free of weeds and pests. Possums and rabbits are territorial. A coloured trip wire 15cm above the ground and 15 cm out from the fenceline on outriggers will deter them.
- Blackberry, gorse and ragwort could be a problem. Get on top of it before the problem becomes bigger. Keep the plantings weed free, especially when they are trying to establish.
- Do not plant deciduous trees in a position where the leaves will fall into the pond, as this will pollute the water.

Effluent pond planting plan

This section is on planting around effluent ponds. There are some principles here that can also be applied to dams and water ponds.

The aims of the plantings:

Wind:

For the aerobic pond: To keep the surface clean and for oxidation.

For the anaerobic pond: To protect it from strong winds.

Sunlight:

For the aerobic pond: To provide heat and promote oxygen-producing algae.

How is this achieved using trees and shrubs?

- Provide wind protection for the anaerobic pond.
- Do not plant tall species on the northern side to assist sunlight penetration.
- Do not plant deciduous trees where the leaves will fall into the aerobic pond.
- Plant trees and shrubs between the bank base and the fence. Grass the banks.

Stabilise them with a vigorous sward of phalaris, rye, timothy, and clover.

Sheep can be used to control this, but be sure to fence the pond and the tree plantings off.

- Do not plant water tolerant plants, such as reeds, flaxes, willows. They will spread to the dam and wreck the banks.
- Leave room for maintenance, probably the north facing where there should be no tall plantings.
- Other suggestions can be found in the previous list for ponds and dams.
- Duck weed could be introduced to take up excess N and P.

Suggested species

These are only a suggestion. There will be many more.

Area A (on map)

Aim: Northern side, no plant higher than the tops of the banks; could provide nectar and berries

Suggestions: Coastal flax (*Phormium cookianum*), Coprosma sp. - low shrubs up to 2m, Crimson bottle brush (*Calistemon citrinus splendens* var), Grey's groundsel (*Senecio greyii*), Hebes (*Hebe* spp), Native broom

Area B (on map)

Aim: Partial sunscreen up to 5m

Suggestions: Crab apple (*Malus gorgeous*), Chatham akeake (*Oleria traversii*), Tagasate (*Chamaecytisus palmerisii*), Karamu (*Coprosma robusta*), Tupelo (*Nyssa sylvatica*), Golden totara (*Podocarpus totara aureus*)

Ground cover suggestions: Toetoe and pampas grass (*Cortaderia* Sp.) (Check pampas is not a noxious weed in your area), NZ lowland flax (*Phormium tenax*)

Area C (on map)

Aim: Semi-permeable windscreen of narrow trees for the SW to slow the wind for the aerobic pond.

Shelter suggestions: Cabbage Trees (*Cordyline australis* sp.), Swamp she-oak (*Casurina glauca*), Deodar cedar (*Cedrus deodara*)

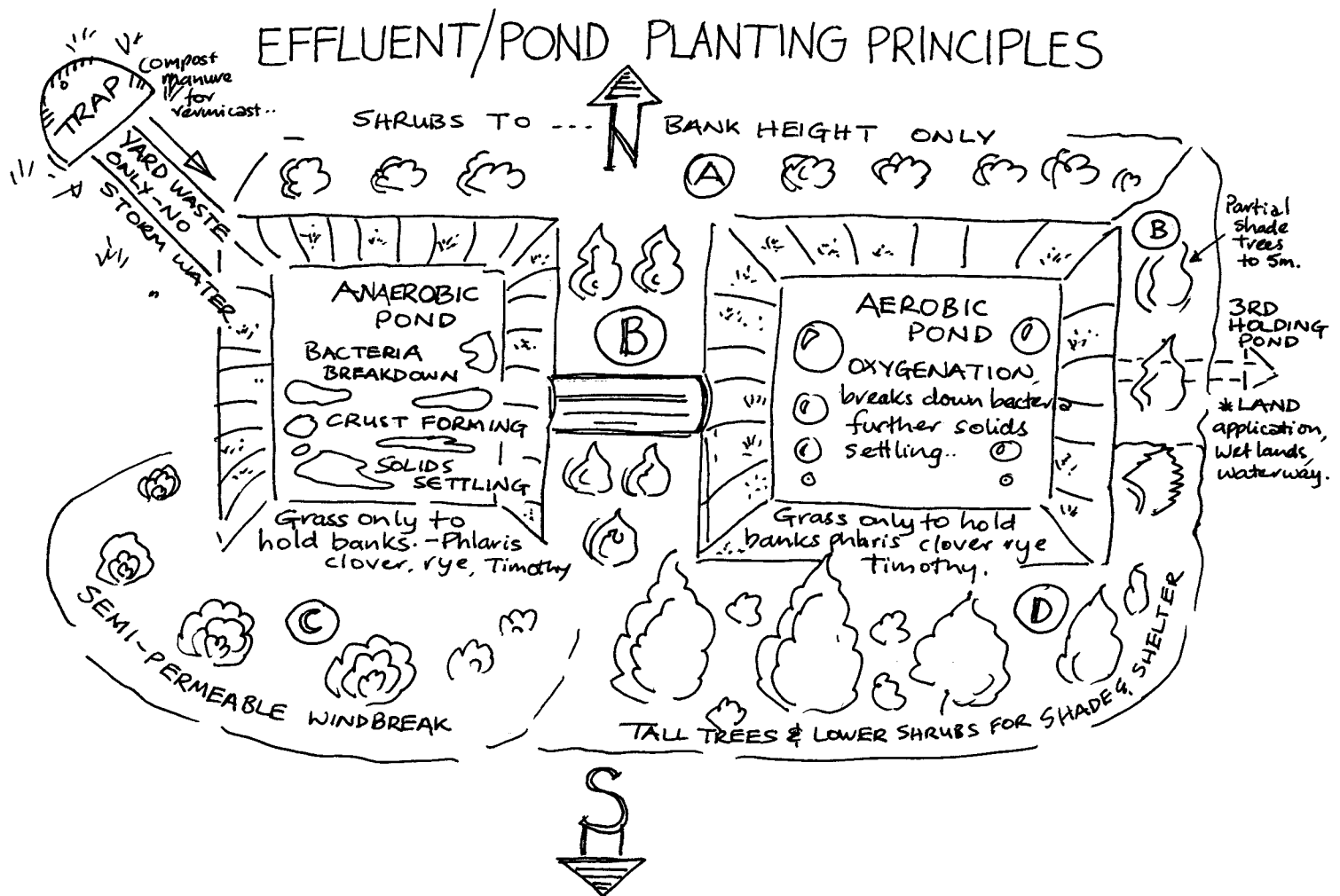
Nectar suggestions: Kanuka (*Kunzea ericoides*), Kowhai (*Sophora tetraptera* & *S microphylla*)

