I have used electric fencing since 1954 when working on farms, before buying one in 1955. We set up 40 paddocks on our dairy farm, allowing a fresh paddock after each milking on a 20 day rotation, or faster when some paddocks were being harvested. We set up 106 paddocks on our dry stock farm of 107 ha, allowing five mobs to each have a fresh paddock daily on a 21 day rotation, or faster when harvesting or forage cropping some. 99% of the fences were two wire electric.

From 1979 I was a fencing consultant to Gallagher and their 100 international distributors full time until 1984, and part time after that.

The information here and in Dairying > Shocks Affecting Cows doesn't replace the need to get and read the instruction manuals that come with energisers or can be obtained from Gallagher dealers world-wide, or the necessity of getting an expert with the right equipment, not just a voltage measurer, to find the source of current flows and fix them, before they cause problems. In other words, have your farm checked by measuring between possible conductors in dairies, and between water troughs and the ground, across the whole farm. Across the whole farm? Yes, because a neighbour's system could create current flows affecting your animals and you may not know it. This has happened, even causing shocks from a neighbour's energiser in a shower.

100% return per annum

Under today's land costs and low farming income relative to investment, intensive consulted grazing is essential. If the farm is grossing $4,000/ha (1,000 kg of milk solids at $4/kg) then the best areas can be grossing about $6,000 and the poor ones about $2,000/ha, so it is easy to see how spending $500/ha on fencing can very soon give 100% return per annum on the investment. The bottom line is that fencing increases profit, even after allowing for its cost. The only way to find out on your farm is to measure the difference in pasture yields with a PastureGauge.

Testimonials

World fencing and shearing champion and steep hill country sheep farmer, John Fagan, had this to say in 1984 after increasing his animal carrying capacity by 80%.

"Pasture quality and growth improved dramatically once I got up to 50 paddocks. I'm planning for 15 more paddocks to ensure that all the various contours are separated, to eliminate fertility transfer from the slopes to the flats.

"Fencing is done once, whereas fertilising and spraying go on for ever, unless subdivision is increased. I aim to turn every blade of pasture, including weeds, into manure.

"The steep terrain has all been well subdivided because the easier slopes can be block grazed with temporary fences from May to August.

"All rough fence lines are bulldozed first, which really pays for itself.

"Fertiliser use has decreased and weed control has ceased to be a cost," he said.

John reduced his fencing costs, not only by using the most economical permanent materials, but also by adapting them to suit his conditions. His fences are only 0.75 m high.

"As well as saving costs in construction and maintenance, the fences are easy for people to step over and for dogs to jump over, all making for easier farming. Why build them higher when temporary fences for both cattle and sheep are only that high?" John asked.

The bottom wire on his four wire fences is not electrified, so as to reduce vegetation leakage and to allow the animals to graze under the fences to keep them weed free. In areas where stock concentrate, like around gateways, he adds extra droppers for better visibility.

He had eight kilometres of multiwire power fencing controlling sheep with one Gallagher energiser.

High-power

Electric fencing has been used by many dairy farmers in New Zealand since the 1940's, but it was only after Dr Doug Philips of Ruakura discovered and developed the high-power, low impedance, system in the 1960s that electric fencing increased to control all types of animals in New Zealand and larger countries. The power of New Zealand made energisers has continued to increase. Dr Philips's first high-powered energisers were about 1 joule, whereas the maximum power of today's is over 30 joules.

This may sound a lot, but as farms become larger and fences get longer, more power is needed. The

latest Gallagher energisers automatically monitor the fence and send only enough power to maintain animal control. Low-powered energisers or chargers don't control sheep, deer or wild animals, which includes some domestic animals that become stressed. Controlling animals is essential for many reasons, including human safety. For example, in 2002 humans in Germany suffered more than 300 serious injuries from animals escaping and wandering on roads. Proper high power fences could reduce this number. A small group have been campaigning against modern high-power energisers, but in the same time in Germany there were no human deaths from energisers. The following is a clear example of what power fencing can achieve.

From the USA grassfedbeef discussion group.

"I bought a couple of very wild Angus steers from a neighbour. I got them home and put them in a shed to settle down. About 2 minutes later they crashed through the gate and ran right through a four strand barbed wire fence into the woods. I was able to get them back inside a barbed wire fence for about ten minutes before they broke out again. After about a week I spotted them grazing in one of my fields so I put up an electric fence to make a funnel into a pasture that had a single strand electric fence around it. I got behind them and they went right down the funnel into that field. I closed them in and they never got out again because they obviously knew what electric fence was and never challenged it. They also knew that barbed wire was the fence to squeeze through when they wanted some good grass. The steers did eventually settle down."

Almost every New Zealand livestock farmer uses temporary and/or permanent electric fencing. It allows the optimum grazing of animals by building up surpluses for hay and/or silage and accurately rationing them through lean periods.

Five to nine wire heavily droppered (battened) boundary fences were required by law in some countries and were common in New Zealand throughout farms, but today when one sees new internal ones like this one wonders why. Was it previously a sheep farm? Were they erected as a tax saving!? Can they possibly look pretty to some? Has the owner a fear of electric fencing? The erected cost of a five wire conventional fence is five to seven times that of a permanent electrified one.

Many 40 year old electrified fences still look like new, while many conventional ones less than that age under high stocking are a mess, especially in soft soils - unless they have an electrified offset wire. Non-electrified fences should have at least one electrified offset wire, because doing this can save them from being pushed over and double their life, give much better animal control and a live wire to which to attach temporary fences.

Offset brackets with a strong pin-lock insulator are the best. Avoid tubing offsets because they short out, and the shorts are hard to find. Also the wire can rust in the tube where insects breed and exude goo.

Single tubing should not be used for any type of insulating, because tubing wears through, and soon leaks at any damaged points (hammer and staple indents).

Glossary - relating to electric fencing

a.c. Alternating current, as from mains power supply in 110 or 220 V.

Amp or Ampere (A). Rate of flow.

Conductor. A material through which current flows such as in all metals.

Circuit. The path that currents take to get back to the earth.

Current. Current flow and its duration that determine the shock. Current flow increases as voltage increases and decreases as resistance from thin wires and poor connections increase.

d.c. Direct current, as from batteries.

Earth system. The system of conductors in the ground to collect the shock current and return it to the energiser.

Earth return system. Where dry non-conductive soils don't transmit enough current to control animals, so both live and earthed wires are needed on fences and the earth wires are earthed every km and back to the energiser. This system is not recommended in moist areas, but is in snow which is not conductive.

Electrolysis. Corrosion which occurs when different metals are connected such as copper, aluminium or galvanised to another. It occurs faster in damp conditions. Use only galvanised wire and fittings. Copper is four times as conductive as galvanised, but is not necessary.

Impedance. Resistance. The term low-impedance with modern energisers means fast release of the

shock from the energiser without impedance or resistance (friction) so it can fill the fence with current so quickly that it gives the animal a shock even if there is leakage through poor quality insulators and vegetation touching the live wires. Low-impedance means high-power, not low power.

Induction. Current transfer without contact as occurs from a live wire running parallel with a dead wire on fences. The closer and longer they are adjacent to each other the greater the inductance. On electrified fence lines most occurs within 15 cm (6”) of the live wire and almost none at 45 cm. Poor pasture growth under fence lines is not from induction, it is a lack of both animal manure and hoof action so becoming higher and drier than the adjacent ground.

Insulator. A material which resists the flow of currents. Pure glass, porcelain and some plastics are insulators. Some plastics have carbon added to reduce the deterioration in sunlight. Carbon is conductive.

Joule (J). Unit of energy. One Watt per second, which is the most important measure of the pulse (shock or power) of an energiser.

Leakage. Current flow from live wires through poor insulation and vegetation touching the fence, causing a drop in voltage.

Live, hot or electrified wire. The fence wire conducting the shock from the energiser live terminal.

Ohm. Unit of resistance. It is a reverse scale so a low figure is indicates a high load. Zero ohms is a complete short. 500 ohms is the maximum that a normal (not submersed) human or animal body can conduct. A severe shock is about 2,000 ohms.

Power consumption. The amount of electricity used to run the energiser. 10 Watts is 10 times 24 hours or 0.24 units per day which costs just a few cents.

Pulse. The shock an energiser emits for 0.0003 seconds every second. Being shorter than a heart beat makes it safe under normal conditions.

Stored energy. The energy, usually measured in joules, that an energiser can release as a shock in each pulse.

Volt (V). A unit of electrical pressure that causes current to flow.

Watt (W). Unit of power (volts time amps). 746 Watts equals one horse power (hp).

Resistance. Measured in ohms. The equivalent of friction in water.

Short. Leakage of current to a non-insulated wire, post, vegetation or ground.

/ means Per.

Power fence regulations & safety

These are concerned mostly with human safety. In some countries, regulations still insist on less power than a New Zealand strip grazing energiser, notably Japan. The European CEE Regulations, which are fairly well received world wide, have been upgraded to allow for high-power energisers. The work by NZ Standards was largely responsible for this improvement. The New Zealand Regulations are also being updated to allow for modern components.

Mr A.W. Gallagher (senior) discovered in 1972 that in theory an energiser could "over-pulse" and put out lethally close shocks. To overcome this possibility, a thermal fuse was fitted to all the appropriate Gallagher mains powered energisers, and details were given to all New Zealand manufacturers, but some still did not fit a safety fuse for a long time.

Gallagher, when exporting to small densely settled European countries, found that radio and telephone interference could be problem, so developed and incorporated interference suppressors which reduced the problem, but doesn’t eliminate it completely from fence lines that are badly made, with poor joins and leaking insulators, especially if they run parallel to phone wires or cables.

