

GrazingInfo methods reduce weeds and increase earthworms which eat a lot of weed seeds.

To find a specific weed, you can go Command or Control F, and type its name and press Enter.

Weeds are a major problem for some farmers. Causes include acid and deficient soils, lacking earthworms with sick pastures that LimePlus improves in 99% of cases. Out of the 500 for whom I've done pasture analysis since 1960, only 5 (1%) had enough calcium in their pastures so all others needed LimePlus. See Minerals in Soils > Calcium. Never apply lime on its own. Doing so lowers zinc and other deficient minerals. LimePlus is agricultural lime including its synergisms of magnesium, OrganiBor (slow release boron) and other minerals that are deficient on your farm, decided from ryegrass leaf and stem analyses. Earthworms will increase, eliminate hard pans that most acid soils have (See Soils), eat weed seeds and create healthy soils, pastures and animals. Read Earthworms in the Soils Chapter, and read Calcium in Minerals in Soils, Pasture & Animals. They show how to make buttercup (not giant buttercup) palatable so cattle and horses eat and reduce it, and how to increase earthworms to eat the thatch and create facial eczema spore-free pastures, improve soil fertility and animal health, and increase profit, which deficient cows like this one doesn't.

Weed control

I've farmed since 1948 and consulted since 1960, and have not had to use or recommend boom spraying of weeds even on weed covered farms we bought. Today, in 2016, our farms, sold in 1984 and 1987, are still comparatively weed-free, while neighbours' farms were, and still are, covered in weeds, simply because they over-stocked, over-grazed (which ryegrass hates), applied too much P and K and not enough LimePlus.

These daisy types (there are many) on a roadside should be dug out.

If you boom spray your pastures to control weeds, you'll have to do it again and again. You'll also have unhealthy animals like the one below on page 3 with spring eczema, and few earthworms. However, Kikuyu (when a weed), Couch, Johnson grass, Bristle grass, Cape Weed, Smooth Witchgrass (*Panicum dichotomiflorum*) and similar ones can't be kept out completely by management. Don't buy a farm with them, and don't allow any to enter your farm from neighbours or the roadside. Small areas may have to be cultivated and fallowed to kill Couch. Roundup doesn't. See Grazon.



Bamboo

These grow fast and are hard to get rid of with cutting and spraying. I found that cutting them down to close the ground, then stamping on the 20 cm high regrowth so the stems are still in contact with the roots, so don't break and are not cut off. This worked for us. Please let us know if it doesn't work for you.

Grazon

This is the only killing spray I've used for 18 years, always with 50% Codacide (vegetable oil) added, which gives a better spread and allows half the rate of Grazon (and other sprays) to be used, and stops drift so saves money and danger. Codacide is a brilliant product. See Weeds and Agripower 4 Princes Street, Onehunga, Auckland, New Zealand T: +64 9 634 4632

For international suppliers see:

<http://www.microcide.co.uk/pdf/CodacideBenefits%20andEfficacy24.09.14.pdf>
and microcide@microcide.co.uk

Perennial ryegrass grows well in most of New Zealand and can be kept pure by spraying with Grazon that kills everything except ryegrass, unless made too strong. It kills Poa, Paspalum, fescues, Wandering Jew, shrubs and trees. Kikuyu, twitch, couch, all need two sprayings, so be careful with it. Mixed with an equal amount of Codacide, halves the amount needed, gives a better kill, and stops drift.

Mix it with 50% Codacide which improves the spread, halves the spray rate needed and stops drift. Californian thistle can be reduced by mowing it in the rain or by being eaten by Alpacas. Read Gardening for more on Grazon and Codacide.

Farmers have sold their farms after they became infected with some weeds. Farms with 30 or more earthworms per spade spit usually have fewer weeds, because the earthworms eat weed seeds.

Used correctly, it is a safe spray. I and many farmers are allergic to Roundup (Glyphosate) and other sprays. I have used Grazon since 1998 with no problems, but I'm careful and always use Codacide which is a vegetable oil that makes sprays go twice as far by spreading the spray evenly over the leaves, halving the amount of Grazon or other chemical needed, slows evaporation, reduces drift, improves spread and coverage on the plants, makes hormones less volatile, so operators smell the spray less, but don't be fooled into safety. If using 50% Codacide you must use only half the Grazon rate, or the higher killing rate can burn weeds and grasses which reduces translocation to the roots, so not killing the plant.

If it rains soon after spraying, the Codacide holds the spray on the leaves.

There are organic sprays for small areas. See Organic Weed Killer below.

Most weeds prefer low fertility and sour conditions, whereas most improved pasture species, especially legumes, prefer close to neutral conditions, so the first thing is to fix the drainage and your soils. See the chapters on Soils, Drainage, and Minerals in Soils, Pasture & Animals > Calcium.

Unfortunately, going by what I see on farms, including some organic ones, and questions I get, very few farmers know what good soils look like or how to achieve them. A reason for this is soil testing which is an historic disaster promoted by scientists who don't think or check outside of what they were taught decades ago, so they tell farmers that if levels of certain items are within, in some cases, 100 and 300 (equals 200% difference!) then soils are OK. How ridiculous. Some farmers say, "With that wide an option, why bother?" I agree. Use the following.

I recommend accuracy, with one optimum (best) level for each plant. Do you want to be the best farmer, or just average? Use the spreadsheet called Pasture Mineral Analysis and

I've not been affected by Grazon, nor has anyone complained to the agents and makers (Dow Ltd in New Plymouth) about being affected, while bad effect complaints about Roundup have been frequent. Grazon effects have not been complained about to the Hamilton health specialists who drain toxins out of people. Toxin specialist, Dr Ricky Gorringe, has not heard of anyone affected by it.

One has to be very careful with information because of commercial rogues. When researching items for GrazingInfo I had to discard a lot of propaganda and untruths, as do USA doctors Mercola and Sears who are excellent and helpful international health specialists.

I've not been affected by Grazon, but have twice by Roundup used by the council 30 metres away.

The easiest way of getting sprays out of containers is to drill a 5 mm hole in the lid and use a self tapping screw to close and open the hole from which to pour.

Grazon is toxic, but apparently drains out of the body, unlike many sprays and mercury that stay in the body and can cause severe health problems. Wear safety gear of longs, long-sleeve shirt, hat (not just a cap). Immediately after, rinse your mouth a few times and shower in cool water (hot water opens your pores), followed by warm water and Ego GV safe bath oil from a chemist.

We have to be very careful about what one believes because of commercial rogues. When researching GrazingInfo and other things one has to discard a lot from suppliers and attacks from the oppositions.

Roundup was known by Monsanto since its beginning to affect the pre-borns in animals and women, but this was only exposed 30 years later.

Put the Codacide in the measurer first, swill it around to cover all the inside surface then pour in the chemical and mix it thoroughly with a rod. Putting the Codacide in first makes the measurer easier to clean. Wear protective gear and keep your mouth closed in case of splashes you may make.

Use an extension wand when spraying to keep the spray further away from you.

Spray units that strap on the body are not advisable. One burst while on a person.

Grazon (when new) at only 6 ml (half the recommended) per litre of water mixed with the same amount of Codacide does a good job by killing everything in lawns except ryegrass. If not well done a second spraying may be necessary. As Grazon gets older it loses effectiveness so after a year use 10 or 12 ml per litre of water.

Don't spray in the heat of the day because the leaf stomatas (pores) closed so don't absorb. Late afternoon is best and Poa is easier to see then. A very slight breeze allows spraying safely by walking backwards into the wind.

The first weed control system is to prevent weeds from arriving. This can happen from road graders or mowers, buying hay or silage and the wind.

The second control is to avoid it spreading and/or seeding.

The third is to have plenty of earthworms to eat the weed seeds that do fall on the soil.

The fourth is to lime and fertilise correctly so that weeds become palatable, so more are then eaten by most grazing animals. This doesn't apply to ragwort that cattle won't eat, which is just as well, because it is poisonous to them, but not to sheep, unless they eat too much.

Many pasture soils have very few earthworms, as shown below, while the best have 40 per spade spit of 20 by 20 by 20 cm (8 x 8 x 8 inches). Read Soils > Earthworms. Briefly, apply sufficient LimePlus based on pasture analyses.

Boom spraying weeds and insects can kill the beneficial ones, as well as the problem ones, so should be avoided. I've seen worse weed infestation after spraying, because clovers were killed, so pastures opened up.

Lime has been mentioned a few times. See Elements > Calcium for the full information on it.

Getting rid of the causes of weeds with drainage, subdivision, correct LimePlus, fertilising and trace elements, and controlled grazing, is cheaper and more effective, lasts longer, and is not as dangerous, toxic or polluting as spraying. There are exceptions with some of the grass type weeds.

LimePlus makes soils grow better pastures with fewer weeds, some of which, like buttercup (except Giant Buttercup), then become palatable so are eaten. Unfortunately giant buttercup, is not controlled with lime. Some Buttercups are toxic to animals.

Tony & Gwen Ashford of Ngatea, Waikato, had been helicopter spraying their whole farm twice a year, once with herbicide for weeds and once against facial eczema with a fungicide. This cow was the worst of many Spring Eczema ones from toxins that they had annually. All spring eczema stopped after I advised them to stop spraying, and got them to apply the required amount of LimePlus. Most New Zealand soils are low in calcium and magnesium, and the high amounts of lime necessary in its acid soils reduce magnesium levels, which needs to be applied, but is in Graymont Aglime and some others. Unfortunately too much lime can reduce zinc and boron levels, if not applied, but about 8 kg of zinc sulphate per hectare with the lime or with fertiliser costs only \$20/ha and is usually enough to get zinc to the optimum level of 50 ppm. Ten kg/ha of OrganiBOR achieves the same.



Best of all is that adequate lime increases humus substantially which holds (so increases) moisture, nitrogen, cobalt, selenium, etc. It also makes good elements like phosphate and magnesium more available, and makes bad heavy metals like mercury and manganese less available. Read Calcium in Minerals in Soils, Pastures & Animals.

Benefits of cultivation

It avoids using sprays that are taking over on too many farms and in some local bodies, causing a lot more ill health in animals and people than realised, and allows today's improved pasture varieties to be sown. Those of you who have had bad results with some new pasture varieties, should know that the best are doing extremely well on correctly farmed land. Bealey NEA2 ryegrass is one example. Calculate its profit from two litres more of milk per cow per day when grazing it, that many farmers get, when sown with the best clovers (not Kopu which dies out after a few years). The first sown NEA2, fed and grazed correctly are 12 years old and still thriving.

Remember that most weed sprays get weaker with age and may need double the original recommended mixing rate. The older the sprays are, the more shaking or stirring they need to mix up the crystals that form in the bottom of containers. Manufacturers and suppliers deny this, but ask contractors.

When buying, always check the manufactured date, and buy recently made ones, not those half a year or older. The best way to do this is to decide on the spray and then phone the local suppliers and ask their dates of manufacture and price.

Organic weed killer

This is a small scale safe organic weed killer recipe for spot spraying especially in gardens.

One litre of white vinegar with 100 g of table salt. Heat the vinegar and salt in a pan until the salt is dissolved. Stir in 2 drops of detergent. Allow it to cool.

If you use an old stainless steel pan that is dirty looking, it will acquire a new look.

This spray gives excellent control on paths and drives.

If spot spraying, use a jet nozzle aimed at the middle of the weed to avoid affecting the surrounding plants, as done by fan shaped sprays.

As with all sprays, wash the equipment well because while stainless steel can cope, some rubber seals don't.

A flame thrower is also toxic-free. Fumes from it are nothing compared with that from toxins.

Hot water from a kettle also kills weeds in paths, etc.

Correct farming

Most weeds can be reduced, and some eliminated with correct farming. See the photos of our two farms below and the last two photos in the Beef chapter, then you will read how to do the same with excitement. My wife Auriel, was a major weed eliminator, digging or pulling out individual plants. Our children enjoyed imitating her. When we sold our first farm there was not one weed on it.

Some weeds are poisonous, smother better species, cause bad flavours in meat and/or milk, is likely to spread out of control and take over.

If animals will eat it and subsequent animal production is not lower than from pasture, it is not a weed and can be called a herb!

There are some grazing herbs such as chicory and plantain that have been improved by natural selection and crossing, and are now highly desirable pasture plants.

We have cleared three farms infested with blackberry, ragwort, docks and other weeds (one had gorse), as have those of my clients who have done exactly what I recommended, without any toxic chemicals.

Weed control didn't occur under fence lines where correct liming, fertilising and grazing could not be applied to the full.

The exception is the killing of creeping weeds. They have to be dug up if a few, or sprayed if thick. Most farmers use a Glyphosate, but I never have because of the bad effects on people, pre-born humans and animals, because of its problems that have caused countries to ban them after polluting underground water. I've used the comparatively safe Grazon since 1990 and recommended it where essential. See below.

Apologies for the lack of clarity in some photos. Some were taken in 1970. The next two have been reduced from about 4 MB to 400 KB because there are 27 photos in this chapter, so if not reduced, the PDF would be slow or too large to download in areas with slow Broadband.

This 775 Piako Road, was our first farm bought in 1955 that got more 60 cm deep drains and Lime Plus, than the neighbour's rush and weed covered farms. Ours earned more than double the neighbours' per hectare income from superphosphate and conventional fertiliser, This allowed us to build a new three bedroom Lockwood home in 1958 from income (no borrowing) and buy a neighbour's farm later, again from income. Above is our the front left paddock and on the right is our front right paddock.

Both paddocks were two metre deep peat in 1955, consolidating to about 1.5 metres deep by 2006. At the back, the peat was 10 metres deep, and, since developing out of Manuka scrub and brush, grew no weeds, because it was done correctly, and grazed with 2.5 cows per hectare three years after developing it, which was as good as the best Waikato land then. Read the Soil > Peat Chapters.

This weed covered paddock on the right was the front one on our second farm in 1984 when we bought it. Below shows it two



years later. The neighbour's house can be seen in both photos. The previous owner asked how we did it. We put a half metre deep spinner drain in, left of where the tractor is on the flat below the slope. The drain can be seen in this photo. We also applied LimePlus at 6 t/ha on the hill and 8 t on the peat of and chisel ploughed it in, and then applied 3 t/ha and harrowed it in.