Area D (on map)

Aim: Taller species on the SE and SW area of the anaerobic pond. No planting limitations, taller trees, dense lower area with shrubs, you can use your imagination here.

Shade, shelter and nesting suggestions: Liquidambar, Miro (*Podocarpus ferrugineus*), Lacebarks (*Hoheria* sp.), Norfolk Island honeysuckle (*Banksia intergrifolia*), Pin oak (*Quercus palustris*), Pohutukawa (*Metrosideros excelsa*), Puriri (*Vitex lucens*), Karaka (*Corynocarpus laevigatus*).

There are many more plant options and there are many organisations that are willing to give you help and advice on plantings, especially if it is going to be of benefit to the environment.



Fodder trees

Fodder trees are defined as those that provide part of the tree, which is palatable to stock - and this can be foliage, seed, pods or fruit.

Alders (*Alnus*):

A nitrogen fixer, has been used quite extensively for hedging as it grows quickly. The roots are not invasive. The timber can be useful but many trees show bad 'fluting'. The Andean alder is showing promise as a variety for timber and is also a quick growing tree.

Ash (*Fraxinus*):

A deep rooting shade tree with palatable foliage. Great timber - strong tree.

Many different types, so choose carefully.

Black locust (*Robinia pseudoacacia*):

This tree fixes nitrogen and has a light canopy and so can have quite a bit of grass under it!

Tough hard timber which is very durable. Excellent tree for nectar and pollen for bees but flowers (white or pink) for only a short period in early summer. Has two problems - thorns and sometimes can sucker and make a nuisance of itself but stock find these as palatable as clover. The young tree is susceptible to hare and rabbit damage. Use rabbit repellent and/or rubber tires placed one upon the other.

Sweet chestnut (*Castanea sativa*):

This is a wide spreading tree that is tough and takes the wind well. The timber is ground durable but care is needed if used in the furniture or building trades. The nuts are highly nutritious. It is an excellent shade tree. This tree can coppiced and be used for poles and posts. Grows fast compared to oak. Very susceptible to bark damage by animals.

Fruit trees, plum, pear and apple:

These are fruit trees rather than fodder but these trees can still be used as shade trees and food for livestock. It is not uncommon to see cattle waiting under a pear tree laden with ripe pears waiting for the next one to drop. It is best to get these fruit trees grown on more vigorous root stock rather than the traditional semi-dwarfing root stock. Timber from these trees makes excellent firewood but has a traditional use for furniture and ornamental objects.

Honey locust (*Gleditsia tricanthos* - American, or *Gleditsia japonica* - Japanese):

Gives good shade. Fixes nitrogen. A smallish rounded tree that is quite attractive.

Large pods are very nutritious to stock and keenly sort after by them but there are reports (from Gisborne) that by the time these fall on the ground they are not as digestible as stock prefer. These are available in autumn and winter. Can be slow to establish and is not a great timber tree. It breaks in strong winds. Get good healthy seedlings. Select species that don't have the needles! This tree grows well in some parts of the North Island but it did not adapt to

the climate further south. Needs 700 plus mm rainfall area and warmth.

Has potential as bee fodder (honey).

Paulownia (*Paulownia*):

Avoid planting in soils with a high water table. Likes free draining soil. Deep rooting.

Extremely wind tender. Leaves palatable to sheep but cattle seem indifferent to them. Leaves contain a lot of nitrogen so will aid the soil if not eaten by livestock. These trees can grow extremely fast - 5m in the first year. A good bee tree and the white eye love the seed in winter.

Poplars (*Populus*):

A very common tree to plant - especially in the lower north island. These trees can be coppiced or pollarded (i.e. chopped down to feed stock during droughts and they will grow again from the stump). The foliage is very palatable for stock. Some species of poplar are high in minerals such as zinc (*Populus yunnanensis*) and so can be useful in the facial eczema period in the North Island. One disadvantage to these trees is that they tend to be shallow rooted so can rob the surrounding pasture

Plane (*Platanus*):

This is a well known and popular tree in New Zealand. It grows quickly and with age develops into an imposing and impressive, wide spreading tree. Its timber is heavy and solid but not used as much as it should be as these trees are too attractive to cut down. The leaves are large and are slow to breakdown so you do not want these trees close to houses with gutters and drains. The bark in mature plane trees is not palatable to stock - even goats. Horses are an exception. The leaves are high in zinc.

Tree lucerne or tagasaste (*Chamae Cytisus palmensis*) - a nitrogen fixer:

This tree suits the drier east coast areas. Is suitable for dry windy areas. Doesn't like shade. It tolerates a wide pH range in soil. It is not suitable for wet areas - it doesn't like persistent wet feet - better planted on ridges and faces. It doesn't like the freezer either - especially when young so don't select frost prone gullies. Mature trees are a little hardier when it comes to frosts but the flowers will be frosted at -10 Celsius.

It is a good windbreak tree and has bee forage. It produces white flowers over a long period with a peak in spring. This tree supplies an invaluable source of nectar for apiaries in winter and early spring when other sources are scarce. This tree also produces abundant pollen for both honey and bumble bees alike. As one of the few rural sources of winter nectar and pollen, bee populations can be kept higher than normal through winter and spring with a supply of a natural food source instead of a very poor (refined white sugar) substitute supplied by bee-keepers, and could be of considerable benefit for boosting cross-pollination of spring-flowering crops such as apples, pears or blueberries. The native wood pigeon is attracted to this tree especially when this tree is flowering, as are the bellbirds, tuis and silvereyes. They also love the foliage all year round.