High voltage can occur at the end of a fence line because the pulse has nowhere to go so compresses or builds up. Voltage is pressure so increases. Never touch the last 100 metres of any electric fence.

Never lean on a steel building and touch an energiser earth wire. In Holland the law in the 1980s (I hope they’ve improved it) was that only electricians could install the energiser and the single earth peg which was 12 mm (⅝ inch) diameter and one metre long - and that is all they installed. As soon as the electrician left most farmers would add to it. Working with electric fences since 1954 I’ve had many shocks, but the worst was in Holland in 1983 when sorting out a problem where animals could not be controlled. While leaning on the iron shed I touched the silly little 12 mm earth peg a metre deep close to the building under the eave, so in dry soil. The building was a better earth than the peg so 3,500 volts went through me. It was the amount on the earth peg which should have been zero or no more that 500 volts. We installed a proper energiser earth system. Some other countries also stipulate 12 mm diameter one

metre long earth rods. These are often inadequate for mains power supply. 60 Hz AC is a slow trickle of perhaps a small fraction of an energiser's 5,000 volts with five or more joules in 0.0003 of a second. An old electric motor when starting can overload these small pegs causing the current to find another source to ground which can be a building or milking parlor.

The following are for the protection of you, your family and friends and your bank balance, because some are laws in some countries and litigation is becoming more common.

Safety Rules

As well as the above -

- Everyone with pacemakers should keep away from electric fences.
- Children and those incapable of a normal response should be warned to keep away from all electric fences. Demonstrate the shock to children and visitors by using a long piece of grass to touch a live wire.
- No one should climb through an electric fence.
- Barbed wire should never be electrified or even be used in a fence with electrified wires.
- Internal fences on beef and dairy farms need have only one live wire, which can be the middle one of three. The reason for this recommendation is so children and working dogs can go under the bottom wire without a shock, and adults can go over. However, where calves are grazed, the bottom wire will need to be live. This can be done with a Flexible Connector which allows connecting and disconnecting so that dogs are not shocked.
- Don't string wires across lanes or thoroughfares without marking them clearly. Motor cyclists have been injured through not seeing them.

The thought of 5,000 volt fences on farms near cities could be frightening to townies, but thousands of human contacts occur annually with nothing more than discomfort. However, care should be taken to avoid contact through the head because it is very uncomfortable. Young children and elderly people should be kept away from even low powered fences.

Electrified fences in any position where the public could come in contact with them must be clearly marked with approved warning signs at frequent enough intervals so as to be easily seen, but at least every 90 metres by law.

In blizzard and migration areas don't build fences across the route animals would take to migrate or get away from driving wind and snow to get to shelter.

Type of fencing

Since high-power electric fencing became available in the 60s there has been no justification for anything else. It costs less to buy, erect and maintain per kilometre. Australian analyses of time and costs of maintenance showed this. It also gives better animal control. The benefits of electric fencing are wide and varied. It can increase the profit of most farming operations by reducing costs and increasing production.

Examples of benefits

Whatawhata Hill Country Research Station west of Hamilton has about 500 paddocks and is a good example of what can be done in developing gorse and scrub covered steep hill country, using intensive subdivision without sprays. If all hill country farmers had been following the example of the Whatawhata and Farms of the Year winners, they would have fewer debts and more profits. Whatawhata staff have said that they could not have afforded to do the same amount of land development and research using conventional fencing.

Sheep farmers, like Gerald Hargreaves of Fairlie in the South Island, who in 1976 started subdividing his farm with Insultimber into 100 four hectare paddocks, made more profit and bought more land to keep his farming profitable. Those who didn't use the benefits of power fencing during the profitable years of the seventies can now hardly afford to subdivide the land they already own, let alone buy more.

When electric fencing is used, only half as much money will be needed and three times as much can be put up in the time available. The fences will last longer because wires don't rust nearly as fast, because the shock prevents animal pressure from over-straining them. When wires are over-stretched the

galvanising lifts, allowing moisture to rust the steel, as is seen on many farms, especially on top wires which have been jumped on and the centre wires which get the most animal pressure. Quite often on a conventional fence the the stressed ones are rusty while the bottom wire is still like new although in moist grass. Another sign is where the wire around end posts where it is not stretched is free of rust, while beyond the knot tying it, it is rusty.

Animal control is better and block grazing can be done by connecting to any PF wire, so other than in certain areas, there is no justification for old fashioned fencing now.

The application of electric fencing comes under four main categories.

1. Controlling animals securely and economically.
2. Improving soil fertility and pastures.
3. Security.
4. Improving profit with efficient grazing.

Controlling animals securely & economically

There is no better and easier ways of controlling animals than with good PF and no harder way than with bad PF. Whether it is good or bad is in your hands.

Improve pastures and fertility by -

- Thorough and fast grazing of each paddock, which gives more rapid regrowth, enabling more animals to be grazed on the same number of hectares.
- Shortening the grazing and lengthening the growing periods.
- Eliminating having to back fence.
- Increasing plant tillering and pasture density.
- Returning the animal manure evenly over the whole grazing area, rather than in camping areas.
- Reducing or even eliminating weeds.
- Helping maintain the optimum grass/clover balance by lengthening the rotation for more grass, or shortening it for more clover.
- Preventing the grazing out of clovers.
- Preventing the smothering of clovers by long grass.
- Grazing pastures at the most nutritious stage.
- Allocating the best feed to the highest producing animals, or those being finished for market.
- Providing extra pasture for flushing ewes and increasing lambing percentages.
- Rationing pastures to build up reserves for anticipated lean periods.
- Identifying surpluses and conserving them for hay or silage.
- Using short duration grazing to minimise pasture damage.
- Confining pasture damage during wet periods to small areas or sacrifice paddocks, which can be regrassed if necessary.
- Using animals' hoof action to improve sod-bound pastures.
- Preventing the formation of footpaths in pastures, by rotational grazing.
- The bottom line is that users make more profit.

Animal security

Unfortunately, the theft of animals is now also of concern in many countries, so a demand for security fencing has developed. High-power fencing can be an excellent security fence. Stock thieves have been unsuccessful in getting animals to go through cut electrified fences because the animals knew where the fence was and the shock it could give. With an alarm system power fencing becomes a good security system. Many power fencing systems, some very sophisticated, are available, and can pay for themselves in reducing theft, and escaped and entangled animals.

Animal breakouts are fewer with high-power fencing because animals don't apply pressure to fences all the time like they do to conventional fencing, and even if power fencing is damaged in storms, trained animals usually stay in their paddocks.

Fencing first, drainage next, then lime and fertiliser

Dairy farms with fewer than 40 paddocks, or dry stock farms with fewer than 20 paddocks per mob, can achieve a better return from increasing the number of paddocks, rather than from fertiliser. Animals

also do much better in smaller mobs and produce more, so many large dairy farms divide their herds in to mobs of about 250 to benefit from this. This then requires about 40 paddocks per mob to allow the optimum grazing rotation for each mob.

Comparative trials have shown that subdivision can replace fertilisers to a degree, and that fencing is a once only semi-permanent cost, whereas fertiliser is an annual expense.

On almost every farm the best paddock is the smallest one, because it is the most thoroughly grazed, gets the most even spread of animal manure, and has the shortest grazing period and the longest rest period. On most farms the back paddocks are the worst, usually because they are the biggest, and suffer from stock being left in them for longer. The back grazing of regrowth and uneven grazing cause pasture deterioration. Weeds are not chewed out, but are left to multiply.

Good drainage reduces pasture waste from mud, soil and pasture damage and reduces weed growth.

Fertiliser is still essential for the profitable production of pasture on most New Zealand soils, however, more benefits of fertiliser are achieved when fencing is used to consume all the extra pasture grown.

Weed control

The uneven grazing in big paddocks causes pasture deterioration and weeds not to be eaten. The result is that they multiply and have to be sprayed, or sometimes the paddocks have to be regrassed, as has happened with thousands of hectares of gorse covered land in New Zealand.

Power fencing (PF)

The old term “electric” fence refers to the original low power fences charged by high impedance chargers (rapid flow of current from the charger is impeded so a high-power shock is not possible). Since the 60s, high-power, low impedance energisers have changed fencing, hence the name Power Fencing which differentiates it.

Electric fencing has been used by many dairy farmers in Australasia since the 1940's, but it was only after Dr Doug Phillips of Ruakura Animal Research Station, Hamilton, New Zealand, discovered the high-power, low impedance, system in 1960 that permanent electric fencing really took off.

These days almost every dairy farmer uses PF in one form or another (temporary or permanent fencing). It allows the grazing of animals on mostly, or all, grass farming year round (except where deep snow and droughts prevent this), by building up surpluses and then rationing them through the lean periods.

Reasons for using high-power fencing

- It is an economical way of intensifying controlled grazing with minimum effort and cost.
- It enables grazing to be more flexible and profitable, with the addition of temporary electric fences for further seasonal subdivision where necessary.
- It is very easy to put up and take down.
- Maintenance is minimal - provided quality components and correct construction are used.
- It is low cost and the returns it gives means that it soon pays for itself.

Planning

Before starting, plan the whole layout of fences on your farm relating to numbers of mobs to be grazed, number of days in the rotation, future expansion, etc. Usually at least 20 even paddocks are required for each mob (group to be grazed together). In extensive arid areas using long rotations fewer paddocks are needed.

Measure the area to be fenced so that all paddocks are as near as possible to the same size, otherwise the smaller paddocks get overgrazed and the animals underfed, and the larger ones are under-grazed and the animals overfed.