Using pasture tissue (ryegrass leaves and stems) mineral analyses, we made the correct decisions on liming and fertilising. Soil analyses are useless, especially on peat, and can't achieve results like these. We saw this in 1956 (yes, 1956) when the Department of Agriculture consultant took two samples for us at no charge on our first farm and the results showed that they were useless, so we have not tested soils again. Soil tests are more sophisticated now, but still not as useful or accurate as pasture tissue analyses. Read Pastures > Analysing Tissue Vs Soils. Pasture figures told us that lime was needed. Previous owners using soil tests, indicated wrongly that lime was not needed, partly because K was high, so raised the pH. Soil test figures to aim for, have been wrong for 60 years, possibly to suit fertiliser companies that sponsor research that discourages lime sales.

We swapped our first 87 ha dairy farm on 775 Piako Road Gordonton, with a 50% sharemilker for a 106 ha farm on Greenhill Road near Hamilton, in 1984. It was growing maize and going bankrupt, as did the owner before, when dairying. We improved it, and sold in 1987. This photo was taken in 2007, so lime we had applied in 1984 had lasted until then. The neighbour using a fertiliser and manganese recommending consultant applied no lime for more than 20 years.

The photo below in mid May 2013 was a paddock two to the left of the above one. It had not had lime since we applied it in 1985 so had a hard pan, and was weedy, dried up and yielding less. The



neighbour's farm covered in buttercup as shown above in 2007, can be seen near the top in mid May 2011 green, and with no weeds. A few years before the neighbour had asked us what we did on our farm that grew a lot more clover and pasture than his, and without weeds. We had installed half metre deep spinner drains every 30 metres in the wet peat, applied LimePlus at 8 t/ha once on peat and 6 t/ha on clay and chisel ploughed them in to sow pasture after maize that the previous owner was growing, then applied another 3 t/ha on top and harrowed it in. This surface lime is essential to achieve good weed-free pastures with clovers on soils starved of LimePlus for decades because of a history of using pH

from soil tests, and being influenced by fertiliser company sales people, Ruakura, AgResearch DairyNZ, LIC, commission consultants, etc., all using soil tests rather than ryegrass leaf analyses.

In 1987 Cor Feyter, Mike O'Connor and another Ruakura scientist came and asked us what we had done to grow such good weed-free clover-based pastures. See Minerals in Soils, Pasture & Animals > Calcium, for complete details. We used pasture analyses and experience to decide correct LimePlus and fertilising at one tonne per hectare of reactive phosphate, Serpentine and deficient elements. The above photo taken in June 2011 shows a drain too deep for consolidated peat. Its spoil had been spread in front of it which prevented water getting to the drain, so created a low wet area growing weeds on the left as shown.

Both our two farms are still comparatively weed-free, while neighbours, and most farms in the Waikato, are covered in weeds.

Briefly, soil tests show what some scientists (not Ken McNaught) think is in the soil. They don't allow for the good organically farmed high humus soils and peat soils, that are lighter than clays. Soil measurements are all based on weight percentages, so light soils give higher percentages. Organically farmed soils become lighter as the organic matter increases, while those getting urea become heavier as the organic matter gets used up. Soil mineral figures are not adjusted to each soil type. In one case Olsen P in dry raw peat from a deep drain was 70, showing another fault of soil testing. The excellent LIC consultant/farmer who discovered this in 1985, left LIC because they insisted on the typically faulty soil tests, not the accurate pasture leaf analyses that she wanted all her farmer clients to do.

A university in Holland asked me to come and help them in about 1983 because, despite applying more and more urea each year, up to 1,000 kg per hectare for 30 years, pasture yields were decreasing. Their soil had become hard, like a weak sandy concrete mix, because the organic matter had been used. I suggested they apply some of the dairy cow effluent that is a surplus in Holland and dumped wherever they can by "dung running". See GrazingInfo > nitrogen for more on this soil destruction and how the British applied urea to make soils harder for landing on by their masses of Spitfires and Hurricane fighter planes.

Grazing weeds

Not many farmers know this, but animals prefer the plant there is least of, whether it be grass,



clovers or weeds. Watch them and see; however, few except goats and giraffes eat tall weeds, while most animals will swallow most weeds when they are short and are mixed with lush pasture, often because they have no option when it is mixed in.

Most animals will eat young buttercup, young docks, young gorse, and even young pennyroyal. However, if there is too much, animals will spend more time trying to get enough grass and legumes.

New "improved"? pasture varieties are usually selected and developed by plant breeders under perfect high fertility conditions, so will only thrive in similar conditions. If they don't thrive, weeds will.

When the fertility and mineral balances are correct, grasses and clovers will cover bare patches and make a much thicker pasture with fewer weeds.

Most animals will eat most weeds, but only if they are encouraged to, or made to. Nothing happens

on its own. Luckily, controlled grazing and good management work by -

1. Keeping pastures soft and palatable with lime and salt, and by not allowing potassium to get above 3% in the grass tissue, which makes grasses become hard for cattle to break off.

2. Encouraging animals to eat weeds by mowing a quarter or third of the paddock before grazing, and fencing them on it until eaten; however mowing is a cost. The better way is grazing management, but in practice management can need a bit of mowing, especially with thistles, which many cattle will eat when wilted, but not when too dry. Once trained, most will eat the wilted pasture, weeds and all, before the standing pasture, as they are doing here without fencing them on it.

In 1 and 2 above, the stocking rate has to be correct. It can't be done with too few animals for the amount of pasture and weeds. Too many animals will do a faster job, but will not grow, finish or, if cows, won't milk well, so would not be profitable. However, there are times when not making quite so much profit out of buying and selling animals is better than the costs of mowing, harvesting or spraying. After one year of correct farming, pasture growth and production should increase, with fewer weeds.

Controlling weeds without spraying

In 1981, the NZ Ministry of Agriculture (MAF) staff told themselves and farmers that, "Vaughan will not develop the rush, gorse and blackberry covered two metre deep peat on Kahikatea Drive, Hamilton, without spraying."

I succeeded, and ran many field days on it, attended by hundreds of farmers, but no government or LIC consultants ever attended.



Gorse, blackberry and weeds galore were slashed, without sprays, which I had avoided using on our two weed infested farms, which MAF staff didn't see when we bought them in 1955 and 1984. Again, the 'establishment' was wrong, and, despite the gorse coming up as thickly as the grass, dairy weaners and heifers ate them with the lush pasture (Tahora white clover, Concord and a perennial ryegrass), but didn't when the pasture was not lush and palatable, i.e., Yatsyn and clovers.

I did many profit based comparative trials on our two farms and on others for clients. Some were to prove again what I already knew, to show what was not known by the 'establishment' (Ruakura, MAF, AgResearch, DairyNZ, Massey Agricultural University, Livestock Improvement Corporation, etc.) and to show farmers and overseas subscribers how to improve soils and increase pasture growth cheaply.

Trials showed -

1. Even dairy calves and yearlings ate the gorse in the pastures that included Concord (highly palatable and favoured winter ryegrass), much more, in fact completely. MAF was against Concord because a farmer developed it, not them. In their practical ignorance they didn't know about its benefits - that many Fieldays winning farms of the year farmers sowed it. Many winners oversowed with Concord every autumn with excellent results. With Bealey NEA2 this is not necessary.

2. Lime was applied at 12,000 kg per hectare on this two metre deep peat, 1,000 kg per hectare of correct fertiliser with 11 trace elements, all chisel ploughed in to 40 cm three times, which gave pasture like that two photos below. Fertiliser spread on top of raw hungry peat with no earthworms to move elements, doesn't feed the roots or encourage them to go deep.

3. Gorse and most weeds don't like lime and fertiliser, but pastures do, so pastures won. No burning was done because it increases the germination of gorse seed. The procedure was to rotary hoe the gorse and weeds, in this case over two metres high, until able to chisel plough, which was then done several times to decompose, deepen the lime and fertiliser and consolidate the peat. Shallow spinner drains were put in and their banks pulled off to low areas, gateways and water troughs.

LimePlus was then applied and chisel ploughed in twice, then fertiliser, with any of the 11 necessary elements, (See Free Items > Pasture Analysis) applied and chisel ploughed in once. See Soils > Cultivating & Subsoiling.

Pasture seed was sown at about 27 kg of seed per hectare (25 lb per acre) and rolled several times until firm and moist (rolling brings up moisture). A lack of seedbed firmness cause seeds to be buried too deeply, so they don't germinate.

Gorse and other weeds germinated profusely, but optimum liming, fertilising, pasture management and rotational grazing eliminated them.

This photo shows old gorse and weeds left standing at the very top right to show what it was like, gorse re-growth at the bottom right that was not grazed, and that grazed on the left. All got LimePlus and reactive phosphate fertiliser with deficient elements. A selective mild spray was used under the fence. There are comparatively safe non-toxic sprays such as Grazon which kills everything except ryegrass, unless made too strong. We recommend adding an equal amount of Codacide, an adjuvant organic oil that halves the amount of spray required, improves the kill and reduces drift. Read Gardens > Lawns to see how to use Codacide and Grazon. It is an oily substance that makes spray equipment harder to clean, but well worthwhile. I'm allergic to many things, especially Glyphosates, but not to Grazon and have used it since 1990. See Gardens > Grazon.



We did many pasture species comparisons. In paddocks where we grew the new, lush, faster growing types, including the highly palatable, high moisture long rotation tetraploid ryegrasses, the dairy calves and heifers we grazed on it sought out gorse for some roughage. It came up as thickly as the grass, but was eaten off at ground level, whereas where older, lower producing varieties of clovers and perennial ryegrasses, and no tetraploid ryegrasses, were grown, the animals were so busy looking for some lush grass that they ate less gorse and weeds. Once the trials were over, we over-sowed the best winter ryegrass (Concord in those days, long lasting Tabu now.) and the animals did the rest. Had we started a boom spraying programme we would have halved the earthworms, halved the clovers, then the ryegrasses, which need ample organic matter made by earthworms, and need nitrogen from clovers, and would have ended up with open weed-prone pastures requiring repeated spraying and artificial nitrogen. Instead, 99% of weeds were kept out and about 1% grubbed. Weeds wouldn't germinate or survive in pastures like this on the right and animals would eat the weeds without even knowing that they had.

Many have emailed or asked me asking how to get rid of weeds organically, and from what I've seen, about 90% of pasture farmers need the help of this information.

Initial liming at 12,000 kg per hectare on this raw two metre deep peat helped the weed control.

An old timer before pasture analysing was done, said to me, "Weeds decrease as the calcium level rises." It is a pity all, including the many scientists, don't know this.

The pasture on the left was after 14 years of 600 kg of lime per hectare per annum. On the right was a year after no lime and 1,000 kg per hectare of Abron which has Ca 9%, Mg 2%, Sulphur 3%, Sodium 16% and the following in ppm so of no value. See the spreadsheet Fertiliser Values.

A question I'm asked is why do weeds grow in some patches as shown below?

This is the corner of the paddock which got no, or very little lime and fertiliser, as often happens in corners, so was low in fertility, which then grew less palatable pasture and more tough gorse that the animals would not eat. Note the clover growing well and making nitrogen at the top left where lime and fertiliser were adequate. I often



get asked why pasture doesn't grow in some parts. One reason is bad spreading as shown below.

Lime helps soils hold moisture, so the 2 m deep peat soil here that got 5,000 kg per hectare was dry, while on its right that got 10,000 kg chisel ploughed in, was moist. pH on the drier peat on the left was 5.7 and on the more moist peat on the right was 5.8 which is the minimum level recommend by some for high organic matter soils like peat. I prefer a higher pH, but am influenced by the pasture calcium level, NOT by pH, which is unreliable. The soil tests and photos were done in mid February in summer dry conditions.

Ryegrass calcium tissue levels were 0.6% on the left and 0.8% (optimum) on the right. As can be seen, the right had much more clover.

Look at the weed-free lush grass and clover on the back of the photo, where calcium was correct, and look at the weeds (Ragwort and Browntop) and dead facial eczema material in the front, where the only difference was half the lime. The milk and meat production from the right would be 50% higher, and weeds didn't establish.

The value of animal manure and urine can be seen by the shorter pasture next to the electric fence. It is not from the power, except that animals soon learn to not lift their tails near electric fences in case the wind blows it against the live fence, so the 'no manure' strip is wider, and is narrower next to non-electrified fences. Farmers often ask me why pasture is not growing on some patches of their farm, but weeds are. This photo shows one of the causes, due to fertiliser and lime spreaders travelling too far apart, so fertiliser and lime miss some areas. Wind gusts can do the same. The bottom left got double rate and the middle left and right, got none - because the paddock was slightly triangular in shape. Weeds are more likely to grow in these hungry areas.

4,000 kg per hectare of LimePlus, and sometimes even 6,000 kg per hectare, applied on the surface, and based on pasture calcium and magnesium requirements as determined by pasture analysis, has given "unbelievable growth", in some farmers' words, and clover increases from previously dead, weedy, soils.

3,000 kg per hectare of plain lime without serpentine, boron and zinc caused this severe boron and zinc deficiencies, while 3,000 kg per hectare of LimePlus gave healthy clover and grasses, both on the small farm of Shane Hobson at Whatawhata, just west of Hamilton.



Reasons for weed problems include -

- The cause of weeds spreading includes not digging out the first ones when first seen, so they then seed and spread. I've seen this occur on many farms, especially with Californian thistle, Couch and Daisies.
- Acid soils encourage some weeds and discourage clovers and earthworms, so soil fertility suffers and weeds thrive.
- Drainage can be overdone with few deep drains, or excellent with half metre deep V drains 30 m apart in wet soils.
- Wet, pugged and over-drained soils grow some varieties of weeds. Hills are always over-drained, compared with flats, so have to be fenced, fertilised and farmed more carefully.
- Subdivision is inadequate. Both under-grazing and selective-grazing grow more weeds.
- Cultivation is not deep enough to bring up subsoil in small amounts by chisel ploughing. See Soils.
- Fertiliser and/or lime are insufficient and/or wrong. Base the liming and fertilising on pasture tissue analyses, not on soil analyses which can't do it. Low fertility and/or high aluminium levels in soils, both through inadequate lime and/or low fertiliser levels, cause clovers and grasses to die out, leaving open spaces for weeds.
- Pasture varieties are not the best for the conditions.
- Grazing management is wrong, by over-grazing, mowing too short, or allowing pastures to get too long before grazing.
- Deficiencies in soils causing pastures to not thrive. Analyse pasture tissue in case there are deficiencies or excesses. Use the Pasture Minerals Analysis spreadsheet in the Free section to record the laboratory figures.
- Spraying can be an added cost that produces no more pasture, and from what I've seen many, many

times, produces less, because clovers and earthworms decrease in number, and animals sometimes get eczema. See Facial Eczema.