This tree makes good firewood although it is difficult to

split or cut up. It burns with great intensity and leftover branches from stock feeding make great kindling when dry too. However, in its green growing state this tree is difficult to burn so should be considered as a suitable tree for firebreaks or to be used as inter-plantings amongst other more valuable timber trees.

Planting tagasaste amongst timber seedlings can mean increased soil fertility (nitrogen effect), an alternative source of firewood as it will grow faster than other trees and can also cause the timber trees to grow straight and tall. This tree is also palatable to possums and hares, which may draw these animals away from the more valuable timber crops. If you need to protect these trees from rabbits and hares you can achieve this by putting 2 old tyres - one on top of the other - around the seedling.

Tagasaste grows rapidly - up to 2 metres per year - and yet it's maximum height is 4- 8 metres. Using this tree offers a quick solution for stock shelter and shade. Tagasaste leaves have a similar nutritive value to silage but lower than that of intensively managed pasture and the leaves are extremely palatable to cattle. It is excellent for providing emergency feed supply for stock in periods of drought. Tagasaste is high in dry matter content and digestibility if you compare it to hay, willow or poplar foliage. The protein content is comparable to grass. Periodically 'hedging' rows of trees and cutting re-growth for fodder can provide a planned forage supplement.

Tagasaste can out grow or suppress gorse, broom and manuka. It is an ideal tree for those drier, difficult to get to places, which are not very fertile. It is a real magnet for the native wood pigeon. From the crops of these birds come other native seeds, which get deposited in dung around the tree so that a seedling nursery is established! An understory of natives!

This tree is very sensitive to herbicides so spray drift from neighbours may be an issue.

Tagasaste leaves are excellent in the dry or green form for birds - hens, emus and ostrich.

Planting

If sowing seed then get fresh seed and plant immediately in a free draining seed mix in a warm sunny location, but not too hot initially. Do not over water at any stage. Plant out in autumn or winter.

Spacing

Space at 2-metre intervals in small groups, as in most cases, the area to be planted is too big for the number of trees available. Clumps provide ample shade and shelter and suppress light-demanding weeds.

Other trees for fodder

Elms (very palatable to stock), lime, hornbeam, Liriodendron and cherry are other options but not a lot is known about these in New Zealand.

The non-invasive willows are beneficial for its medicinal value and browsing. This is due to the aspirin contained in the bark and green leaves (relief from Facial Eczema symptoms) and feed value of green leaves when pollarded during dry periods and drought for stock to browse. The

matsudana willow is excellent for shade, shelter and stock food. It is highly palatable and produces large quantities of food. The pollarded trees also rapidly regrow for the next harvest.

Stock and native plants

Some farmers may hesitate to plant natives in areas that stock might access because they are unsure if any are poisonous to stock. Fortunately, very few New Zealand native species are poisonous to stock. Of the approximately 2,000 native plant species in New Zealand, only around five could be considered dangerous to stock (Connor, H.E., 1977).

Tutu

(Coriaria species which include *C. angustissima*, *C. arborea*, *C. kingiana*, *C. plumosa*, *C. pteridoides*, *C. sarmentosa*, *C. pottsiana*, *C. lurida*)

Poisonous to cattle and sheep and a prominent killer in the early days of settlement where some farmers reported losses of 25-75%. Horses and pigs not affected. Modern estimate of cattle losses to tutu in the South Island high country are 5-10%.

Ngaio (*Myoporum laetum*)

Small tree up to 10m found throughout New Zealand in coastal and lowland forest. Ngaio deaths are most common in cattle (In 1945, 73 cattle died on Banks Peninsula), though pig deaths have also been reported, and on one occasion a horse was thought to have been poisoned by this plant. Ngaio leaves are the most poisonous part of this plant with livestock being most at risk after storms when branches and leaves are blown to the ground.

Bracken fern (*Pteridium aquilinum*)

Poisoning of cattle is frequent in New Zealand and occasionally sheep deaths have also been reported. However bracken must be taken in large amounts over a few weeks to cause death.

Strathmore weed (*Pimelea prostrata*)

Found in grassland and shrubland throughout New Zealand. In the past many horses have died from this plant, but today poisoning of cattle is most common, and ten have reportedly died from this plant (sheep are unaffected).

Tree nettle (*Urtica ferox*)

Can kill both horses, dogs (and humans) that blunder into a patch. May cause ill health, probably not death.

St John's Wort (*Hypericum japonicum* & *H. gramineum*)

These species have been suspected of causing photosensitivity mainly to sheep on the South Islands high country sheep farms, and also to a small number of cattle and horses throughout the country. Signs of the disease include mummification of the skin, loss of wool down the midline of the pelt, with scabbing and rawness from animals rubbing the affected areas.

Kowhai (*Sophora species*)

Possibly poisonous but not known for sure.

Rock Fern (*Cheilanthes sieberi*)

Coastal to montane fern found throughout New Zealand. Has been reported to have caused livestock deaths in Australia; however, no reports of this have been made in New Zealand.

Pigeonwood (*Hedycarya arborea*)

Abundant in bush and around bush edges from North Cape to Banks Peninsula and to Milford Sound in the west. Though not thought to be poisonous, loss in health of both sheep and cows can result if large enough quantities are consumed.

Pukatea (*Laurelia novae-zelandiae*)

Tree up to 35m, abundant in swamp forest through out the North Island and found in localised patches in the South Island. Can be lethal to frogs and rats but has never been reported to affect livestock.

Centella (*Centella uniflora*)

One report of killing a sheep but otherwise not known to be a problem.

Karaka (*Corynocarpus laevigatus*)

Probably not poisonous, but may possibly affect livestock.