A scale plan or scale aerial photograph of your farm is not a luxury, but an essential. Survey departments here sell them for a few dollars. If not available and you have unevenly shaped paddocks, measure the perimeter fence and plot it on squares, measuring some and counting them all is accurate. An easy and surprisingly accurate way of measuring these is to go to the centre of the paddock and then to measure to the average boundary each way at right angles to get the average width and average length. Don't measure to the nearest (unless the paddock is close to square) or furthest points from the centre, but

to the average. If unsure, measure several "crosses" and average them. On a vehicle, as described below, it doesn't take long.

Strains can be 1,000 metres or longer, especially where there are large differences in temperatures. The length allows stretch with less breaking, and saves time and is cheaper.

If something is easy it gets done, if hard it doesn't. The thought of measuring every paddock on your whole farm might put you off fencing for life, but there is an easy way, sitting on your tractor, ATV or farm bike. Put a large clear permanent paint mark on the side of the front wheel which can be seen as you drive around the farm, and then just count the number of turns. To calculate the distance the wheel travels per revolution, ensure that the tyre pressure is correct, travel ten turns on pasture (not on a road when the distance travelled could be different), measure the distance and divide it by ten. Make it 20 revolutions if you want more accuracy. To save driving into corners and reversing, estimate the distance or number of turns left when turning and add them on to both measurements. The marked wheel can also be used for measuring block grazing sizes.

Plan a main supply line running up the centre of the area to be fenced. Plan the position of cutout switches and lightning diverters if in a lightning area. Commercial lightning diverters are available. Get the best. Aim for square to close to square paddocks if possible, for more even grazing and less animal walking. Long narrow paddocks are over-grazed at the front and under-grazed at the back and footpaths can develop and can grow weeds.

On hill farms fence the hills from the flats and the north sloping ones from the south sloping ones to make grazing management easier. Angles in power fencing are easy, and better than trying to fence across steep, broken or stony areas.

Metrics

USA is going metric - their coke bottles are in litres, and most USA research is done in metrics. It is far easier to use. A paddock 100 m by 100 m is 10,000 square metres or one hectare which is 2.47 acres. A paddock 100 m by 40 m is 4,000 sq m or one acre (which is actually 4,047), but 4,000 is near enough.

The only problem with changing to metrics is that your farm will become smaller (fewer hectares than acres) and further from town (more km than miles), but you'll be allowed to travel faster, however you won't get there any sooner. The worst will be that you won't remember measurements as well because they won't mean anything to you for quite some time, and you can end up wishing that either metrics were brought in before you were born or after you were dead!

Despite this working in metrics is faster.

Boundary fences

These should comply with local laws. Some countries and states have laws that define a minimum legal fence. If yours is not, and an animal gets out and does or causes damage (vehicle accident) you could be liable. Bad boundary fences make bad neighbours, However, a mile of ours was two wire high-power fencing and the neighbour and I were happy with it. No animal ever went through it, while two bulls over a few years jumped standard seven wire boundary fences - before we put electrified offsets on them.

Power fencing rules

Aim for permanence by using long lasting materials and erecting them well. Animals' bad habits don't have to be broken if they are not allowed to develop, so obey the fencing rules and your animals will too. High-power, good fence design and the best fence products reduce the possibly of animals forming bad habits.

The greatest pressure on a fence is under it, rather than through it, and so fences must follow the contour so that there are no large gaps that stock can try and crawl through, so position a post on all rises, and a tie down in all hollows. It can be a hard wood or ground treated dropper (batten) driven at a 10° angle or a half post buried deep enough to not come out.

Cattle are seldom a problem, but with sheep, goats, pigs and wild dogs the bottom wire should be no more than 15 cm (6") from the ground, and it should follow the ground contour. To achieve this, on all except flat land, place posts according to the contour, not according to the distance between them.

Prepare fence lines by making the fence area smooth and clean, which will make fencing easier with fewer dips and hollows and without trees falling over them, rain washing them out, etc. Sow pasture seed over any bare areas.

Kinks and nicks on wires will break some time in the future, so as soon as you see one cut it out and tie a good knot.

Less rust

Electrified wires don't rust nearly as fast as non-electrified ones, because the shock prevents animal pressure from over-straining them. When wires are over-stretched the galvanising lifts, allowing moisture to rust the steel. One can see this on the non-electrified fences' bottom and top wires that get the most animal pressure so rust, but not around the strainer (end) posts, where stretch doesn't occur.

Design

Internal fences on beef and dairy farms need have only one live wire, preferably the middle one of three. The reasons for this recommendation are to allow children and working dogs to go under the bottom wire without getting a shock, and for adults to go over.

It also allows clean grazing under the fence, thus eliminating leakage through vegetation, which means a lower powered energiser can be used and a higher voltage maintained, to give better animal control with less leakage over-loading the earth system. Pasture under electrified wires gets grazed twice as often and animals learn to not lift their tails near live wires in case they get blown against them, so don't drop manure there and there is no hoof action. The result is a plus because there is less vegetation to grow up and short out the fence when paddocks are closed for silage and hay.

The power lead out and fences along the lane-way may need two live wires to conduct sufficient power to the back of a big farm.

The boundary fence may need a low hot wire to keep out stray dogs and a calf training paddock may need low live wires.

If calves start going under an internal three wire fence, the bottom wire can be electrified (without insulators) for a day and then be disconnected again.

Whatever is done, use the best insulators, not single staple ones which don't insulate well with today's high-power energisers, especially in dew and after bird droppings fall on them. They cost less than a good pinlock insulator, but the saving on the whole fence is a very small percentage.

Poor insulation can lead to requiring a higher powered energiser and leakage problems.

Porcelain used to be the preferred material, but under today's costs the best plastic and fibreglass compounds are more popular.

If an energiser earth is on the opposite side of the parlor to most of the fencing on the farm or of a leak, the current can flow under and/or through the parlor - and through the cows. Energiser earth systems are best placed in damp areas well to the side of parlors, and away from water pipes rather than in line with them, so that the current flow from the back of the farm doesn't flow down water pipes or anywhere near the parlor. Current flows affecting cows in a parlor or animals in barn will be higher after urine makes the surface more conductive.

If current is flowing across the parlor then 'ring earth' it with double insulated electric fence cable which should be buried to eliminate damage, and connected to two metre long galvanised steel or stainless earth stakes four metres apart and in to their full depth. This is a good idea in all cases.

Limit leaks

Watch for shorts to earth or to a non-electrified wire and excessive leakage to vegetation, because these increased current flows load the earth system and aggravate parlor and water trough shock problems.

A perfect energiser and a perfect earth system won't reduce these current flows. If animals don't like going through gateways, or if they change to single file when walking along a lane, then suspect a short in the area. The leak will cause a current flow along the ground in the immediate vicinity, and this could travel through an animal, or between touching animals.

Check the energiser and utility switchboard ground and live wire connections every year for corrosion, and replace rusty wire, especially on the earth system, because rust is a poor conductor.

Thread undergate cable through plastic piping, and never secure undergate cable or the plastic piping with staples, because you can damage them, which encourages leakage at the point where the staple pinches the cable. Just thread the piping with the undergate cable in it up the post in the gaps or tie it to the post with wire, and bend the top down to stop water entering.

Fence Voltage Alarm

Automatically switches powered flood gate off when the river is in flood

Controlling animals with fencing

1. Controlled grazing, the solution to profit from pastures, is only possible on a large scale by using high-power fencing. On most farms both temporary and permanent fencing will be required. We'll cover permanent fencing first because how it is done affects temporary fencing.

2. In the Northern Hemisphere where many milking cows are housed in milking bails for most of their lives, or even if only during milking, some farmers use what they call a 'Cow Trainer' that consists of an electrified wire running the length of the barn just above the back of the cow. If the cow arches its back to pass manure, it normally moves its back legs forward in the bail, and then, instead of the manure going in the gutter, it drops on the floor where the back feet stand. The cow then lies down in it and gets mucky. The cow-trainer wire stops this. To save the cow from getting a severe high-power shock, use a low-power energiser and a 'Flood Gate Controller' that lowers the shock substantially.

Earth (Ground) systems

This is the most important part of an electric fence so read this fully and again each year. Remember that earth wires carry just as much current as live wires.

Energiser earthing is easy to test, but not always easy to fix, and it must be perfect or the full power of the energiser can't complete the circuit, so can't do the distance or control animals with a full shock. Modern large low-impedance energisers need a large earth system. In the 1960s the most powerful was one joule. In 2005 the most powerful Gallagher energiser stores 60 joules to charge 140 km of multi-wire fences, but only releases the amount required for the length of fence and for the situation (leaks and animal shock required) at the time.

A permanent installation should be an "Earth Tester" which is just a piece of galvanised wire pushed a few feet into moist ground well away from the energiser earth system or any other earth, and run back to a position adjacent to the energiser, to facilitate measuring the voltage between it and the energiser earth terminal, NOT to an earth wire that could be disconnected from the energiser or broken. Electric fence booklets that show checking the earth from the end (last) earth stake don't allow for the wire in long grass being disconnected or broken. There should be no voltage reading on the Earth Tester, and none, or a low voltage, on the earth system. If there is a reading on the earth system, then short out the fence with a dozen steel stakes a few metres apart in a damp area at least a hundred metres from the earth system, and measure again. If there is more than 200 volts (0.2 kV on the DVM), the earth wire and clamps should be checked all the way to the last stake, and if these are OK then the earth should be extended, using double insulated leadout cable with at least 2.5 mm galvanised wire in it, and joint clamps. Don't use copper wire. Connecting it to galvanised wire or stakes causes electrolysis and corrosion leading to a bad connection. It is a good idea to support the earth cable from the energiser earth terminal to the earth stakes in insulators so that if in time the cable wears through it won't short on to the building.