• In recent years, some New Zealand pastures (Waikato in particular) have deteriorated because of spraying, and using urea and insufficient lime, causing more weeds, fewer earthworms and often no clover. Drought and clover root weevil have been blamed, when the problem is misinformation. See Minerals in Soils, Pasture & Animals > Calcium.

Google for Roundup + Cancer to see 1,600,000 pages on it, and it will help you become more determined to farm without it. Denmark has banned Glyphosates (Roundup types), and Australians are not allowed to use it near waterways, both because levels are increasing in their underground waters.



Preventing spreading

Never import seeds into yours or any country without both knowing what they are and the regulations. Google for Importing Seeds, your Country. Some plants have spread to cover whole countries and become noxious. A recent one in New Zealand is Bristle Grass and there are dozens of farms reverting to Gorse brought in from the UK in the 1800s on purpose, for sheep to graze on poor soils, and to grow as hedges.

A farmer recently sold her farm because Bristle Grass covered it. Another sold his a decade ago because Couch was in most paddocks. Don't buy a weed infested farm. Grub (dig out) or spot spray all troublesome ones from now on. See Storksbill on page 29.

Weeds that are likely to be a problem should be pulled up or dug out as soon as first seen, before they spread over the farm. I've seen farmers spend an hour preparing a spray and attach equipment to the tractor to spray a few thistles that could be dug out and chopped up with a spade or shovel in less time, or while walking to milking behind, or ahead of the cows if a good dog is doing its job, and not leave dead plants standing for months, not to mention the possible human poisoning from sprays. Many farmers in old age suffer from the toxins of sprays used decades before, including my best friend Frank Reynolds whose mother had a fruit farm. When with Parkinson's, he told me how casual he had been with sprays, sometimes spraying a snake in a tree with the insect spray he was using without proper protection, and seeing the snake drop dead. It was in South Africa.

Check gullies and neighbours' farms for weeds which can spread to your farm. Watch for seeds blowing in the wind. Some seeds come in with gravel from quarries and in some limes, if the mine surroundings have weeds. Inspect the areas, and if necessary complain to the operators, and report all bad weed sources to the local weed control officer.

There is plenty of evidence of many weeds, especially thistles, reducing in numbers under correct liming, fertilising and good controlled grazing. Over-grazing or mowing too short in dry weather, and/or pugging in wet weather increase weeds dramatically. Droughts can increase weed numbers, and floods can bring in weed seeds which normal management can't prevent, but avoid over-grazing during droughts and try to improve stop-banks and drains to prevent, or at least reduce, the effects of floods damaging pastures and bringing in weed seeds.

Don't buy hay with weeds, especially Couch grass, Daisies, Bristle Grass, or weeds you don't already have.

Have a quarantine paddock that bought animals are kept in for 36 hours to contain weeds seeds in one paddock rather than all over the farm. A quarantine paddock can be easily monitored for new weeds. Organic farmers wisely use them for more than just weeds.

Most of all, keep your pastures dense, so that weed seeds don't land on bare patches and grow.

From CSIRO Australia

Apparently 40 per cent of new seeds identified were brought in, possibly on thick fluffy clothes. It is tempting to pick seeds out of clothes, but it might be better to leave them until at home and dispose of

them down toilets, not down storm water drains.

Questions from organic farmers -

Q. I cut down gorse and burned it, but seedlings keep growing.

A. Never burn gorse. Doing so makes the seeds germinate more profusely. Depending on the calcium level in a pasture analysis, chisel plough LimePlus in at 3,000 kg per hectare or more, and do a trial at 6,000 kg. Again, depending the pasture P level, apply up to 1,000 kg per hectare of the best reactive phosphate including the necessary trace elements, based on a pasture analysis. After reading Cultivation in Soils, chisel plough the LimePlus in twice and the fertiliser once, then sow the best pasture species for your area and continue to fertilise them well. Gorse grows on poor, hungry, acid soil, pasture grows on fertile soil. Avoid pugging soils containing gorse seeds. To control it in paddocks do all the things to improve soils, pastures and grazing. See Gorse below.

Q. How do I get rid of blackberry along drain banks?

A. Pull the banks off with a farm tractor and grader blade and drag the spoil to hollows, around gateways and around water troughs. To control blackberry in paddocks do all the things to improve soils, pastures and grazing. See blackberry below. If in steep or stony land, use goats and/or sheep to graze it. This V shaping of drain banks should be done on even deep drains to stop weed growth and save having to spray drains with the dangerous Glyphosate, which on drain banks in Australia is banned because their underground water is polluted with it. In some countries it is banned completely.

Drains, or contours, like this one, at the tops of hills can divert water and prevent it running down over the steep slopes which makes them wetter. They can reduce slips which are mostly caused by water soaking in from the top and behind slopes, then oozing through. All road cuttings should have them at the tops of hills. They could save millions of dollars blocking roads and repairing slips.

Q. Is there a safe organic weed killer for gardens?

A. See Gardens for a small scale organic one. Grazon is safer than most and doesn't damage earthworms, etc. The manufacturers protect themselves with long safety clauses used with other sprays. See Gardens.

I never boom sprayed because I'd seen too many bad effects - earthworm numbers halved, bare patches that grew more weeds, cows with spring eczema, sick farmers, and, mainly, clover reduced (even with clover-kind sprays). Weeds grow in bare soil. Clovers cover bare patches, but need lime, trace elements and fertility to do so.

After all sprays, wash the equipment well because while plastic can cope with some sprays, rubber seals can't, nor can you if it is in a shed you go into.

If you have to boom spray, use air induction nozzles and an adjuvant (helper) such as BB7 from Hortigro Ltd, 164 Manukau Rd, Pukekohe 2120, Ph 09 237 1777. Glynn Douglas, 021 273 0473. glynn@hortigro.com which reduces spray drift and acidifies the water to make the sprays last longer if not all used on the day.

Spraying weeds is seldom a final solution, while LimePlus, fertility, earthworms and correct grazing with animals and a spade, usually are.

Most pastures can be farmed without toxic chemical spraying, but I accept that new weedy farms can be a problem, but we fixed two we bought by liming, correct grazing, cultivation and fertilising. Therefore, lengthy details on precautions in using sprays are not necessary here, except to suggest that those of you who do spray read and comply with **ALL** instructions. There have been more disasters than one can list from not complying, such as killing plants some distance away and sprays getting into drinking water troughs (called tanks in USA).

Helicopter spraying has given cows spring eczema because it can spray over animals, the pasture they eat and water troughs. Some farms can have wet-condition weeds (rushes, pennyroyal, buttercup, etc.) growing even on the sides of steep hills, which can be wetter than flats because of soil type, high rainfall and seepage from above and oozing out from behind. One usually associates rushes with wet flats, but they grow on high steep hills around Tauhei, Waikato, because of the soil being a heavy clay. The low part of each hill gets the rain that falls on it, plus what runs down to it and over it and what oozes out from above and behind it, and not enough lime, because they are so steep that the expensive

aerial spreading means that less is applied.

I helped a sharemilker get rid of rushes growing on steep hills by putting spinner drains on a fall across the hill sides and running into the valley. They made grazing in wet weather easier with less pugging, so fewer weeds grew. Heavy rainfall areas need a steeper fall in the contour banks than light rainfall areas. Sandy soils need less fall, to avoid erosion.

When weeds like these on the right grow along drain or ditch banks, or at the foot of hills in wet weather springs areas, don't spray them, pull the banks off with a farm tractor and grader blade and drag the soil to hollows and around gateways, drinking troughs, or just over the paddock as I did above in 1955 on the Tatuanui, Waikato farm I worked on. Look at the difference. If the fence was removed and the same done in the other paddock, there would be no muddy paths and no weeds that can be seen in the left paddock. The mud splashes on to udders making them dirty and more prone to mastitis. The



fence could be erected again with a quarter as many posts, close to the centre of the drain, to stop animals walking in it to satisfy water pollution controllers. Drain banks are breeding grounds for crickets and other soil pests and weeds. Cows grazing into the drain control the weeds. See Drainage.

We controlled even gorse with correct LimePlus without spraying, except under fence lines and in corners. If seeding has occurred for years, seeds will be in soils and they will grow again in open (not dense) or pugged pastures. Don't believe the seven or nine years fallow theory. In the UK, white clover seeds were brought out from dry soils under buildings built a hundred years before, and they germinated.

Electric fencing to contain sheep and/or goats for weed control can be cheaper than machinery and repeated sprayings. Improving fertility and mowing Californian or Canadian thistle in the rain a few times, especially before grazing, killed them and some other weeds on our farms.

Try the cheapest method of weed control first. Based on increased profit from improved pasture growth, LimePlus in element deficient areas is likely to be most profitable. Cultivation can be the most expensive and not solve a weed problem because, if weed seeds are in the soil (and they mostly are), more will then grow. However, weeds can be reduced by forage cropping, and sowing new pasture, provided all cultivation, liming and fertilising conditions are met, so that pastures thrive and reduce weeds growing, and animals eat more weeds, made digestible with LimePlus including OrganiBOR.

Look at the soil to see if it is boggy and therefore needs drainage, or needs more organic matter because it is dry, sandy and/or tight, and/or needs LimePlus, symptoms of which include few earthworms, hard soils with what farmers call hard pans, and no friability, shallow grass and clover roots, and few or no nodules on clover roots. Most hard soils and pans I see are from a lack of LimePlus. See Minerals in Soils, Pasture & Animals > Calcium.

Most bought hay is likely to have some weed seeds, which will grow after feeding the hay on your pasture, especially if they are open. Buying top quality silage is better for the pasture, animals and profit, and doesn't spread weeds. See Silage.

The part at the back of this photo is an unproductive steep sidling on the right shows what happens when animal manure is not returned to soils because animals don't camp on steep slopes. Lime and fertiliser had been spread on it with little benefit, partly because some washes off, but mostly because it needs animal urine and manure to improve pastures. We shaped it to a gentle slope, replaced the topsoil to achieve what is shown below, and put in three shallow spinner V drains 30 m apart from the foot of the hill to the road drain, to tap wet-weather springs. The weeds shown on the right changed to the pasture below.

You might question the cost, but the finished job below was where the right weed photo was taken. The dry matter yield was only a tenth as much as the steep part. The bulldozer and resowing cost were recouped in one to two years, which is an excellent return. If farmers measured the poor growth of slopes that can be eased, they would do so. This depression down the centre is from a spinner drain we put in ten years before this photo, to tap wet weather springs at the foot of the hill.

When we bought this farm in March 84, it was growing lots of weeds like on page 10. The previous owner asked how we grew pasture like on the right, because he couldn't. "Shallow drainage, LimePlus, chisel ploughing, spreading *Caliginosa* earthworms and controlled grazing, from 106 one hectare paddocks," we replied.

On some dairy farms, an effluent irrigator can be set to run along the top and bottoms of steep slopes.

In correctly managed pastures, animals will eat many weeds without harm when they are in a young tender growing stage, including some slightly toxic plants, as long as there is enough good pasture. Except for a few deadly poisonous plants, poisoning usually occurs when too much is consumed, or in some species only when flowering. Even forage crops such as Pasja can be toxic when flowering. Variety, little and often, and avoiding excesses of any one helps. Too much clover, or high nitrates in ryegrasses in particular can kill very quickly. Also, avoid animals getting so hungry that they eat anything, especially on an empty stomach. Toxic plants such as Cape weed (high nitrates) eaten on a full stomach in the afternoon can be no problem, but can be fatal in the morning on an empty stomach. See Animal Health > Nitrates.

Jared Seymour of Atiamuri smoothed the small terraces on the left, caused by grazing animals, to be as on the right. He used a bulldozer going up and down, and achieved a big increase in pasture production, with fewer weeds.



Using Animal control

Using animals to control weeds, while improving pastures and making a profit from the animals, doesn't mean forcing the animals to eat weeds by starving them.

There are many plants called 'weeds', however in grazed pastures they are often not a problem. In fact some can add to even a good pasture, by providing the deep rooting benefits of growing when conditions are too dry for normal pasture grasses and clovers, and supplying minerals from subsoils. Dandelions, docks and plantains are examples. More productive plantains have been developed from the weeds to include in pasture mixes where appropriate. The high yielding Puna chicory was developed

from the chicory weed, which is still banned in some countries and some USA States.

The best weed control is to get a dense lush pasture growing, so that weeds are less inclined to germinate, and the edible ones that do grow are gladly eaten by the animals to go with the lush pasture. Some get tired of ryegrass with its high endophyte. Some farms applying repeated urea have nothing but ryegrass and farmers wonder why their cows are not as healthy as they should be, so have ryegrass staggers, and are not as productive.

I've seen thistle seeds arrive in the wind and sit on top of dense pastures, and then be eaten by grazing animals. If the pastures were short and sparse they could have fallen to the ground and germinated.

I've also seen weeds germinate in a good pasture, in an area that was pugged by animals bunched on to a small, area overnight during heavy rain.

Modern pasture species thrive when the fertility is high, whereas many weeds thrive when fertility is low, and/or when things such as drainage, acidity or grazing are wrong, and allow selective grazing, which means some weeds are not eaten.

Typical of the challenges of farming, there are some weeds which thrive under high fertility, such as docks and Chickweed.

Goat farmers have few problems with most weeds, but goats don't like the buttercup family. Cattle farmers, who run a few goats with or after the herd, have only to control the very few weed types that goats won't eat. Goats seldom eat thistles to the ground, but love thistle flowers, so they prevent seeding, provided they are set stocked or on a fast rotation. Sheep are also good weed eaters, and can be used to control weeds not palatable to cattle. A few cattle can help control weeds on goat farms by eating the whole plant down to the ground.