Poroporo (*Solanum laciniatum* & *S. aviculare*)

Probably not poisonous, at worst may make livestock unwell.

Trees and shrubs for honey

For those who want to encourage bees to your farm, or to harvest honey from hives, then some consideration to the quantities and quality of bee forage in relation to site conditions is needed. Also, the time of the year the nectar is secreted is important, as you will need to have major sources of nectar available in sequence and you must avoid undue competition with pollination of pasture, legumes and fruit trees as you will still want these parts of your farm pollinated!

Fruit trees, vegetables, and many useful plants rely on honeybees or bumble bees to pollinate flowers. Pasture, legumes and weeds provide the bulk of nectar and pollen for bees from early summer (November) to early autumn (March).

It is a sad fact that the widespread use of herbicides has removed most of the herbs from dairy pastures and also a lot of the gorse and ragwort has diminished which used to nourish the bees. A huge amount of bee fodder has been removed nation-wide. Large scale planting of bee forage trees to compensate for this loss of food did not occur during this period of 'weed' removal so there is a huge amount of sugar fed to bees to keep the hives alive over the period of nectar shortfall. This substitute is a poor quality food (just a simple sugar - not even raw sugar - it is usually a processed

white sugar) compared to that provided by nature and so the bees are not getting the required minerals needed for their health nor for their immune systems. It would appear now that bees are very susceptible to infections, such as the varroa mite.

It is a fact that bees will work in flowers whose nectar has a Brix reading of 7 or higher (see later section on Brix). If the reading is below 7 the bee expends more energy than it can possibly recover from the nectar. So it is so important to grow good quality trees, legumes and pasture with flowers available for bee fodder for most of the year so that there is the best quality nectar available to keep the bees well fed.

What are the choices of trees for bees?

Evergreens

Kowhai (*Sophora microphylla*)

Moderately cold hardy, good spring bee forage, yellow flowers are out for 3 weeks, is an ornamental. Bees have been reported to get 'drunk' on kowhai nectar.

Tagasaste - (see above)

Tree medick (*medicago arborea*)

Cold hardy, survives the dry, animal forage, bee forage, long period of flowers

Wattles

Ornamental, bee forage for spring.

Choices: Silver wattle (*Acacia dealbata*)

Green wattle (*Acacia decurrens*)

Australian Blackwood (*Acacia melanoxylon*)

These are all bee forage plus windbreak trees with blackwood a timber tree. They are not so good in cold dry areas.

Deciduous

Black locust (See above)

Honey locust (See above)

Siberian pea tree (*Caragana arborescens*)

Windbreak, high honey yields, yellow flowers mid-spring.

Traditional non-legumes

Australian Honeysuckle (*Banksia integrifolia*)

Flowers out of season, likes hot, dry climates, all are windbreaks, used for soil conservation, are ornamentals

Gums (*Eucalyptus spp.*)

650 plus different species, for all types of sites. Flowering at all times of the year.

Mexican hawthorn (*Crataegus pubescens*)

Needs deep, moist well-drained soils. Needs rainfall of at least 760 mm. Needs cool winters - tree is frost hardy. Can fruit to one quarter of a tonne per tree at 15 years of age. Fruit is rich in vitamin A and C. Can grow to 12 metres. A potential source of food for animals.

Oaks (*Quercus* spp.)

No nectar for bees but a little honey dew. There are 450 species, 19 produce sweet acorns edible to man and animals. Beware, acorns and in the spring, oak buds can cause stock poisoning (a tannic acid causes damage to kidneys) - prevent cattle gaining access to spring buds - allow leaves to mature first. Too many acorns can be toxic too.

Oak trees are a real asset, as they are beautiful and give great shelter, but please put a decent fence around them to prevent stock poisoning at certain times of the year. Acorns are reported to be half the nutritive value of maize.

Poplars (*Populus*)

Willows (*Salix*)

Egyptian willow - (*S. medemei*)

(good for bee pollen July and August)

Native non-legumes for bees

- Cabbage trees (*Cordyline australis*)
- Flax (nectar - bellbirds/tuis, fodder)
- Hebes (*Hebe* spp.)-butterflies
- Lacebarks (*Hoherea*)
- Manuka (*Leptospermum ericoides*)
- Pohutukawa (*Metrosideros excelsa*)
- Rata (*Metrosideros robusta*)
- Rewarewa (*Knightia excelsa*)
- Manuka (*Leptospermum scoparium*)

Non-traditional exotic trees for bees

- Black tupelo (*Nyssa sylvatica*)
- Limes (*Tilia* spp.): Honey producer
- Northern catalpa (*Catalpa speciosa*): All are ornamental bee forage, none of these will survive in dry areas
- Ornamental maples: Spring source of nectar
- Sugar maple: Timber and maple sugar
- Sycamores (*Acer pseudoplatanus*): Spring source of nectar

All of the below are attractive to bees:

- Apple blossom (*Weigelia florida*, *Escallonia* spp*)
- Bee bee trees (*Evodia* spp.)
- Buddleia Himalayan (*Duddleia salviifolia* and *B. colvelei*), South African (*Abelia floribunda*)
- Flowering barberry (*Berberis* spp.)
- Flowering currant (*Ribes sanguineum*)

- Hawthorns (*Crataegus* spp.)
- Heaths (*Erica* spp.)
- Irish strawberry tree (*Arbutus unedo*)
- Ornamental fuchsias (*Fuchsia* spp.)
- Ulmo and Tasmanian leatherwood (*Eucryphia* spp.)
- Tulip tree (*Liriodendron tulipifera*)
- Rosemary grevillia (*Grevillia rosemanifolia*)
- Russian olive (*Elaeagnus angustifolia*)

Trees for firewood

Now that all the pine, gum and macrocarpa trees that were planted by the first settlers are starting to die and disappear from the landscape, we need to be thinking about the next generation of firewood trees. Also, we shouldn't be continuing to raid our tea tree scrub for firewood as these areas are the nurseries for our native trees and forests of the future. On our farms, we need to start planting out special areas for our firewood crops and these can be our hedgerows and shelterbelts as well as larger woodlots. The shift in our thinking here needs to be away from a one-off crop which is planted, matures, gets cut down and another one planted, like an arable crop; towards a more sustainable way of managing our firewood trees by continual cropping, like our pastures. To do this we need to adopt a technique that humans have been using for millennia to sustainably crop trees without killing them, but which we have forgotten only in the last 50 years or so. It is a technique called coppicing.