80% of earth systems checked in many countries have been found to be inadequate. Earthing is so important that some energiser manufacturers include two pages on the subject in their power fencing manuals, which they include free with each energiser, and supply free to all who request them. Few are read, some are wrong and most are lost, so please read and apply the following for your benefit.

The first lesson is that a limitation with earthing is not just the conductivity to the earth system or from it to the energiser, it is conductivity (contact or joining) from the soil to the earth stakes. In soils that are poor conductors, that is most when dry, but especially pumice and peat, it is very difficult to achieve no voltage on the earth system unless the stakes go into permanently moist clay or into a bentonite and salt earth system.

The modern low-impedance (high-power) energiser without adequate earthing (grounding) is as useless as an old low powered one, and won't energise long fences or control animals, especially sheep, goats, deer and wild dogs. If you have a modern low-impedance energiser and your stock are going through fences, check the earth first, followed by the joints on the whole fence, and at the same time look for shorts.

Many farms seem to have earth systems that can't cope with the current coming back to it from typical fences that suffer from poor insulation, leakage into vegetation and the occasional broken wire that touches the ground or touches a non-insulated wire. Because of demand, energisers have become more

powerful, but many earth systems and their recommendations have not kept up with them.

When the energiser's earth system can't handle the increased flow of electrons, they find other ways of getting back to the power supply ground system. Unfortunately they sometimes do this through cows and milking machines, and through steel water pipes or the water in plastic pipes, which can electrify water in drinking troughs that then stops animals drinking, which can in turn lower animal production and their health. Energisers put out thousands of volts and a fraction of a volt through an animal's mouth or a cow's teat can upset them.

On our drystock farm of 107 ha with 106 paddocks (264 acres with 106, 2.5 acre paddocks) we erected 84 kilometres (52 miles) of two wire fencing (168 km of wire) and we used a disused 30 metre deep 10 cm (4 inch) diameter water pipe bore as the earth. It was perfect with no voltage on it at all, which is rare.

Earthing rules -

- The energiser earth system must be installed well away (some say 10 metres, but I prefer 25 metres) from mains power earth pegs and water pipes, wells and bores, and preferably on the opposite side of a building. It should also be to one side of the dairy rather than on the far side of where most current flows come from, so as to avoid the flows from going through the dairy and cows.
- Use 2 metre long dip-galvanised stakes or 25 mm or larger diameter new water pipe or near new piping driven as deeply as possible into moist soil; each stake should be at least 10 m apart, or further in soils which are bad conductors, such as pumice, sand, peat, etc. Thin, black or rusty stakes or similar are not suitable. Rust is a bad conductor. A large surface area is needed to give a large contact area between the soil and stake unless a bentonite system is used.
- One metre of ground stake per joule of output of the energiser is usually sufficient for satisfactory earthing in conductive soils. Long earth stakes which are driven deep into the soil give far better earthing than the same total length at shallower depths because soils are more moist and have more conductive minerals at lower levels. Two three-metre long stakes are better than three two-metre long stakes. Large stakes have a greater soil contact surface, so are better than thin rods. Also see Bentonite systems.
- Connect the terminal marked Earth or Ground to the earth stakes by one continuous length of double insulated electric fence leadout cable (not household or industrial cables which are made for less than 400 volts, not for 10,000 volts) containing 2.5 mm galvanised wire - not thinner and not copper wire which causes electrolysis at the joins. At connection points bare portions of the wire by burning the plastic with a match or lighter, then wipe it clean. Burning doesn't damage the galvanising which a knife can do, and clamp the bared area tightly to the earth stakes with the proper double galvanised earth clamps. Ordinary galvanised wire can rust where it is damaged or touches the soil. Using cable reduces this.
- Earth systems can have stakes driven in to soil level as long as double insulated undergate cable is used to avoid corrosion of the wire.
- It is best to have no voltage on the earth system, but maximums of 200 volts and perhaps 300 on large energiser earths are acceptable when the fence has been shorted out to as low a voltage as possible.
- Soils are not good conductors, so electrons spread out, inclining towards moist and mineral soils, when travelling back to the energiser. Aim for a moist area, work out a system of keeping the area around the ground stakes moist, or, if necessary, take a 2.5 mm or thicker galvanised wire along the bottom of a fence to a moist area, and then install more ground stakes at that point. If the distance exceeds 100 metres then use two wires or better still use aluminium or aluminium coated wire which is up to three times more conductive than the same thickness galvanised wire. Where soils are very bad conductors such as dry peat, pumice, volcanic ash soils, etc., or are extremely dry at any time of the year, and there is no wet area within a few hundred metres which could be used, a bentonite grounding system can be bought and used.

Bentonite earthing system

Bentonite holds up to seven times its weight in water. Gallagher sell a Bentonite system that includes the bentonite, salt and a stainless steel peg that won't corrode as quickly in the salt. The bentonite mix should be made into a slurry and poured down a 1.2 metre deep 75 mm (3") or larger diameter hole. Place it in a low moist position if possible and keep it moist during very dry weather. A 200 litre drum of water with a slow drip onto the earth system can help. Spread more coarse agricultural salt around it as required because it leaches downwards, which is not all bad because doing this creates a deeper earth. A

bentonite system can improve grounding by up to ten times and is used extensively in arid areas of Australia.

The earth system

Testing the earth system without the fencing shorted out is a waste of time. You must create a flow of electrons to load the ground system before testing it.

Also testing the ground by holding the last ground stake can be a waste of time if the wire between it and the energiser is broken.

To test the ground system, firstly short the fence out with steel rods at least 100 metres from the ground system, and then use a digital volt meter to measure the voltage between the energiser ground terminal and an independent ground wire. This should be pushed as far as possible (about one metre) into damp ground in a position handy to the energiser and several metres away from any other ground stake.

To lower the voltage on the ground system add more ground stakes and/or connect the ground wire to the bottom wire of a conventional fence.

NEVER use your water supply, bore or well as an earth or allow a charger earth wire to touch them or any part of buildings. It can cause shocks in the water and stop animals from drinking, and buildings can become a transmitting aerial for radio and phone interference. Double insulated 2.5 mm (12.5 gauge) double insulated underground cable should be used for the ground as well as the live wire to the fence. Take both through good quality insulators. Unused bore pipes or steel well liners are usually good earths.

Joules (energy) can be measured roughly by holding the live wire and feeling the kick in good insulated gumboots standing on one foot to halve the electrons flowing through your body. Don't do this if you have a weak heart or Pacemaker. Many New Zealand farmers use this system. High-power energisers are essential for controlling animals where long lengths of wire are electrified. The high-power is on for the very short period of 0.0003 seconds, which makes them safe.

Voltage measured at the energiser is useless, especially if the fence wire is thin, limited to one wire or has bad connections, but voltage can be an indicator of the energy when measured at the end of a long fence.

The latest best New Zealand energisers have a system of telling the farmer at the energiser the effectiveness of the fence at various points, and the ground condition, both of which are extremely clever.

The lower the voltage on the ground the better it is, but with high-power energisers it can be difficult to get the voltage below 200 volts, which figure is acceptable, provided it was measured when the fence was shorted (grounded) a few hundred metres from the energiser.

If your stock are going through fences because the voltage is low, check the earth (ground) first, followed by the joints on the whole fence, and at the same time look for shorts.

Test your ground by thoroughly shorting out the fence at least 100 metres away from the energiser with steel standards. Doing this creates the maximum current flow so puts a load on the ground system. If your ground stakes can't handle the flow, you'll get a voltage reading at the energiser terminals. If there is no voltage, then your grounding system is satisfactory.

You should have a digital voltmeter, then install a ground monitoring point by pushing a piece of 4 mm (8 gauge) wire into the ground handy to the energiser and measure between it and the energiser ground terminal. Don't check the last ground stake because there could be a break in the wire to it, in which case you'll think the ground is OK, but it may not be.

With the fence shorted out there should be no more than 200 volts, although no voltage reading is best. The more voltage you read flowing to your ground, the less power you will have on your fence, because it indicates that the ground is inadequate and needs more stakes.

To improve your ground system, increase the number of ground stakes and put them in as deep as possible.

Doing all the above reduces the chances of clicks on your radio and telephone.

See your energiser installation instructions for more details on installing it and a ground system.

Poor earthing costs animal production

A common problem is having energiser ground stakes behind the milking parlor, so that the leaked electrons (there are always some leaks) flow from the farm under the yard and parlor when the soil is moist, but when it is dry they look for easier routes, which can be across a moist yard (especially when wet with urine) and through parlor steel work.

The ground leadout wire from the energiser should be insulated, and not allowed to touch any other wire, building or stake.

Electrons can also move through water pipes, giving shocks to cows when drinking in a paddock, so no wires should be allowed to touch water troughs. Even if not electrified, they can conduct induced current. Cows standing around a full trough waiting to drink can be a sign of power deterring them from drinking.

Where conventional fences have a live wire running with them or as an offset wire, the conventional fence wires can absorb induced current, more so in damp conditions, and become electrified, so un-electrified wires must be grounded or they can build up a voltage which can -

- Jump gaps (bad joins) and cause sparks and radio and phone interference.
- Conduct current to water troughs they may touch. Animals then won't drink so growth and milk production suffer, and females can get cysts on their ovaries through stress. This happened to a herd near us, causing calculated losses of $30,000 over the years it had been happening.
- Give people shocks when opening and closing gates.
- Give animals shocks as they go through gateways and brush against the wires tied around strainer posts.