When using grazing to control small buttercups (provided they are not the highly toxic ones) and similar edible weeds, give the grazing animals an area that is about a third of what they would normally get. They should then eat everything, thinking that it is all they're going to get. When adequately chewed down, give them the rest. Don't wait any longer than necessary or animal production will be down on that day. Next time they come to that paddock, give them the next third only, and so on. You can't do this every day or they'll learn to wait. Goats learn very quickly and don't like buttercups anyway, so might just come back to the gate and send out a chorus.

Don't over-graze or mow too short. One short grazing or mowing in spring and one in autumn should not do harm, but one when wet, causing pugging, or one during hot and dry conditions, can open up pastures and create bare patches where weeds can grow.

Grazing rotations of ten to fourteen days in spring and 21 to 28 days in summer would be better, giving animals a new paddock or block every day, making animals graze all the pasture and eat the edible weeds each time.

Graze and top (clip) to prevent weeds from seeding.

Regularly oversowing where required, help keep pastures thick and any bare patches covered.

Buying clean pasture seed and preventing weeds from seeding are major controllers of weeds.

Using herbicides is treating the condition rather than the cause, and is something to be avoided in farming and in life, because of the ill-effects most herbicides have on clovers, soils, humans and animals. I have seen many cases where weeds have germinated more thickly after spraying had depressed clovers and opened up the pasture. Adjacent pastures where the weeds were not sprayed but grubbed (dug out) have been freer of weeds, more dense and more productive. This does not apply to heavy, mature infestations of gorse, ragwort, buttercup, Californian thistles (Canadian or creeping thistle), and others, but these problems are rare on well grazed pastures. Rather than spray, mow the weeds, or use a rotowiper which applies herbicide on the protruding weeds without damaging clovers, and is less likely to cause spray drift. Do it a few days after grazing, after the weeds have stood up again and freshened to absorb the herbicide, but the pasture is still short.

Farmers have achieved success in reducing docks by subsoiling hard compact soils, but not Hamilton clay loam which then grows more weeds in the cracks.

As I've written so many times, do comparative trials before doing too much. Many old time farmers, who didn't have access to subsoilers, aerators, etc. placed much more emphasis on soil conditions and encouraged earthworms to do the aerating and softening. Air then enters the soil and gives it some of the 80% nitrogen it contains.

Not all herbicides and chemicals affect earthworms. Grazon applied many times to a lawn, to control

Poa, clover, oxalis and all weeds, had no effect on earthworm numbers, to the regret of a lawn manager. I used Grazon with the same amount of Codacide on half the compost, soil and grass in earthworm breeding areas, and it had no ill effects on them. The safety instructions are the same on much stronger sprays and are to protect the manufacturer's back.

Thistles, ragwort, buttercups, willow weed (needs perfect drainage), chickweed and even gorse seedlings have been controlled by overall management (draining, fencing, liming, fertilising, grazing, earthworms, and a long handle shovel to turn large weeds upside down) without spraying.

Mowing Weeds

In all cases, prevent weeds from seeding. This may require mowing before grazing or harvesting as silage, but not as hay, which will spread them.

Californian (called Canadian in USA) thistles are not normally eaten when standing, but when young, mowing and wilting makes them palatable so they will be eaten willingly. Allow them to wilt slightly before putting the animals in the paddock. These cows are eating topped ones.

DairyNZ wrote in their Newsletter 2 in November 2011, "We have discovered that mowing Californian thistle during rain improves the level of control by 30%." Big deal. Some of us have known since the 1960s that mowing them in the rain kills some of them and that liming adequately thickens pastures and increases earthworm numbers, both of which reduce weed germination, and flies and parasites so calves don't need drenching. See Minerals in Soils, Pasture & Animals > Calcium.



A Ruakura scientist ran a field day on Scott Farm in 2011 to show the benefits of lower sowing rates in pastures, something I had been telling **him** and others since 1960. It took the same scientist 30 years to learn that oversowing was better than drilling which costs 20 times more. From the 1960s Ruakura drilled three quarters of their farm every autumn, when we and my clients oversowed some, but drilled none and had better pastures.

Suffering soils

Julius Caesar declared earthworms a protected species, however now they are killed with sprays, by high and repeated rates of superphosphate, potash and urea, but are not too adversely affected by correct amounts, provided lime and its synergisms are applied. Pugging or even heavy stocking in wet conditions sealing off the surface of soils kills earthworms. Check under the soil two days after pugging and you'll see the dead earthworms, so soils then suffer. The misinformation in recent decades causing farmers to swing away from liming has decreased earthworm numbers and organic matter content of soils, increased the percentage of weeds in pastures, decreased pasture yields and shortening the life of pastures. Some then blame the new ryegrasses, when it is mostly a lack of lime and its synergisms. See Minerals in Soils, Pasture & Animals > Calcium.

Grubbing the occasional plant is far better than spraying it, because I have never seen a plant regrow when turned upside down, whereas many do after spraying, and sometimes large areas of pasture around spot sprayed weeds from a tractor are killed, which encourages further germination of weeds in the dead bare patches.

Blanket weed spraying is expensive and lowers pasture production by knocking clovers and eliminating deep rooting weeds, which are usually higher in minerals than ryegrass, and are eaten in surprising amounts.

Some weeds thrive in the adverse conditions created by bad farming practices such as using chemicals rather than correcting the cause. Examples are docks liking compact fertile soils, and Chickweed liking acid surface conditions.

If a herbicide has been used, and you are not sure whether its effects are still in the soil, thus reducing germination, check it by sowing a patch of seed, either in the paddock - or in a bucket of the soil - without mixing or turning it over. Apply a minimum of moisture, enough to achieve germination, but not dilute the herbicide.

Spraying failures

Don't apply weed killers until conditions for growing good pastures have been fixed. Use wipers rather than sprayers.

Failures in killing weeds with herbicides are frequent. Reasons usually include -

Insufficient water used to give a complete coverage.

Insufficient chemical used. Using an adjuvant reduces the amount of chemical required.

Hard water (use a adjuvant or at least a softener with all waters).

Rain too soon after application.

Wrong herbicide.

Weeds too mature. Once seeding, most weeds are much harder to kill.

Plants not actively growing.

Drought stressed plants stop moving sap up and down, so don't move herbicides down.

For good kills, the pH of the water should be no higher than 4.

Application in the heat of the day instead of in the morning or evening, when the leaf stomatas are open to absorb the chemical. They close when hot to reduce moisture loss from the leaves.

Dairy farmers may find spraying early or late in the day hard to achieve, but paying someone is cheaper than having a failure.

Spray resistance

Glyphosate has been used since about 1980, but reports from Australia indicate that some grasses are becoming resistant to it, including a ryegrass, which is understandable, because in nature there are usually survivors which then propagate. There were apparently over a dozen weeds in 2004 with some level of glyphosate tolerance.

The creeping grasses such as Kikuyu, Couch grass, Indian Doab, Bermuda Grass, Dubo, Dog's Tooth Grass, Bahama Grass, Devil's Grass, Twitch, Paspalum distichum (Mercer grass or St Augustine in USA), Pangola, Para, Star grass, etc., can form a dense mass of roots and be difficult to kill with glyphosate, especially if not growing, or if there are insufficient leaves to absorb the spray. They may need nine litres of glyphosate per hectare, sprayed on to about two weeks' growth. It can take nine to twelve weeks and a second spraying for these types of grasses to die. Many spread from drains and lanes, so keep these clean and avoid animals grazing the seed heads or spreading them from their coats across paddocks. This spreading by eaten seeds also applies to other weeds, such as willow weed and black jacks.

Growing a dense vigorous forage crop, such as Pasja with Japanese millet, or Nutrifeed in warmer areas, can help smother weeds, but another spraying may be necessary in the autumn. Translocation herbicides (not desiccants) kill best in autumn, when they move down to the root system much better.

Care with sprays

When using sprays remember that they are killers, so use protective clothing, avoid wind, and keep people away, especially children and pregnant women. Immediately after finishing spraying, blow your nose, wash and change clothes, have a cool shower so that your pores don't open to absorb spray, rather than having a bath which could inadvertently result in soaking in spray residue, and wash your lips then rinse out your mouth several times without swallowing any. You are likely to be thirsty so have a drink of plenty of water to dilute any spray still on your lips or in your mouth. There are many sick people thanks to abusing chemicals - don't join them.

Modern sprays are more efficient at killing weeds and are more powerful, so be careful.

Crops have been accidentally damaged by a herbicide. Weeds in a block of land a few kilometres away from a vineyard had been sprayed with this herbicide, and shortly afterwards heavy rain caused residues of the spray to enter the irrigation canal from which the vineyard drew its water. In spite of being heavily diluted from the original application rate, and only being present for a short time, the residues were sufficient to cause significant damage to the irrigated grape vines.

Sulfonylurea herbicides can be used at the extremely low rates of g/ha, rather than kg/ha as with some older herbicides, and they have low toxicity for mammals, some considering them less toxic to mammals than ordinary table salt. However, their strength means that only a minute trace of a sulfonylurea herbicide can damage crops.

If new pastures have to be sprayed for weeds such as land cress, to prevent milk tainting, then use

MCPB, which doesn't damage clovers, but does slow their growth. Spray once there is 75% ground cover and the clover has three main leaves, usually after the first grazing, which should be about five or six weeks after sowing. Leaving it until later uses more spray and kills fewer weeds. If left for too long a stronger spray may be needed.

In established pastures it is better to look at the cause of weed infestation, and cure that, rather than spray the weeds and leave open gaps for further weed infestation, and possibly adversely affect the pasture, soil and animal health in the process.

Tips on applying

Wipe rather than spray. Brush killer type herbicides work well on older plants through a rotowiper - don't use them to boom spray pastures, because everything will be killed.

Wear the best safety gear covering as much of your body as possible.

Wear a broad rimmed hat to reduce sprays from settling on your ears.

Don't smoke, eat or drink while spraying or before washing.

An adjuvant (helps things work) such as Codacide or BB7 vegetable oil, should be put into the measurer before the spray, swilled around to cover the inside surface. Then add the spray and mix before adding it to the water. This halves the amount of some sprays needed. It makes sprays go twice as far, slows evaporation and makes hormones less volatile (operators smell the hormone less, so are less affected by it), so reduces spray drift. It also improves droplet spread and coverage. With an adjuvant you must use less spray of any kind, or the improved spread can burn plants which reduces translocation to the roots. If it rains soon after spraying, good adjuvants hold the spray on the leaves.

Spray on calm days and work into any breeze, not with it. When hand spraying walk backwards into a light breeze.

If using a hand wand, make sure that it is a long one so you are far from the nozzle.

Ensure that animals don't get into the sprayed paddocks for a few days (the exact time varies with herbicides and weeds). Play safe rather than sorry. Some animals are attracted to the sprayed plants so eat sprayed poisonous plants such as ragwort, with fatal results.

It is an offence to spray in windy conditions and to adversely affect neighbours in any way.

Some herbicides are non-volatile, so safer to use than volatile ones, and some cause no long term soil damage, being gone from the soil in two to 40 days. Some, however, last in the soil for many months, adversely affecting clover growth. Some kill seeds in mature flowers, but not mature seeds. The prices vary by up to 300%, so shop around.

If you have to spray, use the suggestions above.

Small farmers may not be able to justify owning a rotowiper, especially if a local contractor has one, but don't assume that all contractors know all about weed control. Contractors are busy people and are frequently held up by weather. Don't let their being late or rushing your job cost you a failure. Discuss everything about the job and monitor the operation.

Washing equipment

After using hormones, desiccants, or similar in spray equipment, and planning to use it with other products such as liquid fertilisers, wash all equipment thoroughly with a litre of household ammonia per 100 litres of water, filling the container to cover all surfaces. Then spray it out through the nozzles and do the same again with clean water.

Weed Species

This Weeds chapter is 30 pages which is too long. More photos would increase it.

Photos of most weeds can be seen by Googling for the weeds name + photos"

For example Googling for Thorn apple weed, gets this. Without adding "weed" gets apple trees as well. Click this.

http://www.google.co.nz/images?client=safari&rls=en&q=thorn+apple&oe=UTF-8&redir_esc=&um=1&ie=UTF-8&source=univ&sa=X&ei=aoZ5TafcKIOLrQGyp8iABg&ved=0CE4QsAQ&biw=1258&bih=1261

Alligator weed (*Alternanthera philoxeroides*)

This is one of the world's worst weeds, originating in South America and found in slow moving and

stationary waters, forming a thick mat of roots and stems in many countries. It has a hollow purplish stem up to 1 cm diameter. It flowers from January to March in the southern hemisphere, but spreads more by pieces attached to machinery. It can block rivers and is difficult to control. A 2 mm thrip attacks it and has been imported from its home in South America into some countries.



These photos and information are from Buckingham, G.R. (1994) Biological control of aquatic weeds. The Alligator weed flea beetle



Alligator weed in lawn is 4 to 6 mm long and the larvae grows to 6 mm long. It is a parasite that is so successful that it is often used as the symbol of biological weed control.

Within four years, alligator weed like this was practically eliminated at the two northern Florida, USA sites where the flea beetle was first introduced.

For information on Biological Weed Control using insects

If Alligator weed is seen in New Zealand, phone 0800-246-732. NZ Environmental bodies are responsible for controlling it.

Amaranthus

Amaranthus (Redroot) should be controlled because of its toxic nitrate levels and the severe kidney damage it can cause. See Nitrates. Frequently a crop is blamed for adversely affecting animals when it is not the crop, but a weed such as Amaranthus, which can kill within a few hours.



Some crops, especially in the reproductive (flowering) stage, fast growing period, especially in cloudy conditions, and some weeds like Amaranthus (Red Root or Red Shank) can have 12,000 ppm (12%). Even 1,000 is too much. If an animal likes Amaranthus and selects it when grazing a crop, it can die within hours.

Never allow the brassica Pasja to flower before grazing, because the nitrate levels increase to dangerous levels when in the reproductive stage. If grazed correctly, flowering will not occur, however early spring sown Pasja can shoot to flower and seed quickly if a cold spell makes it think that winter has arrived. Graze it immediately, even if the feed is not required.

Plants can be toxic in the early morning and safe on a sunny afternoon, so aim to graze and harvest in the afternoon when levels are lower. Nitrate levels are higher in the mornings and after cloudy days, so graze all suspect species in the afternoons.