What is coppicing?

Coppicing is the term for the rotationally felling of trees and shrubs, allowing the root bole or stool to regrow from the base. Depending on the tree species, rainfall, fertility of the site, and what the cut wood is being used for, the tree can be re-cut on a rotation of 1 to 20 years or more. Annual cutting is for species like willow for basket making or poplar for fuel biomass, cutting of species like hazel every 5 years or so produces pliable branches for weaving into wicker fences, and cutting bigger species like ash, oak and chestnut every 5-10 years produces ideal sized round-wood for firewood. Not all species of tree coppice. Most of our native trees don't, but some of the broadleaved species do. The best coppicing species, and those which yield the best dense wood for burning are the northern temperate deciduous species, which grow fast and well in most situations in New Zealand, except for very exposed locations.

It is surprising how much firewood can be grown on a relatively small area using this system, especially if shelterbelts are also regularly regenerated by this method, prolonging their function indefinitely. The leaf litter and brush from the felling continually restores the fertility of the soil, and this can be aided by planting some nitrogen-fixing species in the coppice mix, like Robinia and Alder, so that fertility never needs to be added in this self-sustaining system. A few larger trees can also be grown in the mix for retention as timber species, and at certain stages in the coppice cycle livestock like sheep or pigs can be allowed to forage through, again adding fertility, so the system is incredibly versatile and functional.

For those interested and who live near, there is a coppice

woodland at Lincoln University which was planted in 1985 by Bill Brandenburg in which he trialed various species for NZ conditions. See his article "Brandenburg's Concerto" in *Growing Today* September 1996 for a fuller account.

Trees to use for firewood coppice

Non-natives:

Alder species (*Alnus spp.*)

Ash (*Fraxinus excelsior*)

Beech (*Fagus sylvatica*)

Black Locust (*Robinia psuedo-acacia*)

Elm (*Ulmus spp.*)

Hornbeam (*Carpinus betulus*)

Horse Chestnut (*Aesculus hippocastanum*)

Oak (*Quercus spp.*)

Silver Birch (*Betula pendula*)

Sycamore (*Acer platanoides*)

Wattles (*Acacia spp.*)

Willow (*Salix spp.*)

Plane (*Platanus*)

Natives:

Lacebark (*Hoheria populnea*)

Red Beech (*Nothofagus fusca*)

Some species of Eucalypt will coppice, as will some conifers in the right conditions, but these trees do not have fertility enhancing leaf litter, rather they tend to deplete the soil, and so cannot be used in self-sustaining systems except in very small numbers in a mix with the broad-leaved species given above.

Water

- Good water is the key to happy, healthy, productive animals.
- Access to clean, cool water is essential
- Cows can drink up to 100 litres a day each
- Water is necessary for body function, milk production and avoiding heat stress.
- If necessary, treat water to remove surplus elements e.g. iron.
- Chlorinated water eliminates iodine from their bodies.

Water is often one of the least considered requirements on a farm. It is all too common on the traditional farm to have an inadequate supply of this vital solution available to every animal every day. With the lack of shade on most farms, during a hot summer's day the animal is a huge heat sink (especially more so when animals have a dark colouring). These animals have to rely on dissipating this heat energy at night and if the night temperatures are high and/or there is high humidity then the animal is not able to return to the normal temperature of 38.5°C by morning. It will then start the next day at an elevated temperature and ultimately suffers heat stress or hyperthermia. These animals are extremely stressed, will mouth breathe, with tongue protruding. Animals have died of this.

Water requirements for dairy cows

Milking cows need free access to clean, cool, water. It is a requirement by law to provide stock with water and in the case of our bovine species she should never have a day (even when dried off) that she doesn't have access to water. There are times when cows can drink up to 100 litres per cow per day. An indicator of good water is when the cows drink heartily rather than sip at the water.

In the ideal world this water should just be water. A cow likes to quench a thirst with plain water; not water with a whole lot of minerals or salts added to it (salts, chorine, fluoride, bloat products).

Water is closely linked with all of the body's internal reactions. It is necessary for the solution of all food materials and the waste products, plus their passage in and out of the tissues of the body. Its physical properties make it an important factor in the transfer of heat in the body and thus in the regulation of body temperature.

An indication of the importance of water in these functions is the fact that the volume of water passing in and out of the body stream every minute is larger than the volume of water normally maintained in the fluid portion of the body. When water is 'contaminated' with additives, it loses much of its ability to perform these functions.

Trough size, herd size, diameter of the alkathene pipes and water pressure dictate the ease with which a cow can partake in her quench for thirst. If trough size is small, water flow low, herd size large and a hot day you will have many thirsty stressed cows in the herd with the larger dominant cows controlling the trough from as far as 30 metres away.

The ideal for a dairy cattle using a circular trough is that each animal has a minimum of 600mm space, and enough troughs to allow them to drink a minimum of three times daily for five minutes each time. Lactating cows should not have to walk more than 100 metres to a trough each time to drink. It is also important that there are no electric wires anywhere near a trough. Heifers will be last in the pecking order. It is thought that half the herd should be able to drink at any one time.

If there are problems with adequate water supply on your farm this must be corrected as apart from being an animal welfare issue, the lack of water will be costing you dearly in lost production (milk volume less, higher somatic cell counts from stressed cows, poor condition score).

Having access to a water trough near the milking parlour or even in the milking parlour is another option as is having a trough half way along the farm race if there is more than 1.5 km walk from the back of the farm. Take care to avoid crowding or congestion in raceways or yards where a steady flow of animals is important.