Grounding these conventional fence lines is easy because, being induced power, it is of low joules (energy or power). All they need is a piece of soft galvanised wire wrapped around all dead wires at the strainer posts and pushed into the soil. These will need replacing when they rust at ground level.

Shocks in milking parlors and water troughs have cost some farmers small fortunes in lost production and empty cows over several years, until the problem was identified.

New Zealand manufacturers discourage grounding the fence circuit though the ground or ground terminal of the charger to the utility (power supply) grounding system because it is illegal in many countries and can cause shocks in all directions including in your shower. The power supply ground is usually just a metre deep rod. A modern high-power New Zealand energiser needs ten to twenty times more.

Radio & telephone interference

It is an offence to operate any appliance which causes any electronic interference, so points to note include -

- Some brands of energisers cause more radio and/or phone interference than others, even if not on a fence. Switch it off, disconnect the fence and ground cables at the energiser (if they were loose the sparking there could cause interference) and switch on the energiser and check for interference.
- If still there, return the energiser to the supplier and try another unit or brand. Some brands are bad.

If the interference disappears when the fence and ground are disconnected -

- Tighten all joins and clamps on the energiser and fences. Those on some energisers work loose because of the thump (vibration).
- Ensure that all wire connections are figure of eight or reef knots, or are clamped and tight.
- Tube insulators will crack and leak in time. Even double tubes and those with steel inserts leak and spark in some cases.
- Sparking causes radio and telephone interference, so insulators must be good quality with adequate tracking distance to avoid arcing over the surface, as occurs with staple insulators, or through the insulator, as occurs with single tubing. Use quality insulators with at least 25 mm (1") of tracking distance (length on insulator from the live wire to any other point).
- Some cable can have breaks in it causing sparking. Single insulated cable gets cracks sooner than double. Try bending a sheet of cardboard and a wad of paper the same thickness and you'll see why. The card will crack. Some of the orange cable from New Zealand cracked and leaked soon after installing. Replace it all.
- Even the best cable when buried can become damaged by a stone and then leak. It is essential that all be threaded through 12 mm, or similar black plastic piping to give it physical protection. If the distance is long, push a piece of high tensile wire (with its end bent back) through and then pull the cable through. To check under gateways, disconnect before each one and check if the interference stops.
- Ensure that the ground is perfect. Check it at the energiser, not at the last ground stake as shown on some instruction books. There could be a break in the cable so there would be no voltage at the last, or

even first stake.

- The ground cable should be one continuous length of double insulated cable or be joined with a good galvanised joint clamp, and must not touch any building or stake. Support the cable in good insulators.
- Use a digital volt meter to test the ground and to locate shorts and maintain tidy, trouble-free fences.
- If still there, tighten all joins and clamps on the farm. This is best done in summer when joint clamps have expanded.
- Walk along it and all wires with a radio tuned off the station and clicking. It will get louder close to the interference cause.
- Shorting to vegetation or to any grounded object can cause clicking, so disconnect the bottom wire and/or clear the fence line with a weed wiper. Once grass touches a live wire, stock won't graze it, or anywhere near it, so the problem increases. Always have the bottom wire able to be disconnected with a flexible connector and do so BEFORE vegetation touches it.
- The mains power supply (utility) ground and all connections including power point terminals and plugs must be adequate with no loose or old verdigris connections.
- If wires run parallel with overhead phone wires or underground phone cables interference can be worse, so avoid the constructing of electrified fences parallel to them and closer than 100 metres from them.
- Live wires on conventional fences can induce current to the dead wires which can then cause a spark as the current jumps joins. The closer the live wire is to the dead ones the more induction.

Radio and phone clicks and computers

Poor connections and leakage through small insulators and vegetation are the biggest causes of clicks on radios and phones, but some brands of energisers are worse than others. Radio interference is worse in poor reception areas, and if the radio is not tuned exactly on the station. Telephone systems are not always perfect. A building livened by an earth wire touching it can act as an aerial and cause clicks. As well as shorts, electric fence wires running parallel with phone wires or underground cables for a hundred metres can cause phone clicks and slow down computer use. When using your computer in a slow area, try disconnecting (unplugging) all other phones and faxes to see if your computer is faster. Also try switching off your energiser.

New (2007) energisers in New Zealand are better now, because all have to comply with interference regulations, but none can prevent clicks from bad connections, shorts and poor earthing.

Finding shorts

The solid state digital volt meter is important for fault finding and for testing the ground system, and enables accurate reading of the voltage and easy fault finding, because of its extreme accuracy. Start by going to the first switch (these must be installed along fence lines to save going back to the energiser to switch it off for repairs and for fault finding) and see if the voltage before the switch increases after opening the switch to stop current flow down the farm. If the voltage increases then go to the next switch. If not, check the fence between the switch and the energiser.

Time savers

Some energisers have systems that tell you at the energiser whether there are shorts, and approximately where they are.

There are many digital volt meters and neon testers. Neon fence testers are of no use for finding small leaks or ground system faults. Many are bought and not used for long before buying a digital volt meter.

A Livelite (Gallagher) positioned in an easily seen position flashes with every pulse if over 3,000 volts and every second pulse if between 1,000 and 3,000 volts.

A Smartfix (Gallagher) volt meter and fault finder helps guide you to the short.

A SmartWatch (Gallagher) continuously monitors your fence and in the event of a short sends a text message to your cell phone, or you can use your cell phone to check the condition of your fence. SmartWatch can also monitor and text your water levels and gate or door openings to your cell phone. It has -

- 25 Joules stored energy.
- Powers up to 80km of multi-wire permanent fence.
- Features SmartPower adaptive output control technology that automatically adjusts to suit your fence conditions while minimising power consumption
- Mains powered with battery backup or battery only operation.
- Remote controlled to switch the energiser on/off from anywhere on the fence.
- Alarms on output, fence and earth voltage alert when voltage is under pre-set levels.
- Advanced lightning protection.
- Self diagnostic capability.
- Fully modular for quick servicing.
- RFI (Radio Frequency Interference) suppressed circuitry.
- Four large easy-to-read digital displays show stored energy, output voltage, fence voltage, earth voltage.
- Special features include battery backup, alarms, auto-dialers.

SmartPac [G50250]

- Includes integrated fault finder functions for improved convenience
- Current and voltage displays simultaneously in 'fault finding' mode for ease of use
- Rechargeable battery means no more battery purchases
- 'Inquire' function shows energiser displays on the SmartPac from anywhere on the fence so you can confirm the fence repair has returned the energiser operation to normal
- Simple interface with three buttons – on / off / Inquire
- SmartPac is able to communicate with nine different energisers.

Permanent electric fencing

The reasons for permanent fencing include keeping animals in and out and getting the best out of pastures and grazed crops. Stones, wooden rails and pickets driven into the ground, were the first barriers used over the years. Barbed wire was patented in USA in 1874, but should not be used in electrified fencing because of the danger of becoming caught and entangled in it. Skin gives a certain amount of insulation, but not when punctured with a barb.

Before deciding on any fences' positions and designs, plan your complete and ultimate layout. This means how you'd like things (herd size, lanes, water reticulation, ditches, shelter belts, buildings and fences) to be in the long term.

Allow for a wintering pad if you think it could be necessary, and plan it large enough for future herd sizes, and for animals to lie down in a sheltered environment. Five square metres per dairy cow has been quoted, but closer to double this is required. Check with your animal welfare and SPCA people as well as environment and private consultants.

Fencing is a comparatively low cost capital item which gives one of the best returns, has a snowballing effect on income, and yet is low on the list of some farmers' priorities when planning and budgeting. Fencing is a management tool which reduces the cost of production by saving fertiliser, reducing weeds, improving pastures and by reducing the uneven distribution of fertility.

Ask farmers which is their best growing paddock and most will answer "My smallest one." Ask them why and they'll say "Because it is the most thoroughly grazed, gets the most even spread of animal manure, and has the shortest grazing period and the longest growing period (termed "rest period" by some, but good pasture doesn't rest during the growing season)."

On most farms the back paddocks are usually the worst, usually because they are usually the biggest. They suffer from having stock left in them for too long, and become uneven through fertility transfer caused by camping.

Electric fencing instruction manuals detail almost every aspect of fence building, but, in spite of this, most electric fences are of a very poor standard, mainly through poor quality insulation and connections.

Always thread undergate cable (use double insulated) through black UV treated plastic piping, and never secure undergate cable or the piping with staples, because you can damage them, which encourages leakage at the point where the staple pinches the cable. Just tie the piping or undergate cable to the post with wire.

The lower the live wires the more leakage through vegetation and through insulators down posts and a live wire too high on the fence is a nuisance when getting over.

Instructions

Complete instructions come with the energisers and accessories, and for those who read the instructions first, PF is very simple. Many instruction books have things in them which are wrong, such as drawings showing a half wit testing the voltage on the last earth (ground) stake on an earth system. If the wire connecting that stake to the energiser is broken there will be no voltage, so the farmer will think his earth is OK, but it may not be.

There are other examples, and commercialism is used promoting their products. I try to promote generically, unless there is good reason to mention a brand product, such as the exclusive Gallagher Tumblewheels.