Pasja, being a brassica, is a milk tainting crop, so graze it after the afternoon milking and not before any milkings.

Blackberry, also called Bramble (*Rubus fruticosus Linnaeus*)

There are many varieties.

Birds, foxes, and other animals that eat them, spread the seeds (about 70 in each berry), so to get rid of blackberries all of them in the area must be eliminated.

Roots, sprigs and slashed stems can grow.

Cutting in any way won't kill them. Plants have to be sprayed, dug out roots and all, or thoroughly cultivated.

Australia has 7 million hectares of blackberries which are designated noxious throughout the whole country, so landowners are required to control them. Check with your local council or state/territory government agency about its requirements. The Australian CSIRO is looking into more effective biological controls.

Existing biological control, particularly on large, inaccessible infestations of blackberry helps, but

doesn't kill it. The blackberry leaf rust *Phragmidium violaceum*, which attacks the leaves, is now present throughout all areas of southern Australia where blackberries are a problem. It affects the leaves and can also grow on flowers, unripe fruit and young canes. The rust is harmless to native *Rubus* species and varieties of commercial raspberry and brambleberry such as loganberry, boysenberry and youngberry. The rust alone will not eradicate blackberry but it slows its rate of spread and allows more time for control by other means. The rust appears as purple-brown blotches, 2–3 mm in diameter, on the upper surface of the leaf. Corresponding powdery yellow or sticky black pustules of spores appear on the leaf's lower surface. Epidemics of rust caused by summer spores initially kill leaves in summer and autumn, forcing the plants to grow new leaves, which in turn are attacked by the rust. Rust epidemics result in fewer fruit and seeds, shorter canes and fewer new plants. This continuous attack on the leaves weakens plants by depleting root reserves. Light can start penetrating the thicket, which helps re-vegetation by other plants, especially in autumn and winter. Competing plants can then grow through the blackberry and in turn limit its growth by shading. The blackberry rust has been so effective in the Gippsland region of Victoria that farmers complained about having to re-do their fencing when blackberry hedges fell down! However, the rust seems to be severe only in regions where the annual rainfall is greater than 800 mm and the average daily maximum temperature in summer is at least 20°C.

Applying herbicides to plants stressed by drought, cold or heat can decrease effectiveness.

If spraying is not an option, large areas should be cultivated, small areas and plants under hedges and fences dug out, and drain banks pulled off with a tractor and blade and spread.

Bristle Grass or Yellow Bristle Grass (*Setaria pumila*) and similar grasses

These are frost tender summer annuals that arrived in NZ in early 1900 and are recognisable by the upright plants having red base stems like ryegrass. It is common in most countries and has increased in Taranaki and Waikato since early 2000 and has caused a small dairy farmer to give up dairying and sell the farm. It spreads by every method - wind, water, birds, animals, machinery, especially councils mowing roadsides. The barbed, bristle shaped seed heads attach and spread. Animals eat the seed and it spreads from the subsequent dung.

A selective weed killer is being worked on, but Grazon at the correct strength kills it, and everything else except ryegrass. See Gardens > Lawns. The photo on the above right shows it seeding on a roadside. The next one shows its seeds. It can be sown in many ways such as roadside mowers or down the road in water, in which case spray it with Grazon or it will spread seeds over your farm.

I saw a single plant that looked as if it had arrived in maize seed, but it can germinate after 8 years in mouldboard ploughed paddocks bringing it up.

Buddleja is a curse in forests, so should be controlled.

A similar grass with a red base is Smooth Witch grass (*Panicum dichotomiflorum*), but its dark red/brown coloured base is longer and grows horizontally, unless dense.

Buttercup (*Ranunculus*)

There are about 400 varieties of *Ranunculus*. There are perennials, annuals and biennials, some of which are poisonous in varying degrees. Ask your vet if toxicity has occurred in your area. Eating a little of safe ones should not cause a problem, but too much, especially *Ranunculus sceleratus*, can cause blistering of the skin and allergic reactions in humans.

Some buttercups are poisonous because they contain a compound called protoanemonin, which is a powerful irritant, causing inflammation or ulceration of the mouth, often with soreness, increased salivation and sometimes colic. However this usually causes horses to stop eating them, although it is always advisable to contact your vet in case the cause is something else.

Like many toxins, a little with other feed may do little or no harm.

Animals can be susceptible to poisoning from SOME not all buttercup plants. Cattle are the most often affected. Animals froth at the mouth, scour, have gastric irritation, abdominal pain, diarrhoea with black faeces and muscular trembling and eczema. Twitching of the ear and head muscles extends into a general nervousness and paralysis. Acute deaths can occur in sheep, while pigs may become prostrate and remain paralysed for two to three days before dying.

Leaves cause mouth irritation and blistering, minutes to a few hours after eating, followed by increased salivation. Eating can cause abdominal pain, vomiting and diarrhoea. Large amounts cause

dizziness, delirium, tremors and convulsions, and can cause kidney damage, excessive urine production and blood in urine. Milk production drops and milk is bitter and can be tinted red. Sheep may suddenly collapse. Animals worst affected are ones that were hungry and just arrived on a farm after transport, so keep all hungry animals away from toxic plants, and aim to keep the toxic ones out of silage. Some buttercups are only very slightly toxic when grazed or cut and fed.

Some stock will eat some buttercups without problems, whereas the giant buttercup is seldom eaten. Some young buttercups will be eaten safely even by horses under controlled grazing, but old buttercup plants are seldom eaten by any animals.

Sheep, which quite often prefer weeds to pasture, can be the worst affected, sometimes within a few hours of eating toxic ones; however, sheep control most buttercup, so it seldom increases on sheep farms in quantities enough to cause a problem.

Most have yellow flowers, but some are white. Types include -

Bulbous Buttercup (*Ranunculus bulbosus*). It is upright with a bulb. Its flowers are the most toxic part. The bulbs have been harmful in autumn and winter.

Celery-leaved Buttercup (*Ranunculus sceleratus*). It has hairless celery shaped leaves, hollow stems, an erect annual growing to 300 mm or more with a tap root, growing in damp places. It is poisonous, more so to cattle, but not eaten in excess because of its taste, unless the animal has a craving or needs something green.

Creeping Buttercup (*Ranunculus repens*) is a hairy, creeping perennial rooting at the nodes with flowers over 12 mm diameter. It is poisonous to sheep.

Giant Buttercup (*Ranunculus acris*) has large variegated leaves, is unpalatable, hard to control and can be toxic.

Floating Buttercup (*Ranunculus fluitans*) has white petals and floats on water.

Hairy Buttercup (*Ranunculus sardous*) is an annual with long sparse leaves and is upright with no bulb.

Small-flowered Buttercup (*Ranunculus parviflorus*) is a hairy annual or biennial with three to five petals on small 5 mm flowers.

Spearwort Buttercup (*Ranunculus flammula*) has spear-like narrow leaves, growing vertically with small flowers.

See the weed websites at the end of this chapter.

Remember that LimePlus (Lime and synergisms - needed trace elements) make buttercups so palatable that animals will eat them, but not all, when there are a lot.

Control

A lack of LimePlus, poor drainage, pugging and over-grazing increase buttercup, and sheep decrease them. Goats avoid them.

There are now selective weed killers which control buttercup (and Chickweed and docks) without damaging clovers. Seedlings in new grass and in badly infested pastures should be sprayed in early winter. If snow covered, then spring will be best to get the seedlings. RotoWipers are good at controlling buttercup because they wipe the hormone on to the weeds, so there is no spray drift or killing of legumes. Use it a few days after grazing, when the weeds are standing up again above the pasture, so that the legumes are not badly affected. Drive around the Waikato and you'll see clean farms because they were limed, right next to buttercup covered farms because were not limed sufficiently.

Cape Weed or Cape Dandelion (*Actotheca calendula*)

An annual that starts prostrate (flat) and grows up to 25 cm high with yellow rosette daisy-type flowers. Seeds have a woolly surround. Where Capeweed is a majority of the pasture, prolonged grazing can cause high nitrate levels and death which killed 140 cows and abortions in a 1,200 cow herd in Victoria, Australia, in June 2007. Like some others, the nitrate level is highest in the morning and in autumn when flowering. See Animal Health > Nitrates. It can also taint milk.

Chickweed

Chickweed dislikes calcium, but likes fertile soils with a high organic matter content near the surface. Liming decomposes thatch, encourages earthworms to take the organic matter down, so helps reduce Chickweed and improves soils.

Like some other plants, Chickweed generates its own conditions by increasing the levels of organic matter on the soil surface, which then makes the surface acid and deters the germination and growth of good pasture species.

The best way of reducing Chickweed is applying the correct amount of lime on a regular basis. If pasture calcium levels are already high (over 0.9% in ryegrass), apply little and often, and the correct soil trace minerals measured in pasture, both of which encourage earthworms. These then reduce the amount of dead material on the surface, which in turn discourages Chickweed and encourages the germination of grasses and clovers to compete with the Chickweed. Mob stocking and even pugging may be necessary to reduce it.

Intensive grazing discourages Chickweed, while lax grazing and over fertile areas, as occur near trees, gateways and where horses and Alpacas drop their manure repeatedly, encourage it. Well-fed dairy goats ignore it. Cattle can be made to eat it. If too much Chickweed is consumed it can be toxic to animals.

If you inherit a mess and can't get rid of Chickweed by managing, limeing, and cultivating the patches and resowing them, use Preside, or another weed killer that controls Chickweed (and Buttercup) without damaging clovers. I hate recommending sprays, but that's life.



Chilean Needle grass

This, on the right arrived in New Zealand in about 2007 and has been declared noxious, but council roadside mowers are spreading it, after which it spreads over farms. A 40 ha vet's Waikato farm was sold because it became covered in it. Be careful what land you buy.

Creeping Grasses

Kikuyu, Indian Doab, Bermuda Grass, Dubo, Dog's Tooth Grass, Bahama Grass, Devil's Grass, Arugampul, Grama, Star Grass, Scutch Grass and Quack Grass. Some are called Couch grass, and smaller finer ones Twitch grass.

They are all similar in nature and similar in control. Most farmers use Roundup (Glyphosate), but since the 1990s I have been using, and still recommend, Grazon, that kills everything except ryegrass (unless very strong), and is safer. Glyphosates have been banned in some countries and along waterways in Australia because it is now in their underground water. The manufacturers and some sales people have claimed that it becomes inert, dead or safe once it reaches the soil, which is completely untrue, and Monsanto know it.

This large leafed Couch creeping grass weed has three runner roots shown, and swamps out clovers (it stops clovers making their own N) and good grasses, especially in moist soils. A lack of lime is indicated by soil stuck to the two earthworms in this photo of couch and its roots, and low fertility, which increases couch's ability to suppress high fertility species such as ryegrasses and clovers. It should be sprayed with Grazon which at correct rates doesn't kill ryegrass and BB7 (Adjuvant spreader. See Gardens > Lawns) to eliminate it all on every farm. Spot



spray it twice before cropping because cultivation spreads it. Couch grass, in the centre of this photograph, is becoming one of the worst weeds in the South Auckland area, and should be treated like vermin. If not controlled it can become a major problem by killing clovers and being unpalatable, reducing animal production, so keep watching for it. A few plants are best dug out and left to die in the sun somewhere safe. If spraying has to be resorted to, best results are achieved on shorter rather than on longer Couch, and in autumn rather than spring, but quite often both are needed because it takes two sprayings.

Couch should also be controlled along lanes and drains, because it spreads by roots in hooves and by

animals eating the seeds. Check your implements when you leave paddocks with couch. It has been spread in maize paddocks to such an extent that every maize paddock I checked between Hamilton and Ngatea in 2014, had it, but more around the edges, than right across the paddocks, so it could have come in from the roads, so spread by seed wash, and mowings.

At least two farmers have sold their farms and moved off because Couch had covered them, and farmers with experience of Couch avoid buying properties which have it, because it is so hard to control. I stopped a client buying a farm because most paddocks had about 10% of couch.

Spraying with products such a glyphosate seldom kills it all, especially if the pH of the water is neutral (Use Codacide to acidify it and to make it go twice as far and reduce drift), and/or sprayed twice within a few weeks of each other. After the second spraying, the paddock should be chisel ploughed reasonably deeply, to bring up subsoil, deepen the topsoil, and create good conditions for thick dense clover based pasture, especially the clovers (see Soils > Cultivation), to suppress the ingress of couch. If not killed completely before cultivating, the roots will be spread around the paddock and create a bigger problem.

Crowsfoot (*Eleusine indica*)

Crowsfoot grass (also goosegrass) is a tufted, hairless annual with a very strong fibrous root system which can reach 50 cm in height. Stems can form a mat, but they do not take root at the nodes. Leaves are shiny and hair free. It dominates in thin, open turf when subject to heavy traffic and is troublesome on golf tees, fairways and sporting fields.

Cudweed (*Gnaphalium spp*)

They are annual or short lived perennials with grey-green woolly hairy leaves, or with no hairs on the upper surface, depending on the variety.

Dandelions (*Taraxacum officinale*)

These are not weeds as far as pastures and grazing are concerned, because animals love them and they disappear under good management; however, if there are more than one per ten m², it shows a lack of lime or that the paddock has been pugged and not oversown. Flowers are yellow. See both Herbs and Pasture Analysis.

Daisies

There are many kinds. Avoid over grazing and mowing too short. Keep pastures well fed and dense. If not controlled by spraying the thick areas with a safe spray like Grazon (See Gardens > Lawns.) and pulling sparse areas, they can take over farms, especially under poor fertilising and over grazing. Prevent seeding.



Daisy *Bellis perennis*

A common dwarf daisy that grows to 20 cm high and spreads as a weed across lawns and uncultivated areas. It is not acid or alkali sensitive.

Oxeye daisy (*Chrysanthemum*)

This is noxious in some USA States. It has a medium un-branched stem with one flower of white petals around a yellow centre, in spring.

Docks (*Rumex spp*)

These are mostly erect growing perennials; however there is a prostrate one that spreads via an underground root system. Male and female flowers are on separate plants.