An extra note about heat stress, make sure cows have access to a salt block on the race or in the paddock. Do not put salt in the drinking water.

Keeping your troughs clean is also important. This can be done several ways. There are covers available; you can pump them out regularly; or you could put goldfish in them, but make sure you don't use a species that could establish in a nearby stream, and don't let the trough run dry.

“Studies at Massey University confirm overseas research showing an increase in milk volume up to half a litre per cow per day, improved food conversion efficiency of around 8 per cent, and up to 23 per cent extra weight gain on beef and sheep, when animals are given ready access to good water” (from Bentley 2003)

Water requirements for sheep, beef and replacements

Water requirements for beef, sheep and dairy replacements are no different to that required for dairy cows. The ultimate is to provide good running water in troughs, and always have it available at all times. Sometimes, however, this is not possible. This may be due to physical barriers or the costs involved providing a system involving troughs. It still is important to have water available at all times.

Several options of water sources are underground water, communal water schemes, town water supplies, natural springs, artesian bores, drains, and streams and rivers.

All present their own individual advantages and challenges need to be dealt with appropriately.

Natural streams and rivers are abundant in New Zealand and can be a good source of water. It is best if these are fenced off and water piped from them to troughs or receptacles that animals can drink from. You need to check the flow in summer to ensure there is a constant source of water for your stock. There are small, cheap, water rams available for pumping if gravity feed is impractical. Quality needs also to be checked, especially if there is activity upstream.

Dams and ponds can be made, using natural water courses and catchments. Making them summer safe, when the animals need the water most has to be factored in. These are a relatively cheap option and once again, the ultimate is to fence these off and try to pipe the water from them by gravity feeding, or pumping the water to troughs.

Animals moving in and around, has the potential to contaminate the water you are expecting them to drink. Worms, bacteria, and other diseases spread by animals and vermin can be further spread through this medium. Regular water tests will be needed to monitor your water quality.

If you do find yourself with a problem of quality, then you will need to explore your options as to how to overcome this. There are many options. This may include finding another source of water, reorganising your system, putting a filter system in. There are professionals around who will also be able to help you if it is a major problem.

A note about chlorine and fluoride in water

The affect of chlorinated water and the well-known law of halogen displacement has to be mentioned here as well. The halogen displacement law influences the way in which a cow can get access to the mineral elements in group 7 of the periodic table.

The halogen group of elements includes the following:

Halogen	Relative atomic weight (weight of the atom)
Fluorine	19
Chlorine	35.5
Bromine	80
Iodine	127

The clinical activity of any of these four halogens is in inverse proportion to the weight of its atom. The significance of this is that any one of the four halogens can displace the element with a higher atomic weight but cannot displace an element with a lesser atomic weight. Looking at this list fluorine can displace chlorine, bromine and iodine. Chlorine can displace bromine and iodine; and bromine can displace iodine but the reverse order is not possible. If you are putting iodine in your water to boost your cows intake, this may be unsuccessful if you have the presence of fluorine, chlorine or bromine. Drinking chlorinated water does provide us with water with the harmful bacteria killed, but it does cause the body to lose much needed iodine.

If your cows are drinking town water, monitor it and the animal health. If there is a choice, then supply water free of chemicals to your animals. Our grazing animals also obtain fluoride through phosphate type fertilisers and probably do not need the extra added via a town water supply. If this is a problem, explore your options. There are many people around with experience and sell water dispensers. Alternatively explore other water sources.

IFOAM Organic Principles and Recommendations (2005) for Organic Water Management

General Principle - Organic farming methods maintain water quality and use water efficiently and responsibly.

Recommendations

- Operators should use techniques that conserve water, such as increasing organic matter content of soil, timing of planting and the appropriate design, efficiency and scheduling of irrigation practices.
 - Operators should apply water and inputs in a way that does not pollute water by runoff to surface water or leaching into ground water.
 - Organic processors and handlers should install systems that permit the responsible use and recycling of water without pollution or contamination either by chemicals, or by animal or human pathogens.
 - Operators should plan and design systems that use water resources responsibly and in a manner appropriate to the local climate and geography.
 - Organic management plans should anticipate, address, and mitigate impacts on water resources, including but not limited to the application of manure, stocking densities, application of soluble fertilisers, and effluent from processing and handling facilities.
 - Operators should respect sustainable resource management and the common good.
-

Wetlands and waterways

Wetlands tend to be very much the poor cousin in terms of habitats and areas that we appreciate and cherish. They are not imposing in stature like forests, nor constantly moving and changing like the sea; everything is on a micro-scale, too small for the human eye. To us wetlands tend to look dull and lifeless, nothing moving, nothing happening, all very uninteresting. And so we have tended to use them over the ages as places to dump our rubbish, or infill, or drain to 'improve' the land, or plant up with trees to make them more visually attractive.

It is only relatively recently that we have realised that we have been doing our wetlands a grave injustice, and begun to appreciate them for what they do, and even to see their subtle beauty. For wetlands are the half-way house between dry land and our waterways. They act as natural sponges and filters in the water cycle, cleaning our water of any impurities and delivering it into the waterways as fresh and clean for wildlife and human consumption alike. Wetlands soak up the surface water run-off from the land and hold it in their highly absorbent peaty soils. Wetland plants are specially adapted to be able to grow in these cold, waterlogged soils, and so they are able to utilize the nutrients brought in by the water, so that wetlands can be highly productive ecosystems. This holding of surface water run-off at the top of the water catchment, followed by its slow release, prevents flash flooding lower down the catchment, and also retains more water in the system so that there is a reduced tendency for water courses to dry out during periods of little rain.

Whilst the water is slowly percolating through the wetland system, any pollutants and excess nutrients are taken up by the wetland plants and metabolised, thus removing them from the system and preventing them from running off into the water courses where they can cause the death of wildlife and pollution of the water. Excess nutrients in the water is a state called 'eutrophication', and is often noticeable by blooms of algae which are reproducing rapidly, and a consequent death of fish and other wildlife caused by a depletion of oxygen and imbalance in the system. Wetlands also act as a filter for soil and other particles, holding them in the tightly bound roots of the wetland plants and preventing them from entering the water where they would cause sedimentation and turbidity, which also has a negative impact on water quality and wildlife.