Problems

Despite the fact that there are approximately half a million energisers made and sold around the world each year, and many millions of farmers using them, there are still farmers who have problems, and even some who abuse electric fencing. There are those with 60 km of power fencing operated from a battery energiser, which is approximately one thirtieth the power of the latest high-power energisers, and yet there are those who run out of power with only 5 km on the latest high-power energiser. Obviously quality of erection is the problem. Keep at least 3,000 volts on your fence line in dry weather (it will drop during wet weather but the animals get a greater shock then), practise good stock handling, and problems should disappear except for the occasional rogue animal which should be disposed off.

Many farmers find that, once more than fifty per cent of their farm is electrified, their stock treat most fences with respect, and animal control and maintenance of electrified and non-electrified drops to a minimum.

Lanes

These should be well made, shaped and consolidated so that they need not be wider than necessary. Avoid having any right angle bends in the lanes, because large animals don't like walking around tight bends, and, when they do, they twist their hooves and damage the lane. Make lanes as short and direct as possible to save time and energy.

Check for stray electricity leaking across the lane, especially when a PF runs down the sides. A sign of this is when cows suddenly change from walking several abreast in the race to single file for no apparent reason. If they always stop at one point check for power leaks and flows there.

Strainer posts

Strainer or end posts can be up to 1,500 metres (5,000 ft) apart saving costs and adding to the flexibility of the fence. See below. These posts should be 2.1 m (7') long by 150 mm (6") diameter (larger diameter if heavy gates are to be swung on them) of long lasting material, and set with more in the ground than out, then supported by a bed log (1.2 m long by 150 mm half round just below ground at right angles to the fence) or a 2 m long stay pointed to fit into a chainsaw made hole in the strainer post a third of the way up (no higher or it will lever the strainer post out of the ground) and held from moving by a 1.2 m by 150 mm half round foot just below ground level. In soft soils an H brace may be necessary. The uprights should have more in the ground than out.

Line posts

On undulating land set them at the tops of rises with tie-downs at the bottom of hollows, to keep the wires parallel with the ground contour. Where possible, as on flat or gently undulating land, it is helpful to have posts spaced at regular distances of, say, exactly 15, 20 or 25 metres, so that when block grazing and giving animals a certain number of square metres, pacing need not be done each time the temporary cross-fence is erected. If necessary on long spans, droppers, battens or fibreglass rods with clips can be installed between line posts.

Flexibility

Posts should be spaced well apart to save money and make a flexible fence that allows wires to

move and spring back, rather than break if supported too closely, with no room to flex or move. Insulators and wire supports must allow the wires to move through them freely to add to the flexibility. This reduces the chance of wires breaking.

Snow load

Where snow-load is a problem, posts need to be closer together to reduce the load on insulators. Also springs must be on all wires, to allow sagging under frozen snow-load.

Use a high-powered energiser to save money. The savings by using power fencing are substantial, and there is nothing more frustrating than stock getting through and wrecking fences because of low power, so use the best and highest powered energiser you can get, especially for long fences, goats, deer, sheep and predators. Once it is discovered how easy electric fencing is to construct, the length will be increased, so a high-powered energiser will allow more to be added without running out of power. The cost divided into the length of fence is low. A $1,000 energiser divided into 5,000 metres of fence is only about 20 cents per metre. 5,000 m (5 km) may seem a lot, but it is the length needed on a 40 ha (100 acre) farm. The energiser should also be modular for ease of fault finding and repair. Modules can be changed by the vendor until the energiser works, saving having to send it back to the manufacturer. Modern ones display the fence voltage, earth voltage, energy and faults. Position the energiser in the building closest to the centre of the area to be fenced, where it is frequently seen, not in a hot corner (electronic components fail in heat), won't cause a fire if blown apart by lightning, and out of reach of children.

Gates can be the most expensive part of fencing and can require the most maintenance; however there is a strong, highly visible 45 mm (1.75") wide 12 stainless steel strand tape gate which has adjustable buckles expanding to any width up to 5 metres (17 feet). Longer tape is available for crossing lanes, etc. The high tensile galvanised spring in the handle keeps the gate tensioned. There are also multi-tape sheep gates.

As herds get larger, gates and gateways become muddy restrictive problem areas. The easiest solution is to do away with them - don't fix things which can be done without. Fences can be lifted up on a pivoting post to allow animals and machinery to walk under, or uncoupled from pinlock insulators and attached to ones at ground level for animals to walk over. Different parts of the fence can be used if one area becomes boggy.

The use of electric fencing for sheep has been slowed by not having low cost simple electrified sheep-proof gates. However, the self insulating insultimber droppers helped, by allowing the use of netting gates for sheep, and the Spring Gate I invented for Gallagher in 1979 proved ideal for cattle. Two spring gates can control trained quiet sheep when their wool is not too long and the pasture is not too short so they are not hungry. For sheep four or more wires are needed. Come winter when long wool and feed shortages coincide, five or more wires may be necessary. Don't wait until sheep are getting out before improving gates and fences, because you will be giving the sheep bad habits which then have to be broken. There are now a number of electrified swinging gates available, but there is room for improvement in this area. An ingenious farmer is likely to invent a gate to fill this gap. On large sheep stations in Australia, lift-up gates whereby the whole fence lifts, work well.

Gateways are where animals expect to get through, so they work on gates more than on fences, therefore gates have to be better at controlling animals than the fences. The gate below achieves this where animal pressure is likely to be high, which with sheep and goats is most of the time. Your time is money so don't waste it and money erecting gates which will be a problem in the future, and possibly have to be thrown out. Also in using high-power fencing you are saving a lot so don't begrudge using gates that cost about what non-electrified ones would cost. Whatever you use, remember that when all fences are electrified sheep will hang around and rub on gates that aren't electrified.

Lift-up system

If fence posts are spaced at about 17 metre centres apart, which is ideal for cattle, fibreglass rods with hooks can be used to lift hot wires to allow animals to move under them to an adjacent paddock, which saves gates and moving the animals to the lane through gateways that can be at the wrong corner of the paddock. If animals are to go south along the lane, then lift the fence as close as possible to the south corner and stand on the south side or have your dog stand there so that animals go out into the lane. Some

farmers prefer to let the wires down and have the animals walk over them, but when doing this the power must be turned off at a switch not too far away, or by using a Gallagher remote switch that turns the energiser off and on again from anywhere on the farm. Put it in your left pocket when off and right pocket when on to avoid forgetting it is off - or on! If unsure, it also measures the voltage.

Let-down system

Some large farms with large herds have given up using gateways that can't cope with hundreds of animals going through and take quite a bit of maintenance. They just use pinlock insulators and let the wires down preferably on a high area so the wires sit firmly on the ground, or they pin them down with a treadin. It is essential that the wires are dead by using cutout switches or remote energiser switches. If an animal gets a shock from one it may refuse to cross.

No thin or rusty wires

These restrict the flow of power so are not good conductors.

Top quality insulators

These prevent the loss of power and reduce repairs.

Use porcelain or white long-life strain insulators and pinlock insulators on the fence line. Tubing is short lived, speeds wire corrosion, and makes it hard to find leaks.

Animals and machinery can hit wires and break weak insulators and snow can overload them. All insulators should have two staples holding them and a tracking distance from the live wire to any support mounting of at least 25 mm (1 inch), and the live wire should be at least 12 mm (half an inch) from any mounting support. The surface should be smooth, to discourage dust, spider webs and moss, all of which can cause leakage. The staples should not be driven in until tight, but stopped to allow a slight movement. Tight insulators are more inclined to break or tear off under pressure.

End or strain insulators

These used to be porcelain, but under today's costs and manufacturing, plastic and fibreglass compounds are more popular and better, because good ones don't crack. When tying them, leave the knot loose enough to untwist under excessive strain if an animal bursts through, rather than have the wire break, and/or cut through the end insulator. It is easier to re-tie the wire back on to the insulator than to repair a broken wire. Also a wire that has broken through stretching has lost its spring, so is damaged and will break again more easily and rust sooner, because the galvanising fractures and lifts from the steel.

Line insulators

These should be attached with two staples, have a smooth surface, a tracking distance of about 25 mm (1") and a straight distance of about 10 mm to any mounting or potential leakage point. A long tracking distance eliminates arcing problem with high-powered energisers. Small insulators which allow leakage through and around them are expensive disasters and nullify the effect of high-power. Use top quality insulators of close to permanent materials from reputable companies. Some companies have sold garbage. Small ones held on with only one vertical staple are the worst at leaking, especially after bird droppings, spider webs or sea spray cover them. The saving in using them is only a fraction of a cent per metre of fence, while the loss of production and your time could add up to thousands of dollars. I've seen these replaced three times with similar new ones - the old three still hanging on the fence. How much does it take for some people to learn. I've seen 300 metres of new five wire all live sheep fence going down to the sea lower the voltage to a useless low level even when a 12 joule energiser was used, through salt leakage. After a shower of rain the voltage was almost zero. Proper insulators (good pinlocks) would have lost little.

Sea air and its salt on a live/earth high-power fence using fibreglass lowered voltage excessively. Fibreglass is an excellent insulator, but when covered with salt and with live and earth wires about 150 mm (6 inches) apart, it still has difficulty. Good insulators with 25 mm tracking distance would increase the total tracking distance to nearly 200 mm (30% more) and give a broken surface which helps reduce tracking. Don't confuse a broken track with a corrugated one as on some insulators. The corrugations can fill with dirt and then, when wet, short badly.

Pinlock insulators eliminate the arcing possibilities of high-powered energisers, and there is no

possibility of metal to metal shorting even after many years, or because of being over-strained, or after the wind chatter effects which wear through tubes. Shocks in milking parlors are caused by current flow through leakage from poor insulation on live and/or earth wires.