Large or broad leafed dock (*Rumex obtusifolius*) is the most common dock in pastures. It has long brown/green leaves. Large or broad leafed docks can be a nuisance in fertile soils, but are easy to control. They fall into the category of Edible Weeds so should not be sprayed with weed killer unless more than 50% of the pasture is docks, but should be controlled with grazing, mowing and fertilising management. If docks are kept short, beef and dairy cattle will eat them with the grasses and legumes, but if the percentage of docks is high (say more than 50%), animals will spend more time seeking the legumes and grasses and ignore the docks. In these cases mowing may encourage some to be eaten.

Otherwise use selective spraying, or fine rotary hoeing to chop the roots into small pieces, then chisel plough. If cultivating is done, try to do it when seeds are germinating (warm, moist weather), and harrow the cultivated soil to encourage germination over a month or more, to get rid of as many as possible.

Farming practices that have reduced dock numbers include -

1. Adequate LimePlus to encourage dense pasture and soft soils, but don't apply lime if the pasture calcium level is already high.
2. Encouraging earthworms to keep the soil loose.
3. If necessary a year after liming, subsoiling to make the soil less compact.
4. Not allowing them to seed, and not making hay from paddocks where docks are seeding. Either mow the hay before any seed has set, or make silage in those paddocks. If the docks are already large before closing the paddock for hay they will be seeding by harvest time. To prevent this, mow the docks before closing the paddock for hay.
5. Increasing earthworm numbers to 40 per spade spit. Urea, superphosphate and some sprays reduce earthworm numbers.
6. Earthworms are gregarious so become inbred. Moving some around paddocks and farms overcomes the inbreeding, so numbers increase.
7. They eat weed seeds.

Tania Fernyhough, a dairy farmer at Walton, Waikato, wrote, "I had never heard this from anyone else. It was like a light bulb flashing on for the control of some weeds. Our earthworm numbers are up and weeds are down.

"Our two weed covered farms changed to almost no weeds after only a few years of correct farming."

If bought hay contains docks, or other bad weed seeds, it should be fed in barns in the Northern Hemisphere and the animal manure should be composted for a long time in earthworm full compost so everything is eaten by earthworms, so ground up. See Soils > Earthworms. Agricultural lime, or better still LimePlus, should be added to speed decomposition and to encourage earthworms, which should be added if necessary. Alternatively the weedy hay should be fed on paddocks that don't matter, or already have the same weeds, for two days after eating the weedy hay.

Ferns or Bracken

Ferns prefer acid soils. It is known that bracken fern contains chemicals that cause cancer, and some can kill animals so should not be eaten at all. They poison cattle when there is a shortage of other feed, so animals eat too much fern. It damages blood cells and destroys thiamine (Vitamin B1). Cattle can develop internal bleeding and horses lose co-ordination.

Pteridium aquilinum fern has a toxic chemical that killed 600 cattle on government land in Japan in about 2007. Cultivation gets rid of it, and adequate fertility with controlled grazing keeps it out.

Fat Hen (*Chenopodium album*)

An annual erect plant with grey/green leaves growing to about one metre is a problem in waste land, crops and gardens. A few plants can be pulled out. More can be cultivated in.

Fleabane (*Conyza spp.*)

Native to warm areas of USA, Fleabane is an annual summer growing weed prevalent in all of Australia and New Zealand where it is also called Australian Fire Weed. A few plants can be pulled out. More can be cultivated in. It likes warm areas so can thrive on a sunny slope and not grow on cold shady slopes. Our second farm on which the two previous owners had gone broke, had it, but after 6,000 kg of lime per hectare chisel ploughed in with 800 kg per hectare of fertiliser mix chisel ploughed in, and controlled grazing, it ceased growing, as did rushes, willow weed Pennyroyal, Buttercup, Yarrow and others.



Foxtail African feather grass (*Pennisetum macrourum*), first recorded in New Zealand in the early 1900s, it is also in parts of USA. It is a perennial grass that prefers damp areas. In New Zealand it

is noxious, so contact Biosecurity Plant Pest Contractor regarding eradication.

Most farmers haven't heard of the various foxtails and how dangerous they can be to dogs. They are grass-like weeds that resemble the tails of foxes. Some are annuals. The seeds of the drying or dried grasses detach from the plant and stick to a person's clothes or an animal's hair. They can easily become lodged between a dog's toes, in its ears, and in its eyes. Since the seeds are barbed like a fish hook, they can be very difficult to remove. Once embedded, foxtail seeds cause severe infections and abscesses. It's seed can cause an inflamed, painful, infected lump anywhere on an animal's body. A dog with a foxtail seed in its ear might rub its head on the ground or shake its head violently from side to side. If a dog gets a foxtail seed in its eye, it might squint. The eye will water and the dog will paw at it. Even if you can clearly see the seed beneath the eyelid, do not attempt to remove it. Get the dog to a veterinarian immediately.



Depending on the location of the seed or seeds, other symptoms are compulsive licking and biting at a paw or around the groin or rectal area or whining and crying with no obvious or acute injury.

In addition to causing pain and localised infections, foxtail seeds can migrate and lodge in the spine, in the lungs and in other internal organs. They enter through the nose, ears, paws, eyes, urethra or just through the skin and travel through the body. The seeds are very small, making locating them a painful, difficult and expensive procedure. Depending on where a foxtail seed has travelled to inside a dog, it can even be life threatening and will require prompt surgical removal.

An inhaled foxtail seed which has lodged in the nasal cavity may cause violent sneezing, sometimes with a bloody discharge from the nostrils. To remove it, a veterinarian may need to sedate the animal, locate the seed with a scope, and remove it with a forceps.

Swallowed foxtail seeds lodged in the throat will cause symptoms of an inflamed, sore throat. A dog will swallow repeatedly, gulp, cough and gag. Even if the barbed seeds can be detected on examination, the dog will need to be sedated to relax the throat muscles so a veterinarian can grasp the seeds and remove them.

If you live in an area where foxtails grow, remove weeds from your yard. Keep your dog away from grassy weeds when walking, hiking or hunting. Discourage your dogs from chewing on grasses.

If your dog has been in an area possibly infested with foxtails - examine it daily. Carefully brush its hair, while feeling for any raised areas on its skin. Check inside and under its ears, between the toes, under the armpits and in the groin areas. Keep long haired and thick coated breeds especially well-groomed. If you see a foxtail seed sticking in the dog's skin, carefully pull it straight out, making sure not to break it off.

If you think a seed might already be embedded in the skin, in a paw, in an eye or an ear, or if a dog who has been eating grass seems to have a throat problem, get the dog to a veterinarian smartly. Waiting makes it harder to find, allows it to move and become more dangerous, and makes treatment more difficult.

Eradication is difficult. Dig up and destroy the first ones seen and prevent seeding. Grubbing or spot spraying with Grazon may be necessary where it has seeded. See Gardens > Lawns.

Gorse (*Ulex europaeus* L.)

Gorse is a prickly, perennial, evergreen legume that grows to about 3 metres by 3 metres with deep roots that access moisture at low depths. Stems and leaves have a sharp spine, making plants impenetrable to animals and unpalatable to all stock except goats, although when young even calves will eat it with lush pasture.

The flowers are primarily pollinated by bees to grow vast numbers of dark brown seeds, approximately 4 mm long in grey, hairy pods of three to five seeds. It is a native of Europe, where it is widespread, but causes few problems as a weed, whereas in New Zealand, to where it was imported in the 1800s to grow on the poor acid soils for grazing sheep, it has spread and cost a lot to eradicate.

It is also used as hedges on fences to control animals. See page 2, Controlling Weeds.

When trying to eradicate it, never burn it, because doing so increases germination.

Hieracium

Large areas around Otago in the South Island's semi arid hill and high country, are suffering invasion by the flat weed Hieracium. There are numerous possible causes, including rabbits and

droughts which increase its spread, but four kg/ha of B reduced the Hieracium and had no bad effect on other plants, some of which were not affected by as much as 20 kg/ha. If applied by air on hills, more should be spread to equate it going on at 4 kg per surface area, which ground spreading does, but by air doesn't. Most of this information on Hieracium is from the Proceedings of the New Zealand Grassland Association 56: 169-173 (1994). Google for Hieracium and boron in New Zealand.

Oversowing with Tahora white clover, Alsike clover, Maku lotus, Wana cocksfoot and Massey Basyn Yorkshire fog followed by heavy grazing to trample it in and direct drilling have been successful to date even in very dry seasons.

Horse Nettle (*Solanum carolinense*)

These are a member of the nightshade family. They have yellow berries. Get rid of them, but, as with other weeds, there are likely to be plenty of seeds in the soil, unless you see and get the first one.

When young, animals will graze them without ill effects, so control and prevent seeding this way.

Johnsongrass (*Sorghum halepense*)

This poisonous-when-stressed native of the Mediterranean region has spread to many warm countries by seeds which travel by wind, water, on coats of animals, with other seeds such as maize, and through being eaten and spread in manure. It also spreads by underground rhizomes. It can form a dense mat and smother crops. Watch for it in waste areas, roadsides, crops and pastures.

While some rate this as the world's worst weed, in some countries they grow it for animals. In New Zealand it has been declared a noxious weed. It can spread rapidly and its high cyanide and prussic acid levels make it dangerous to graze when immature and/or stressed. Stress can be caused by high temperatures, drought, damage or frost. Repeated heavy grazing keeps it under control and stops it seeding.



Cattle eat it when short, when it can be more toxic, but refuse it when long.

Land Cress or Twin Cress (*Coronopus didymus*)

This weed is the dairy companies' nightmare, because it taints milk products and its musty flavour can't be removed.

It can grow in lanes, so can be eaten by cows on the way to milking, which is the worst time for milk taint. If eaten straight after milking it may not cause a taint, however it should be eliminated from all dairy farms.

It can come up in newly sown pastures. Spray after at least 75% of the soil is covered with pasture, because soil penetration by the spray can damage pasture roots. Follow the spray instructions exactly. Young pasture plants are susceptible to being killed by some sprays, so wait until the pasture is well established. New pastures containing Cress should be grazed by sheep or young stock which don't produce milk for sale, so have no problem. Certainly spray before any of the weeds seed.

Mallow courtesy of Massey University

There are four common ones in New Zealand -

Small-flowered mallow (*Malva parviflora*).

Dwarf mallow (*Malva neglecta*).

French mallow (*Malva nicaeensis*).

Large-flowered mallow (*Malva sylvestris*).



Animals don't like eating them as they are mildly toxic. They grow 20 to 30 cm tall, but can get up to 1 m under good conditions. They grow mainly in bare areas, such as gate-ways, stock-yards and orchards. There is no selective herbicide for removing mallows from pastures, but 2,4-D ester should kill young seedlings. Grazon will kill all except ryegrass, so can be used if there are no legumes, or they can be oversown a month later if rain has fallen.

Moss

A frequent question I get is, "What should I spray pastures (or from gardeners, lawns) with to kill moss?"

Don't waste your money and accentuate the problem, apply LimePlus. See Minerals in Soils, Pasture & Animals > Calcium.

Nature aims to always cover soils with something, so moss can grow on exposed patches of soil, especially if wet and lacking calcium and its synergisms that lime needs to work. Fertile loving pasture varieties developed in highly fertile soils won't grow there. Moss grows well in cold, wet conditions lacking lime.

Have you heard of hoof and tooth? It has improved many pastures. I believe that pasture should be chewed really short at least twice a year, once in spring, and once in autumn. Not all paddocks have to be done, and not all at the same time. When short, they can be oversown and limed or fertilised. Hard grazing and trampling in lime reduces moss and thatch, buries oversown seeds, and is cheaper and cleaner than topping (clipping).

Moss is unlikely to be a problem where pastures are limed as per pasture analysis, vigorous and healthy, although some can be found just about anywhere after long wet periods.

It thrives where soils are hungry, especially on lime deficient ones, and where acid fertilisers have been used so few earthworms exist. It will also grow after spraying to kill weeds, and not sowing grass to fill the gaps, and/or where there has been over compaction from trampling without lime or oversowing.

Curing the causes includes keeping trampling to a minimum, regular liming, using a fertiliser programme that encourages healthy dense pastures with vigorous clovers, and oversowing with suitable species to maintain good pastures. Tahora 2 and other good white clovers spread well in fertile subtropical and temperate areas. As a trial, spread some lime over the moss at three tonnes per hectare which is 3 kg per 10 m², to see if the moss disappears.

Applying lime can fix the problem on lawns, or applying iron can in some cases, but not always in shady areas. Do comparative trials on your lawn and farm. There are moss killing fertilisers for lawns, but farms need correct liming and correct grazing, with trampling, if necessary. Trampling soils needing lime will not get rid of moss for long.

Lespedeza cuneata is a legume known as Bushclover and Sericea Lespedeza. It is native to Asia and eastern Australia, and present elsewhere as an introduced species or as an invasive weed. It is rare, so rather than add it here, please Google for it. It is my experience that Sericea is better suited to sheep than cattle grazing because sheep will graze even fully mature sericea - at this stage they eat just the leaves.

One of the most amazing things about Sericea is its ability to grow on extremely acidic and infertile soils.

It is a piece of cake to make quality hay from Sericea. Just mow it and after four to five hours of hot sun it can be baled without fear of moulds developing. The leaves are very small and apparently devoid of wax so they dry out quickly. Sericea stems are very woody - hard but brittle - and have a low moisture content. So when the leaves are dry, Sericea can be baled.

Sericea hay is very palatable - even fowls relish it! It mills easily. And Sericea hay has a high protein content -14 to 16% is a par for the course.

Sericea is a drought tolerant pasture plant and has been through seasons when everything else has given up the ghost but Sericea looked as thought it had been watered the day before. You can mix Sericea with Eragrostis to put N into the system, howsoever Sericea on its own can be a better bet.

It is essential to use fresh seed - preferably not more than a year old. The problem is that although Sericea will hold a satisfactory germination percentage for a good number of years, the ability of the germinated seed to turn into a viable seedling declines rapidly with age.

Sericea must be planted in summer - it needs high temperatures to germinate successfully.

Sericea is slow to get off the mark. Good weed control and fertilization - including N - at planting will considerably hasten the process of getting a productive stand. Nevertheless, don't expect too much in the first year.

Information need is on the economic response of Sericea to fertilisation.