One of the other vital functions of wetlands is actually the same as we have already been discussing with our forests and trees, for like wood the waterlogged, peaty soils of wetlands represent a store of carbon in the terrestrial ecosystem which does not get released into the atmosphere as carbon dioxide (CO₂). When we drain our wetlands and the soils dry out, this stored carbon becomes available and is metabolised by soil microflora and fauna to form carbohydrates, but much is also lost to the atmosphere as gaseous carbon dioxide in this breakdown process, thus adding to our problem of global warming.

So, even in this brief introduction to the role of wetlands, we can see how invaluable they are to us in the functioning of our water supplies. They provide us with a natural and free processing service which is very costly to rectify if it is removed, and they can also be very attractive and interesting places if we look a little closer and learn to appreciate their subtle colours and placid pace.

Wetlands on the farm

Wetlands on the farm have tended to be partially drained and used as dry weather extra grazing, or sacrifice areas where we chuck the bulls or other stock not in the normal paddock circulation. Or else we have planted them up with wet-loving trees like willows, or dumped all our clapped out cars and washing machines into them. Thus our wetlands are badly degraded and have become invaded by non-native dry land species, and do not function as they should. The concentration of dung from grazing stock actually contributes substantially to the eutrophication of our waterways, and the trampling and pugging of the soil causes sedimentation of the water as well as severe erosion of the banks. Our waterways are much more prone to flash flooding, known only too well by people living further downstream in the flood plains, with consequent costs to livestock and property.

But increasingly we are seeing the benefits of restoring our wetlands and they are now even being recreated in order to process our dairy effluent before it is returned to the land, and also in human septic processing systems in semi-rural locations where there is space to use the natural processing ability of wetlands. Some of our centralised reticulated human waste processing systems even use this natural technology and are known to produce the cleanest processed effluent, eg. Whangarei..

Also farmers are increasingly recognising the advantages of fencing stock out of wetlands, as well as fencing off buffer strips along water courses, and providing stock with reticulated drinking water instead of using natural water courses to water stock. These buffer strips need to be a minimum of 3m wide from the edge of the water course, and should be allowed to regenerate with natural vegetation which can be enhanced by planting wetland species including shrubs and trees. Suggestions of what to plant are given in our Wetland Planting Guide below.

This taller, ungrazed vegetation along the banks of water courses and in wetlands maintains a micro-climate of shade and high humidity, preventing any excessive rise in temperature or drying out, which keeps the water cool and saturated with oxygen, as required by the wetland wildlife like invertebrates and fish. The vegetation also provides food for the system in the form of leaves, seeds and insects, which fall into the water and are consumed. They also provide essential food and nesting sites for other wetland wildlife like birds, which are again part of the foodchain and the essential balance of the system. Non-wetland plant species like many of our agricultural grasses, cannot grow nearly so well as wetland species can in cold waterlogged soils, and so they are unable to process the nutrient run-off from adjacent farmland which therefore flows on into our waterways.

Your local regional council is an excellent source of advice and information about the wetland species which are local to your area, and for suggestions of nurseries which specialise in these plants. Many regional councils also have grants and other help available for fencing, some even offer free trees, so it is definitely worth giving them a call. Wetlands and waterways have become a major concern to regional councils in recent years in their efforts to keep our drinking water clean, so they will be delighted to hear from farmers who are interested in working with them.

Wetland planting guide - what are the choices?

Plants for exposed sites

Tall herbaceous species:

Reeds (*Baumea*)
Sedges (*Carex*)
Spike-rushes (*Eleocharis*)
Flaxes (*Phormium spp.*)
Juncus rushes
Lake clubrush (*Schoenoplectus validus*)
Raupo (*Typha orientalis*)
Clubrushes (*Scirpus*)
Toetoe (*Cortaderia spp.*)

Shrubs:

Coprosmas (*Coprosma spp.*)
Broadleaf, Puka (*Griselinia spp.*)
Korokio (*Corokia spp.*)
Koromika (*Hebe stricta*)
Karaka (*Corynocarpus laevigatus*)
Mapou/ Red Matipou (*Myrsine australis*)
Tree daisies (*Olearias*)
Pittosporums (*Pittosporum spp.*)
Poroporo (*Solanum spp.*)
Shore Fuchsia (*Fuchsia procumbens*)

Trees:

Akeake (*Dodonaea spp.*)
Cabbage Tree (*Cordyline australis*)
Kanuka (*Kunzea ericoides*)
Lacebarks (*Hoheria spp.*)
Manuka (*Leptospermum scoparium*)
Ngaio (*Myoporum laetum*)
Pohutakawa (*Metrosideros excelsa*)
Ribbonwoods (*Plagianthus spp.*)
Totara (*Podocarpus totara*)

Plants for waterlogged sites

Tall herbaceous species:

Baumea reeds
Carex sedges
Spikerush (*Eleocharis sphacelata*)
Flax (*Phormium tenax*)
Juncus rushes
Lake clubrush (*Schoenoplectus validus*)
Raupo (*Typha orientalis*)
Scirpus clubrushes
Toetoe (*Cortaderia fulvida*)

Shrubs:

Karamu (*Coprosma robusta*)
 Mingimingi (*Coprosma propinqua*)
 Pate (*Schefflera digitata*)

Trees:

Cabbage Tree (*Cordyline australis*)
 Kahikatea (*Dacrydium dacrydioides*)
 Maire (*Syzygium maire*)
 Manuka (*Leptospermum scoparium*)
 Pukatea (*Laurelia novae-zelandiae*)
 Ribbonwood (*Plagianthus regius*)

Plants for estuarine margins**Tall herbaceous species:**

Sedge (*Carex testacea*)
 Sedge (*Carex trifida*)
 Juncus rushes
 Flax (*Phormium spp.*)
 Toetoe (*Cortaderia toetoe*)