Insulators should allow the fence wire to flow through it easily so that an animal or machine hitting the wire doesn't pull the insulator off or break the wire, because it can't stretch over a long distance.

Wire offsets with pinlock insulators

Fit these to all conventional fences because they will make non-electrified fences last longer and be more stock proof, and give power to connect to when block grazing. Use ones which attach to the fence wires (NOT to posts) because wires are more flexible and offsets are less likely to be torn off by machinery and don't fall off the post after it dries and staples pop out. The wire can be disconnected and attached to a pinlock insulator under tension without removing the bracket, and when in position the wire can't come out. Being flexible, they don't injure animals crashing into them, or rubbing on them if there is no power on the fence. Offsets stop animals "walking" the fence and making footpaths which grow weeds and erode. The most economical way of doing this is to take an existing wire off the fence and place it on offsets. Separate insulators on offsets can be easily replaced 20 years later if necessary. While a particular item may cost 10% less, the percentage saving on the whole job may be only 0.1%, but the inferior product could mean earlier and frequent maintenance, leading to frustration with the system.

Hot dipped double galvanised joint clamps

These give good conductivity of the pulse, which is essential. A wire twisted around another is useless when it comes to conducting sufficient energy to control animals. Initially, the twisted join will be reasonable, but deterioration of the join occurs with sparking and the film which forms on the wire. The power loss in loose connections is so great that, after only five unclamped joints, the shock is noticeably lower. Many farmers have increased their voltage at the end of their fence lines by 100% just by using a few dozen joint clamps. Clamp all joints firmly and tighten them every year in hot weather when they are expanded.

When erecting a power fence remember that you have become an electrician. You are not only erecting a fence, you are also erecting power lines, so, to transmit power without resistance, all joints must be well tied figure of eight or reef knots, or be clamped firmly with strong galvanised clamps.

Use only hot dipped galvanised ones specifically designed to give good connections and to last in the field - not electroplated ones which rust within a few years. Some old style joint clamps have been difficult to use. Improved ones are available.

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Clamp wires in parallel to conduct high-power because as with water, the more wires the power has to travel down, the less the resistance. Connect wires in parallel at both ends of strains on main lines down the lane. This will ensure maximum power to the end of the fence. Cross fences should not be coupled in parallel at the far end because doing so makes it hard to find faults on that fence, there is little benefit and because the bottom one or multi wires on sheep fences may have to be disconnected during fast growth of vegetation.

Connect wires in parallel

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Double insulated underground and leadout cables

Double insulation increases cable life and reduces plastic cracking and leaking, which occur more

with single insulated cable. To allow power to continue down the farm when a gate is open, undergate cable should be laid in 12 mm plastic water piping under the gateways, at the same time as burying the animal drinking water pipe. To thread it through the plastic piping push high tensile wire (with end folded back tightly) through first and then use it to pull the cable through. On large farms where multi-wire electrified fences are used, use double insulated 3.15 mm aluminium coated cable to conduct the same amount of power as the fence.

Flexible connectors

Bottom electrified wires which are low should use these for disconnecting them during floods and heavy pasture growth, to reduce the drain on the fence, and during calving, lambing, kidding and fawning. During these periods, stock pressure on the fence is not high and newly born animals should not be subjected to unnecessary shocks. With sheep, goats and pigs, the bottom wire should be no more than 150 mm (6”) from the ground, and it should follow the contour of the ground. In some cases, once stock are trained, the bottom wires of multi-wire fences can be left disconnected most of the time, but the option should be there, so they can be connected if necessary.

Once grass touches the bottom wires it becomes electrified and stock won’t eat it, so it keeps growing and shorts the fence out. When closed for hay or silage, all wires which could get grass touching them should be disconnected. The leakage causes current flows in the area and back to the earth system, which loads it and increases the likelihood of current flowing through water troughs, milking parlors and other buildings. It also lowers the voltage, which then reduces the overall “browning off” ability of the fence, which then results in more leakage. Browning off is where the current flow from high-power energisers kills leaves and dries them out, making them less conductive.

Flexible spring connectors give a reasonably good contact, but are best not used on the main line, nor where voltage monitors and energiser controllers are used. For bottom wires on cross fences which may need disconnecting once or twice a year, they are ideal and save a bit of money.

Pasture under fences

- Bottom wires should always be able to be disconnected with insulated flexible spring connectors or the more expensive switches, as soon as the grass touches the bottom wire. Where there are predators, boundary fence bottom wires should not be disconnected, except in some cases during the day while being grazed.
- Increase the stocking rate so that animals graze pastures closer to fences before any touches the fence and becomes live when it won’t be grazed.
- Sprays which kill everything should not be used, because of cracks which form in the bare soil in clays in dry weather (I've seen fences falling over because of these cracks), possible erosion on hills and because weeds will grow there after a while, which can be stemmy so even harder to control. If essential, use a desiccant such as Paraquat which kills grasses and only knocks clover which grows better after it, because the competition from the grass is removed. Clovers are less likely to reach the fence.
- On small farms a hand held motor driven weed wiper can do a lot in a day.
- Over time pasture will grow less and less under live wires because the area doesn’t get animal manure, hoof action or compaction (some is good) so it ends up higher than adjacent ground and becomes drier. Animals soon learn to not lift their tails near electric fences (the wind can blow tails onto hot wires), so they keep further away from them.

Permanent wire strainers

Buy the best ones, not the first one you see or those you’ve used for years. There are new improved simple low cost ones which allow the tensioning of existing wires without having to cut them, joining broken wires by unwinding them and providing enough wire for the join before tightening the permanent wire strainer again, and to save time doing the above and re-tensioning fences after a decade or so. Don’t wind them up too tight. Power fencing wires must be only tight enough to not sag too low in the heat. When erecting an electric fence you are putting up a flexible psychological barrier, not a physical barrier, therefore the tension need only be sufficient to look neat. In fact, stock have greater difficulty getting through a correctly tightened power fence because the wires move with the animal and give them the shock which occurs every second, whereas wires with over 90 kg (200 lb) tension may allow the animal to slip through before getting a shock. Correctly tensioned wires will also last longer. Much of the rusting of

non-electrified galvanised wires is caused by over tensioning to achieve animal control, and by animal pressure stretching wires, causing the galvanising to lift from the steel core because their stretch rates are different. There is no need for this to happen with correctly tensioned PF. Tie the end insulators so that the knot undoes, rather than break the wire or insulator if animals or machinery hit wires or ice pushes the fence to the ground.

Permanent tension springs

These allow snow and freeze load to occur on wires without over-stretching and damaging the wires, or use let down fences, especially where snow drifts could occur. Also use strong insulators such as pinlocks that are strong and easy to release wires prior to winter snow, and at other times. Space supports closer than the maximum to reduce the load on insulators.

Use let-down fences where snow drifts are likely.

They are made by attaching the wires to a dropper (batten) which is tied to a post and can be easily untied and lowered prior to heavy snow. The wide gateway principle using pinlock insulators can allow snow drifts to run over the lowered wires.

Prepare fence lines

Make the fence area smooth and clean to make fencing easier with fewer dips and hollows and longer lasting without trees falling over them, rain washing them out, etc. Sow pasture seed over bare areas.

Clean up afterwards to avoid shorts because old rusty wires shorting fences are hard to find in long grass. Remove all old fences and wires completely to avoid future short circuits to ground.

Visibility is important because animals soon learn that electric fences are things to be avoided - provided they can see them. To improve visibility and reduce break-throughs, use 2.5 mm galvanised wire for permanent fencing, and high conductivity (ample number of highly conductive metal wires) predominantly white polywire for temporary. Both give most benefit at night when most break-throughs occur, many times just because some animals can't see the fence. Some use 1.6 mm (16 gauge) galvanised wire to save money. It is not as visible and only half as conductive as 2.5 mm, so sometimes okay for cross fences, but not for lanes where the power is being conducted to the back of a big farm.

Before buying polywire check its conductivity. The lower the Ohm figure the better it is, but the conducting wires must also last. Some don’t. If unsure, ask users and ask SEVERAL stores which sells most (be careful if it is also the cheapest) and which users like the best.

Have a training paddock to train animals to power fencing. Placing electrified offsets on existing electrified or ‘old fashioned’ fences around a paddock helps train animals to electric fences. Allow time and space to train any new animals. If necessary disconnect the rest of the farm so that the shock in the training paddock is as high as possible. One severe shock is never forgotten, a light tingle is. If the soil is dry, use an earth return fence.

Animals’ bad habits don't have to be broken if they are not allowed to develop, so obey the electric fencing rules and your animals will too. High-Power and good fence design and products discourage bad habits forming.

Lightning

Lightning is a main causes of energiser failure caused by strikes on fences and on the power supply system. Before a storm unplug and disconnect energisers (and computers, etc.). Don’t do this during a storm when you should keep away from them, telephones, fences and trees. Get off and away from tractors with steel in the ground. If hydraulic, lift the implement. Being in a large safe building is best, unless it has a poor lightning arrestor with insufficient grounding, because it can attract lightning, but be unable to get it to ground quickly enough.

A lightning diverter, also called a lightning arrestor, should be installed. These allow the power surge to go to earth rather than through the energiser and its earth.

Lightning fuses should also be used by plugging them into the mains power point and plugging

susceptible items into them.

Lightning flashes are initiated when the electric fields in clouds exceed the breakdown strength of the ambient air and a progressive spark breakdown commences. At this point the discharge occurs and a return current is initiated from the ground upwards. Currents of a return stroke are between 1,000 and 200,000 amps. Light bulbs are usually between 50 and 150 amps.