Multiflora Rose

Multiflora rose was introduced to USA East Coast from Japan in 1866 as rootstock for ornamental roses. Beginning in the 1930s, the US Soil Conservation Service promoted it for use in erosion control and as "living fences" to confine livestock. More recently, multiflora rose has been planted in highway median strips to serve as crash barriers and to reduce automobile headlight glare.

Its strong growth habit was eventually recognised as a problem on pastures and unploughed lands, where it disrupted cattle grazing. For these reasons, multiflora rose is classified as a noxious weed in Iowa, Ohio, West Virginia, and New Jersey.

To control it, conditions must be ideal for pasture to be thick (dense) and thrive to suppress the rose.

Cutting it short in the rain many times every year with a slasher that damages (shatters) the stem might kill some, or at least slow its regrowth.

Seeding must not be allowed, but birds can spread it from other areas where it seeds. The soil must not be pugged or damaged because doing so allows more to germinate and grow.



Old Man's Beard shown here was brought to New Zealand from Europe early in 1900. It is noxious, so is banned. It is a New Zealand native bush poisonous weed.

Onion Weed (*Asphodelus fistulosus* Linnaeus)

These are like Spring onions and difficult to eliminate, because they seed and the younger underground bulbs give another lot of growth. They have been declared noxious in some countries. They can taint meat for a month and milk for days, but animals usually avoid them if there is enough pasture.

Oxalis (*Oxalis corniculata*)

Creeping oxalis or sorrel is widespread in gardens and turf in all New Zealand and states of Australia. It has yellow flowers with 5 petals. There is also a brown leafed ornamental one. Repeated spraying for years as it appears can get rid of it, but digging it out with 15 cm (6 inches) or more of topsoil around it is usually the best way.



Panicum

See Smooth Witchgrass.

Parsley dropwort

Excerpt from <http://weeds.massey.ac.nz/weeds.asp?pid=111&sf=common>

This is most commonly called "Carrot-weed" in New Zealand, though this name can lead to confusion with wild carrot (*Daucus carota*) which is another species. Parsley dropwort (shown) is an invasive pasture weed which causes major problems where it grows. However, at present it grows mainly only in Northland, and is only present at a few other scattered locations within New Zealand. Parsley dropwort is a perennial weed, and it is troublesome because it is not readily eaten by animals because of chemicals present within the leaves. It becomes particularly unpalatable when it forms woody upright flower stalks in late spring. In New Zealand's Northland, it can become quite dominant within pastures once it is flowering, and the tubers that grow on its roots make it hard to control successfully. It lowers the quality of hay made from infested paddocks, and this hay is probably a major vector for spreading the weeds to new properties if hay is sold to other farmers. The weed also grows in waste areas and roadsides, and even in lawns where the stumps of mown woody stalks can be painful if stood on with bare feet.



Distinguishing Features: The two weeds that parsley dropwort are most likely to be confused with are hemlock and wild carrot, both also weeds from the Apiaceae family. All three of these weeds have

white flowers on top of upright flower stems. The best way to tell them all apart is to closely study the leaves. The leaf shape of parsley dropwort is shown in the side picture. It is made up of leaf segments quite different in shape to hemlock, which is quite fern-like in shape, and different to wild carrot which has much finer leaf segments, almost exactly the same as the cultivated carrot. It is sometimes also confused with yarrow, but this also has very fine leaf segments. Parsley dropwort has little swollen tubers on its roots, though these often aren't very noticeable. These tubers allow the plant to re-grow again following control attempts.

Control: There is very little information available on control of parsley dropwort. We have conducted one small trial in Northland looking at its control, and some information has also been gleaned from chemical company reps. It appears the best way to tackle parsley dropwort is to boom-spray paddocks with a fairly high rate of 2,4-D ester (e.g., at least 3 L/ha of Pasture-Kleen) in August before the Northland Regional Council restrictions on spraying this herbicide in September. We have found applications in June work quite well too. If you have a paddock with a lot of buttercup as well as parsley dropwort, then MCPA seems to kill parsley dropwort nearly as well as 2,4-D. In waste areas, glyphosate and metsulfuron appear to do a reasonable job of controlling it. Clopyralid (Versatill) at reasonably high rates also appears effective on parsley dropwort, so this might be useful in turf or for spot-spraying scattered plants in pasture (though 2,4-D might be fine for spot-spraying too). As the plant can get taller than pasture in late spring, wiper-applicators might work with herbicides such as glyphosate, metsulfuron or clopyralid, but I'm not aware of any experiments with this. As there is so little information on controlling this weed, please e-mail me if you know of other treatments that work well.

Pennyroyal (*Mentha pulegium*)

In North America there is a similar one called *Hedeoma pulegioides*.

Pennyroyal is a small, shallow rooted, creeping mint-type light grey plant, which smells strongly and animals don't normally eat, so it is difficult to control with grazing, but easy with management of drainage, surface lime in correctly fertilised and grazed (no pugging) pastures.

It loves damp acid conditions, and, if left to grow, creates its own root mat as is done by Chickweed, so fix them, mainly with adequate LimePlus.

If wet, drain the land with shallow surface spinner drains, lime it (See Pasture Mineral Analysis and Minerals in Soils, Pasture & Animals > Lime), fertilise, chisel plough deeply to bring up subsoil so that clover grows more vigorously, crop the area once or twice, and, when in pasture, graze it frequently enough to stop it seeding. Animals eat it when short in lush pasture. Drains need not be deep, so use a spinner digger (join with neighbours to buy one between six) or put in a V shaped drain, using a grader blade on an angle. Pennyroyal can spread rapidly, especially in wet, boggy, acid conditions, and even in dry soils that lack lime and are over-grazed.

If cows do eat it, their milk can be tainted, causing down-grades, so graze it soon after milking, not just before.

Trials I've done and many clients have done show that liming reduces pennyroyal. One of our clients reported pennyroyal decreasing from 50% to 10%. This area is in the park next to us which has had no lime or fertiliser for 30 years, but mower clippings have been left on so the fertility is not low, in fact the soil is a lot better than on many farms. The area on the left of this photo got LimePlus at 3,000 kg per hectare and was later correctly fertilised. Previously, all was like on the right - mostly pennyroyal.

In trials, earthworms always spread the elements I applied so made the trial areas bigger and not as sharply divided.

Some have said that low sulphur causes pennyroyal to increase. I have never had pennyroyal and never used superphosphate with its 11% S, but used Serpentine Super with 8.6% S until reactive phosphate in Sechura and Gafsa became available we used it and elemental S, and have not had pennyroyal.

Costly weed control

Nufarm emailed me just to recommend their weed spray to control Pennyroyal which is a simple indicator of low LimePlus, that adequate lime with its synergisms of about two tons of LimePlus per acre (= 5 tonnes per hectare) eliminates it and reduces buttercups and some other weeds. The reason it costs nothing is because clovers double, followed by increased pasture growth, earthworms, soil

improvement and better moisture retention, which is one of the most important, because pastures then grow better. I hope all have read Minerals in Soils > Calcium and seen its 55 benefits.

Nufarm emailed me just to recommend their weed spray to control Pennyroyal which is a simple indicator of low calcium, that adequate lime of about two tons of LimePlus per acre (= 5 tonnes per hectare) eliminates it and reduces buttercups and some other weeds. The reason it costs nothing is because clovers double, followed by increased pasture growth, earthworms, soil improvement and better moisture retention, which is one of the most important. I hope all have read Calcium and seen its 50 benefits.

Plantain

Old plantains are low yielding, but most animals like them. The new small Lancelot plantain is a sheep pasture variety developed in New Zealand, and the new larger Tonic plantain developed in Australia is for cattle. They are not weeds, but higher yielding deep rooted pasture herbs that animals love. They are important because the lack of lime, excess urea and more recently other nitrogens, have changed the typical Waikato pasture of 75% ryegrass and 25% white clover, to mostly ryegrass which is monoculture and mono-feeding and a cause of decreased animal health. See Pasture > Herbs.

Privet - Tree privet (*Ligustrum lucidum*) and Chinese privet (*Ligustrum sinense*).

Both these are pests and cannot be legally propagated or distributed in any way in New Zealand. Because they are shade tolerant as seedlings, they grow under other trees and on bare ground. Their pollen causes sore eyes, sneezing and breathing difficulty. The health effects of privet are wide-ranging but not permanent, confined to the flowering periods in spring and summer.

Small plants can be pulled out of the ground and left to mulch as the roots will not resprout. Stump swabbing is the preferred method for larger plants to stop them growing even after cutting close to the ground. Cut down and apply herbicide to the fresh stump. This method uses much less chemical than spraying and avoids contamination of soil, streams and desirable vegetation. A fairly safe one is Grazon.

See Garden > Lawns. Please be warned again that if you don't halve the amount of Grazon or other spray used with Codacide you can get burning instead of penetration to the roots to kill the plants, and can possibly kill plants you don't want killed. For information on Codacide see.

<http://www.microcide.co.uk/pdf/CodacideBenefits%20andEfficacy24.09.14.pdf>

Poa, Meadow Grass, Toadrush or Wintergrass Annual (*Poa Annua*)

This is a low-yielding short-lived grass that can grow up to 30 cm tall in pastures, especially in wet, temperate areas. It thrives in pastures which lack sufficient fertility for perennial ryegrass to thrive and swamp it out, and in paddocks which are wet or have been over-grazed and/or pugged. It likes compacted soils such as around gateways. Wet winter conditions and wet soils favour Poa which is also called Winter Grass. Sowing pastures in spring can help get better Poa-free establishment.

There are selective sprays for it.

Ragwort (*senecio jacobaea*)

Ragwort has rosette or lobed leaves with dense bunches of yellow flowers. It is poisonous to cattle and horses even in hay, but they normally won't eat it, although they sometimes do if it has been hormone sprayed. It produces pyrrolizidine alkaloids that kill horses and cattle from liver damage. Sheep and goats are not affected in this way. Meat and milk can be tainted (flavoured) by ragwort. Grazing with sheep can control ragwort, but too much ragwort for too long can poison sheep. The period depends on how much other feed they get with it, and on cobalt levels. In high cobalt (Co) soils ragwort is not as toxic to sheep as in low Co soils. Measure your pasture Co level. It should be about 0.13 ppm. Apply 0.5 kg/ha of Cobalt Sulphate (21% Co) if the level is below 0.1 ppm and 1 kg/ha if it is below 0.8 ppm. Correcting Co levels will also increase clover growth and nodulation, which will then increase grass growth, allowing pastures to compete more with weeds. Optimum Co levels will improve ruminant health.

A ragwort flea beetle parasite introduced to NZ has reduced ragwort from being a problem in some areas. It is a weevil sized flea beetle called Longitarsus. It takes many years to get ragwort under control, but if sprays and rotary slashers are used on ragwort, many of the beetles, which feed only on ragwort, could be killed.

The few plants around on some farms are best dug with a spade, shovel or hoe while the cows walk up the lane to milking (or other stock to the yards). If there are more, then a few Tordon granules on the centre of the plant after crushing it is better than spot spraying, which nearly always kills an area of pasture around the plant, wasting spray and creating a bare area for future weeds to grow.

Thicker populations may require spraying in early winter at the young stage with a clover safe product such as MCPB, or rotowiping in spring with a strong salt liquid a few days after grazing when the plants have straightened up again.

Organic farmers may have to crop it twice in a row with forage crops that are grazed to improve fertility.

However, the main solution is a dense, well fed, healthy pasture.

In North America there are Ragweed and Golden Rod problems. They look a bit like ragwort, but are different. Heavy infestations have to be sprayed or cultivated out.



Ratstail (*Babiana ringens*)

Many consider this an inedible weed, but Don & Amanda Withers in Waipukurau, Hawkes Bay, New Zealand, found that after applying LimePlus their animals ate it and other unpalatable weeds like small buttercups. It has a strong stem with side branches that set seeds. The main stalk supports birds to reach the seeds.

Rushes (*Juncus*)

These lovers of wet acid soils soon disappear after the soil is drained and sweetened with LimePlus and intensively grazed.

Smooth Witchgrass (*Panicum dichotomiflorum*)

This summer annual has a red/brown coloured base which is longer than Bristle Grass and ryegrass, and grows horizontally unless dense.

Sorrell AhosuolaheinÃ (Rumex acetosella) and other varieties.

It likes wet acid soils and is not very nutritious, and contains oxalates (oxalic acid) which means that it can kill if too much is eaten.



Stinging Nettles

If only a few are in pastures they can be dug out before seeding, or rotowiped if dense. Nettles can come in the best certified seed because weak rules allow a percentage of some weeds, but none of the worst weeds, but Velvetleaf got in to some pastures and maize paddocks. Some of the New Zealand seed growing area of Canterbury has nettles (jagged leaves covered with stinging hairs) galore along road fences, and I've seen nettle weeds growing in newly sown pastures in the Waikato. When checking pasture and other seeds for germination like I recommend, check for weeds, especially new ones like Velvetleaf shown here, which would mean sowing a seedling to grow and confirm it. There have been photos in farming papers, so cut them and others out and keep them in your Weeds folder or drawer.



Storksbill

As with killing many weeds, Storksbill should be killed when young and before flowering and seeding, which it continues to do over many months. Try to avoid stock eating Storksbill because it has caused photosensitivity in livestock. Young lambs with bare skin have got very bad scabs like Facial Excema. You may not notice it in cows.

Storksbill seedlings germinate over a long period, so some farmers think their spraying has failed.

Pulling them out is not possible because of the long tap root that goes deep. Digging out with a sharp pointed spade or small pointed shovel and turning them over into the holes is OK for small numbers, which is when it should be done.

For large numbers, chisel ploughing (see Cultivation), growing a summer forage crop or other type of crop, to allow time for seeds to germinate and decompose, and then resowing in the best pasture, is the best way by far. We have done this and got rid of 90% of Storksbill, Californian thistle, and other bad weeds, then grubbed the very few that grew. Thick dense pastures that are not overgrazed don't grow many weeds. Having plenty of earthworms reduces weeds, because they eat a lot of weed seeds.

There are organic sprays for small areas. See Organic Weed Killer on page 2.