Shrubs:

Coprosmas (*Coprosma spp.*)
 Broadleaf, Puka (*Griselinia sp.*)
 Karo (*Pittosporum crassifolium*)
 Kawakawa (*Macropiper excelsum*)
 Korokia (*Corokia cotoneaster*)
 Koromiko (*Hebe stricta*)
 Tree daisies (*Olearia spp.*)
 Shore Fuchsia (*Fuchsia procumbens*)
 Shore Ribbonwood (*Plagianthus divaricatus*)

Trees:

Akeake (*Dodonaea spp.*)
 Cabbage Tree (*Cordyline australis*)
 Houpara (*Pseudopanax lessonii*)
 Kanuka (*Kunzea ericoides*)
 Karaka (*Corynocarpus laevigatus*)
 Kohekohe (*Dysoxylum spectabile*)
 Mahoe/Whiteywood (*Melicetyus ramiflorus*)
 Manuka (*Leptospermum scoparium*)
 Mapou/Red Matipou (*Myrsine australis*)
 Ngaio (*Myoporum laetum*)
 Pohutakawa (*Metrosideros excelsa*)
 Puriri (*Vitex lucens*)
 Wharangi (*Melicope ternata*)
 Whau (*Entelea arborescens*)

Additional plants for sheltered wetland margins**Shrubs:**

Brooms – native (*Carmichaelia spp.*)
 Five finger (*Pseudopanax arboreus*)
 Rangiora (*Brachyglottis repanda*)
 Tutu (*Coriaria arborea*)
 Wineberry (*Aristotelia serrata*)

Trees:

Kowhai (*Sophora spp.*)
 Lancewood (*Pseudopanax crassifolius*)
 Matai (*Prumnopitys taxifolia*)
 Miro (*Prumnopitys ferruginea*)
 Putaputaweta (*Carpodetus serratus*)
 Rimu (*Dacrydium cupressinum*)
 Tawa (*Beilschmiedia tawa*)
 Taraire (*Beilschmiedia tarairi*)
 Tree Ferns (*Cyathea and Dicksonia spp.*)
 Tree Fuchsia (*Fuchsia excorticata*)

Other plants:

Eleocharis sphacelata: Native, excellent filter
 Reed Sweet Grass (*Glayceria maxima*): previously *Poa aquatica*: Restrict for grazing, can cause cyanide poisoning.
 Reed Canary Grass (*Phalaris arundacea*): Summer fodder. Can cause poisoning.
 Duckweed (*lemma spp.*): Can be harvested without disturbing remaining wetland system.

Avoid:

Toetoe or pampas grass, Alligator Weed (*Alternanthera philoxeroides*), Manchurian Wild Rice (*Zizania latifolia*). Water Hyacinth (*Eichornia crassipes*), , Water Fern (*Salvinia sp.*)

See also the Soil Fertility chapter; Effluent section for more information.

A word of warning!

Pukekos can wreck havoc in your newly planted wetland sites!

They love to pull up the plants and chew the stalks.

Contact your local DOC office or Fish and Game Dept. for ways of discouraging them.

References: Chapter Six

Climate and weather

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"The Dairy Exporter Great Farming Guide to Climate Change" (2010)

Climate Change Information websites:

www.climatechange.govt.nz

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Trees

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NZ Farm Forestry Association, website with details of branches: www.nzffa.org.nz

QE II National Trust, www.qe2.org.nz

The Tree Cropper Issue 25 Spring 2000 - Natives, pages 13-15

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Andrew Crowe (1990). *"Native Edible Plants of New Zealand"*

Kathy Mortimer. *"Trees for the Land – Growing Trees in Northland for Protection, Production, and Pleasure"*. ISBN 0-909006-03-2 available from Northland Regional Council, Private Bag 9021, Whangarei.

"Biodynamics – New Directions for Farming and Gardening in New Zealand". By NZ Biodynamic Association. Published by Random House 1989, reprinted 1993 – currently out of print but available through libraries. It has a good list of trees on pages 103-105. ISBN 1-86954001-8

Your local regional council or Landcare Trust will have lots of information to draw from.

Water

Richard Bentley. *"A Thirst for Knowledge"*, *Growing Today* July 2003, page 66-67.

Wetlands

Regional Councils. Dairying and the Environment Committee 1996 Available from Regional Councils

Climate data

The National Institute of Water and Atmospheric Science (NIWA Ltd) manage a national database of climate data. Data are available at nominal cost. For more information visit www.niwa.co.nz/services/clidb/

or email climate-enquiries@niwa.co.nz .

Climate summaries

NIWA also produce Climate Update, which is a monthly summary of New Zealand's climate, including soil moisture and river flows. You can access free electronic copies of this at www.niwa.co.nz , look under Media & Publications.

Weather forecasts

Weather forecasting in New Zealand is now centred in Wellington and is strongly reliant on satellite and computer technology. The forecasts provided on the evening news or in the daily paper are sufficient for most farmers. However, as the observant farmer knows, the weather can often be predicted through accumulated experience and wisdom and keen observation.

Government and regulations

There are many organisations and government bodies coming out with rules and regulations. They are different for each area. Whether you are organic or not, it is important to keep informed of the rules and regulations, and any changes that occur. The trick is to be ahead of the game by keeping yourself informed, and working positively and proactively on your farm.

These are increasing as we become more regulated. Be aware of your obligations under law. Keep up to date with them.

Some important regulatory authorities are:

- MAF: hygiene, animal health and welfare, disease, registration of food processing plants, collection of seaweed
- Dairy Companies: (the largest being Fonterra but there is a number of other small ones), milk standards, effluent, dairy regulations, Clean Streams Accord
- Regional council: noxious weeds, drains, pollution, erosion, spray drift, effluent disposal etc
- Local council: Roadside maintenance, rubbish, conservation
- Accident Compensation Corporation: accidents, injury, lepto, disease
- The Health and Safety Act: stress in the workplace, illness, milk contaminants
- Organic certifying agencies