Summer grass (*Digitaria ciliaris* and *sanguinalis* annuals)

Called Crab, Summer or Barnyard grass, it has fibrous roots and clusters of soft stems which grow close to the ground and often take root at the nodes. Leaves are hairy and soft. It is a hardy annual resistant to trampling so survives in gateways. It is hardy, and spreads when pastures are not thriving and not dense. I don't like recommending weed sprays, but sometimes there are no alternatives. Fortunately there is one weed spray called Grazon that kills everything except ryegrass, and it is not toxic to most humans, including me, and I have 30 allergies. I have used it for 20 years to keep all weeds out of our ryegrass lawn, and not being affected by it at all. I have checked with health specialists and the manufacturers, and we don't know of anyone who has been affected by it. It doesn't affect earthworms or other soil life. Read more about it in the gardens chapter.

Thistles

Californian Thistle (*Cirsium arvense*) called 'Canada Thistle' in North America.

These were apparently taken to USA and Canada from south-eastern Europe and eastern Mediterranean in the 17th century, and possibly to New Zealand from Canada, hence the name.

There are several types of this horrible perennial weed, also known as Creeping thistle because of its underground rooting system. It is the most widespread and worst thistle in New Zealand pastures. It spreads by seeds and underground roots and by cultivation. Seeds can blow for miles and soils can be full of seeds, so Cali's are often a continuing problem even if treated regularly.

They are very difficult to eliminate because of their root system and prolific seeding.

From where we lived from 1966 to 1989, we saw on a neighbour's farm, one Cali growing in a paddock. The next year there was a clump and after ten years the paddock was half covered. The first Cali, including roots, could have been dug out in a minute.

There is a **Thistle Weevil** with larvae that eat the roots, and weevils that eat the plants, but a biological control like this, while a great help in reducing them, never eliminates them, because it needs some to continue.

A **fungus** which kills them is being researched in New Zealand and USA and looks promising.

Contact your agricultural department for the above.

Seeds can be in the soil, so maintaining a dense pasture is important. Where seeds are in the soil, pugging can increase their germination. I've seen a pugged area in the middle of a clean paddock get covered in Cali's and other weeds while all around it where it wasn't pugged, there were almost none. The pasture damage that cattle can cause may require oversowing (overseeding or broadcasting), with grass and clover seeds each autumn or spring. Mix the seeds with LimePlus and spread immediately, preferably just before rain.

Dry ewes can be used at 350 per ha (140 per acre) on young thistles, but care must be taken to avoid scabby mouth, or Parapox, a viral disease which enters through punctures in the lips and mouth. Using sheep on older thistles is not advisable because of scabby mouth.

Cattle are less affected by thistle damage to the mouth than sheep. Goats will eat thistle flowers, but are not so keen on the rest of the plant. Deer are susceptible to thistles which can cause dermatitis.

A 'no hormone' method of reduction which reduces the Cali's by 90% within two years is to repeatedly slash them off to 20 mm height in early summer while still soft and preferably while raining. Cattle like them when cut and wilted and some will even eat cut wilted ones before grazing the pasture.

Then graze the area heavily, without pugging, every two to three weeks over summer with between 50 and 100 cows or cattle per hectare (40 per acre). It is crucial to control the thistles while young so

that they are eaten. It will take years to eliminate them completely. A neighbour's farm was covered in them, but very few of its seeds touched the ground in our dense pastures next to his. Our animals grazed most and we dug out the half-dozen or so each year that weren't eaten.

Constant removal of the foliage eventually depletes the root reserves. However, the mowing does need to be constant if it is to be effective. The optimum timing for mowing is when Californian thistle has just reached the flower bud stage, but flower buds have not yet opened.

The next most economical control method is harrowing, especially both ways in wet weather. It bruises their stems and adversely affects them and kills many plants. Mowing them fast with a lacerating forager harvester to tear them, or with a rotary slasher, especially with blunt blades and travelling fast to give a tearing cut, preferably during rain, knocks them back.

They are a woody type weed, so if using hormones, they need a strong weed killer to give good control. A revolving Weed Wiper used over several years each time they get above grazing height allows a strong hormone to be used without damage to clovers, but needs two wipes each year in early summer, and one in mid summer to catch later growing plants.

Tropotox Plus (MCPB minimum clover damage) controls it without too much clover damage. Several sprayings each year while plants are young might be necessary for a few years, and new ones will still continue to germinate.

The best control has been achieved on small outcrops by digging them out.

To keep it out of paddocks that have the seeds, fertility must be optimum to give dense pastures, which requires good drainage and adequate levels of all elements, especially calcium with its synergisms such as in LimePlus to encourage strong creeping white clover growth (red clovers will not achieve this) to cover bare patches. Earthworms eat, so reduce all weed seeds.

The correct earthworm types and numbers (Calignosa is best) must be at least 20 per spade spit (20 x 20 x 20 cm) in other than very dry conditions. The best farmers have 40. These will consume all the cattle dung within a few weeks rather than have it kill patches of pasture where Cali's and others can then grow. Optimum earthworm activity will change a 25 cm dung patch into a 60 cm high fertility area of lush green pasture that weed seeds have difficulty growing in.

Controlled grazing must avoid pugging and be from about 2,800 kg DM/ha down to about 1,700, to avoid opening up pastures.

Nodding Thistle (*Carduus nutans*)

In New Zealand a parasite is reducing this prolific thistle.

Scotch Thistle (*Cirsium vulgare*)

Large thistles, sometimes called 'Bull thistles', can grow two metres high and take over bare areas and pastures, but is seldom such a problem in dense well managed pastures.

Thorn apple

This is seldom dense, so is easy to control by digging it out with a spade. \

Tutu is a New Zealand native bush (forest) poisonous weed. An elephant on a transporter reached out with its trunk and ate some, and died from its poison. Bees taking pollen from its flowers makes their honey toxic, which can make some people very ill.

Twitch

One spraying with Grazon killed the twitch in our lawn without affecting the Colosseum perennial ryegrass, the only ryegrass that stools and covers adjacent areas. Grazon can also kill Couch, Kikuyu and all grasses except ryegrass, unless too strong. Read about its use in Garden.

Wandering Jew (*Tradescantia*)

This creeper shown below under Woolly Nightshade, can spread at a metre a year. It can be pulled out and buried in a one metre deep hole and covered with plastic until dead, after which the plastic can be removed. Adding lime as you fill it will speed its decomposition and encourage earthworms to consume it. Grazon kills it very easily. The Hamilton Council bush that we look after was covered in it and still is in their area, but we have kept it off ours with occasional spraying of seedlings.

Wild onion and wild garlic

These are winter perennials. The leaves are waxy, upright and needle shaped, growing about 30 cm (a foot) long. The leaves of wild garlic are hollow and round and have a strong odour. The leaves of wild onion are solid and flat and appear directly from the bulb. Both plants grow from underground bulbs. The membrane-coated bulbs of wild garlic are flattened on one side and have bulb-lets. Wild onion bulbs are white inside with a strong odour and are covered with a fibrous, scaly coat. The white to light green flowers of wild garlic develop on short stems above aerial bulbs. Wild onion doesn't have a stem. Both wild onion and wild garlic spread by bulbs, seed and bulb-lets. Both plants flower in early summer.



Woolly Nightshade (*Solanum mauritianum* is a small tree or shrub native to South America), also known as Flannel leaf or Kerosene plant, Tobacco weed, Bug weed. It is illegal to grow, in New Zealand.

It has large leaves, grows 10 metres high, smells, and won't be eaten by animals. It is best cut at below ground level. Its unripe berries are poisonous. Birds move them around.

Yarrow (*Achillea millefolium*)

This is one of the many weeds that thrive when calcium is deficient. To our knowledge it is not toxic, but too much of anything can be.



Poisons

Some farmers say that animals know what they need so they provide self help minerals, but it is only partly true and can be horribly wrong. Some animals die and no one finds out why. Possibilities are excess copper, manganese, any noxin, too much ragwort, Tutu, feeds like PKE. It would be helpful if we could categorise plants, but the many variations make it impossible for example some parts can be poisonous and others not, as in rhubarb. The stalk is safe while the leaves are very poisonous. Some plants kill animals in the morning because of high nitrates and don't in the afternoon. The following shows how difficult it is. In New Zealand in the 1930s ruminants were dying on the central North Island sandy low organic matter pumice soils which were low in cobalt (so low vitamin B12) because it needs organic matter to hold it, while horses thrived. See Minerals in Soils, Pasture & Animals > Cobalt.

In Japan, ruminants grazing vegetation in late 2000 on government undeveloped sandy pumice, non-fertilised areas, died because of extremely low cobalt, so they lacked vitamin B12. See Minerals in Soils, Pasture & Animals > Cobalt. There were also poisonous grasses such as this Setaria type on the right.

Some cattle have eaten coal ash from furnaces that was spread on lanes and killed themselves.

They can eat copper sulphate and die. Then there are lead, metal and other poisons.

All can suffer from eating endophyte fungus polluted grasses, but most will avoid high endophyte perennial ryegrasses if there are alternatives. Cows on high endophyte perennial ryegrasses have higher somatic cell counts, that drop in a day when moved to safe or low endophyte perennial ryegrasses.

Flowering Pasja and some other flowering brassicas, or too much too quickly of kale, chou-moellier and some other crops, such as sorghum, make animals sick, and can kill them.

Some animals select and eat Amaranthus (red root, red shank and other names) and kill themselves from its high nitrates while some cows avoid it.

There are many other less common poisonous plants that some animals eat and die.

Some buttercups, especially when flowering, can kill cattle. This doesn't seem to be a problem in New Zealand even in paddocks thick with buttercup, so the type could be the reason.

Pinus Radiata (Monterey pine) needles, Macrocarpa and Cypress can cause abortions in sheep and cattle, and can even kill an animal.

Poisonous leaves

New Zealand, *Macrocarpa* (*Cupressus macrocarpa*) are often grown on livestock farms, but they can be toxic. Some animals like the leaves after they have dried. Even a small amount can cause abortions in sheep, goats and cattle, and deaths have occurred. All farmers should be aware of this poisoner and fence it, or get rid of it, and the leaves. Read the Poisons Chapter

Some oak tree acorns are good feed for pigs, which have very powerful digestive juices, but some acorns can kill cattle. Oak leaves can do the same if eaten in large quantities, which they can be if cows are hungry or if craving roughage.

All parts of Yew are highly poisonous, so avoid leaving prunings around, or better still avoid growing all dangerous plants. Symptoms are excitedness, trembling and death, with no cure.

Rhododendrons are eaten by some animals, such as goats, and not affected initially, then after eating more they can vomit and can die. Ensure that no animals get anywhere near them.

Poisonous leaves

New Zealand, *Macrocarpa* (*Cupressus macrocarpa*) are often grown on livestock farms, but they can be toxic. Some animals like the leaves after they have dried. Even a small amount can cause abortions in sheep, goats and cattle, and deaths have occurred. All farmers should be aware of this poisoner and fence it, or get rid of it, and the leaves. Read the Poisons Chapter.



Sundry

Where weeds such as ragwort or gorse are thick in a paddock, a far better result can be achieved by cultivating, cropping and re-grassing the area or whole paddock, rather than by using a herbicide.

If a summer crop is grown, and the paddock chisel ploughed a few times again in autumn, many of the weed seeds will germinate before the grass is sown, and the good pasture resulting from this treatment will smother and/or outgrow most weeds. The increased pasture production can pay for the whole operation within two or three years, after which the increased growth is all profit. The chisel ploughed paddock ends up much better, smoother, and more productive, allowing good quality silage and hay to be made off it at a lower cost in time and machinery, because of the smoother surface and higher yields, without soil pollution which can ruin silage. The main benefit will be the lush pasture which make most animals eat some of the weeds for roughage - including seedling gorse.

Mouldboard ploughing will not achieve the weed control because it buries the weed seeds, then brings them up again at the next ploughing to germinate with the new pasture. See Soils > Cultivation > Chisel ploughing. Correct cultivation reduces weed germination and subsequent growth, because pastures are thicker and healthier.

At Winchmore Research Station, NZ, grazing sheep, the pastures fertilised with reactive phosphate for 10 years were more dense, with more clover and fewer weeds, than those fertilised with superphosphate (0-9-0-11). Many pasture farmers have found the same, but the 'establishment', and most NZ farmers, still use superphosphate. In USA Single superphosphate is apparently not made. Its high sulphate (sulphate) level of 11% leaches, and takes selenium, potassium, etc., with it. When farmers change to correct lime and reactive phosphate, the leaching of potassium decreases, saving applications at NZ\$900 per 1,000 kg.

Most NZ farmers apply too much potash because NZ AgResearch, DairyNZ, many soil analyses laboratories and fertiliser company recommendations are set high to sell more. I called on a friend where there was a fertiliser sales person. "Thank goodness you came," he said. "That rep was trying to sell me potash." His father worked for me in the 1960s so he knew about the problems of high potassium levels. Excess potassium kills red clovers, then white clovers, and makes harder grasses which increases perennial ryegrass pulling, leaving bare patches, sometimes blamed on beetles, but mostly caused by low calcium. See Minerals in Soils, Pasture & Animals, both Potassium and Calcium.



Overstocking and not making much hay results in little natural reseeding, so bare areas grow weeds. As well as correct grazing, over-sowing at double the drilling rate helps achieve dense pastures. Farmers with 30 year old pastures have done this for decades, and a Ruakura Open Day revealed that they too had discovered that over-sowing gave better results than the much more expensive drilling. Seed is then best trampled in lightly. See Pasture Renovation. Correct control also involves learning about insects that reduce weeds and then sourcing them. These Calamine daisies would not exist if the first ones were pulled out by hand in minutes, when first seen as seedlings, which look like this.

I repeat - Sowing crops and new pastures into chisel ploughed and well cultivated soils within two days of starting cultivating, provided rain falls within a few days of sowing, makes them weed-free in most cases, not like this on Scott Farm. See photos in Forage Crops.

Further reading

Plants Poisonous to Livestock see:

Weeds of New Zealand by FW Hilgendorf, Whitcombe & Tombs, New Zealand.

New Zealand Common Weeds in Colour by EA Upritchard, New Zealand Weed & Pest Control Society (Inc), Box 85, Hastings, New Zealand.

Plants Affecting the Skin and Liver by AP Knight & RG Walter.

Guide to Plant Poisoning of Animals in North America, by AP Knight and RG Walter.

Google for Boron+Weeds and for Photos of weeds.