The long distances of electric fencing now used increase the chance of a lightning strike, so an effective protective system should be used. Also lightning often hits the power supply line and goes through the energiser to its ground system, blowing its fuse or components. The mains power (utility) supply earth system should be good enough to attract the lightning rather than have it go through the energiser to its ground.

Many modern electric fence energisers include diodes in the output circuit, connected either in series or in parallel with the output transformer. Apparently these diodes (assuming their maximum voltage ratings are not exceeded) are more effective at blocking lightning by making the strike go across the energiser spark gaps, if the energiser is negatively pulsed. This creates a condition where spark gaps can operate and give greater protection of output diodes. If an energiser has no diodes in the output circuit, then there will be little practical difference in lightning resistance between a positive and negative pulse energiser.

Energiser earth systems, because they are substantial, can attract lightning so ensure that it is at least 10 metres from the mains power supply earth, because it and your appliances could be adversely affected by the lightning attracted to the energiser earth system.

There have been cases where after installing a lightning arrestor to a building, the building - never previously struck, got struck, but without damage because of the arrestor.

In lightning areas install lightning diverters to the fence at damp points on the farm where a good earth can be obtained and one at least 15 metres from the energiser earth system. In bad lightning areas have the top wire of fences earthed to independent earth systems in damp areas along the fence lines, but don’t connect it to the energiser earth system.

Earth systems for lightning diverters, if built in a square with one in the centre, apparently conduct more current as a bolt, than when in a straight line. A bentonite system also helps.

Regular maintenance saves work

Spend a little time regularly on maintenance, and remember that maintenance starts with the correct installation as described above. Remember that short cuts in fence design and construction can mean more work in the future fault finding. PF saves and earns thousands of dollars, but don't skimp on it or it will end up being more expensive in time and maintenance.

Check all energiser, mains switchboard, earth and fence wire connections

Check your mains power supply earth and ensure that its connections are tight and that it is not in a dry soil. Also check the complete energiser earth system every year for looseness and corrosion and replace rusty wire, especially on the earth system, because rust is a poor conductor and the earth system has the biggest job to do.

Don’t switch off the energiser or any sections of the fence for long periods or browning off of the grass will cease, and because, if the animals get a shock every time they touch a wire, they learn to respect fences, and control becomes easier.

Voltage monitors first developed by Gallagher in 1980 enable farmers to see from their energiser the voltage they have at remote areas on their farm. This system gives electric fence owners a considerable advantage over those with non-electrified fences, in that warnings are given of slips, fallen trees and broken fences. New monitoring systems developed in the 90s are superior to the earlier ones.

Tumblewheels are a great labour saver which PF users in New Zealand have enjoyed since 1980. They enable the mover to go to one end of his temporary fence and pull the fence across on an angle, without the stock having to be moved out, or getting out over the fence. Developed by veteran inventor and farmer Sandy Chesswas, it incorporates a patent automatic disc switch in the centre of six aluminium legs. Automatically, the top four remain live, and the bottom two on which it rests are disconnected, as it

is rolled across the paddock.

Electrified floodgates can be made by hanging galvanised chains down to above water level and electrifying them through a flood gate controller, which limits the energy loss when water rises and touches the chains. Animals won't go through the live hanging chains.

Other Accessories

There are a host of accessories made to go with the modern PF, which, these days are near permanent, so use those which are of a permanent nature.

Deer

It is over capitalising that has removed profitability from many farms so it is a good reason to use PF wherever possible to avoid this. The use of power fencing for deer has a bright future because the material and erection savings in a fence up to two metres are substantial compared with netting fences, although the latter may be necessary on boundaries. They can be improved by adding an offset live wire.

It is important to not skimp on quality of power fencing materials or to avoid a complete system i.e., correct earthing, adequate numbers of cut-out switches, double galvanised joint clamps, etc. Deer, sheep and goats require a high-powered shock to control them. A shoddy fence will not give this.

Fence design for deer

Deer panic easily, move quickly and can jump high and far, but good power fencing design contains them. Adding offset brackets gives even better control, because it makes them stand back from the fence. Some bucks can jump over a normal height fence (1.3 m) from a standing start. The way to prevent this is to have an electrified wire on an offset bracket 300 mm out from the fence, so that the buck has to stand back from the fence. One on the other side too will keep the attractive doe or aggressive buck a little further away and so discourage contact, fighting and jumping.

Silver reflective (aluminium) strips or wide polytape help. They sniff or lick them and get a severe shock through the head (it won't kill them) and then keep away.

Netting fences have entangled deer when they have tried to reach through to graze on the other side of the fence, especially when they have horns. Electrified offsets prevent them from doing this.

It is also advisable to increase the height of fences where bucks are to be kept away from hinds against their will. An insulated extension (Insultimber or fibreglass) nailed or tied to the top of a fence to support more wires is easy and effective in adding height to existing fences.

Remember that power fencing is a visual and fear barrier, not a physical one.

Training deer

Deer must be trained so that they don't get out and damage fences, or worse still damage themselves, as has happened - sometimes fatally. Being one of the smartest animals, they are easily trained to power fencing, but their intelligence must be remembered when designing and laying out the fences.

Training newly purchased deer to power fencing is essential, so a handy paddock with two metre high conventional fencing and an electrified offset wire is essential. The cost is little for offset brackets set at about 15 metres apart and a single wire.

Use offsets with proper insulators which can be changed if necessary. Tubing over wire offsets has been known to fail within seven months and the faults are hard to find inside tubing.

High-Power

Most failures in controlling some animals, especially deer, occur when the shock is inadequate (below 3,000 volts). Large deer farms may require a high-powered energiser of 20 joules or more, and to build and maintain fences to allow this energy to be available on all fences. Poor connections or inadequate earthing (grounding) can be a cause of animals not respecting fences.

If your animals are getting out, check the earth first, followed by the joint clamps on the whole fence from the energiser to the back of the farm, and at the same time look for shorts.

Bare areas around gateways become dry and non-conductive so deer don't get a shock. They also erode in wind and rain. Pasture damage around gateways and in corners is easily prevented by using a live predominantly white (ultra visible) polywire or tape strung around the area.

Fawning

During fawning and for a month after it is advisable to have the bottom wire of fawning paddock fences disconnected by using a flexible connector so that fawns don't get a shock and run a long distance away - disastrous if it is half way through the fence when it gets the shock.

Keeping wild deer out

This can be difficult with power fencing. The problems can be that they have not been trained to shocks and that they don't see the fence. These two factors then result in damaged fences. The information in this chapter on fencing, especially on offsets and angle fences helps . Fences built on a slope from vertical help achieve this because the deer look at it and find it difficult to work out its height and width. Adding offset brackets to vertical fences helps achieve the same thing. An angle fence may seem difficult to build, but once mastered is not all that hard. Silver reflective (aluminium) strips every 10 metres which they lick and get a severe shock through the head help.

Wild deer can run through new fences and damage them, however if they are of 2.5 mm (12.5 g) high tensile wire and not too tight, with posts well apart, and not too many wires, they are less likely to be damaged extensively and will be easier to repair. Deer are territorial so will continue trying to graze areas previously grazed and may take a while to finally keep out. Never erect fences or parts of them without electrifying them and having training strips (see below).

To keep deer out one needs:

- High-Power low impedance energisers maintaining at least 3,000 volts on all the fence.
- At least five wires, about two metres high.
- Something they like laid under the fence so they eat it and while doing so get a shock.
- Silver reflective (aluminium) strips or wide polytape which they lick out of inquisitiveness and get a severe shock through the head.
- Grassed dampish areas where they stand to touch the fence, not dry non-conductive soil. Erect new fences in damp weather, not in dry weather.
- A clear area so they see the fence.

The area next to the fence should be clear of brush, scrub and tree growth so that they see the fence. Deer panic easily so if they are forced into an electric fence by their not seeing it, or by others coming behind and pushing them into it, they can panic and damage the fence in seconds. The other wild deer in the group then all storm through. The first one may have got a shock while others are unlikely to have got one, so the next day when they come back for more of your highly palatable ryegrass, the shocked one may hold back, but another will lead and go through with the same performance, wrecking your fence every day. Deer usually arrive at dusk, so being in the paddock may slow them down in time to get a shock.

Use an energiser which monitors the system and warns you of problems so if the voltage drops you can get there quickly to fix it. You will save a lot of money using PF, don't waste it all by allowing the system to fail.

Always have wire cutting pliers handy to cut animals free and an energiser remote controller or cutout switches to switch the fence off from wherever you are.

Goats

The increase in the number of goats being farmed is attracting the attention of forestry conservators because in the past goats climbed out over conventional fences and went wild in forests. They then multiplied and caused severe plant damage and soil erosion in camping areas and on footpaths.

Warnings are rightly being given about what goats can do regarding erosion and tree damage. In Taiwan they were not allowed on other than flat land until New Zealand power fencing enabled sufficient paddocks to be made to keep rotating them, and so prevent prolonged camping and the development of paths up and down hills which heavy rain can turn into gullies.

Man is quick to blame the weather and others or animals for mistakes he makes. We have ownership and control over our land so are responsible for what domestic animals do to it and for its conservation. If there were no power fencing one could be sympathetic to people not being able control goats, but, when modern electric fencing can be erected so easily, there is no excuse for land abuse through lack of animal

control. Footpaths, followed by erosion, occur when paddocks are large, and there are insufficient paddocks to keep the goats on a reasonably fast rotation.

Fences should not be constructed straight up and down hillsides, but on an angle to the slope, so that water runs through the fence, not down footpaths on the side of fences.

Tree protection is simple with four posts (two if it is next to a fence) and four off cuts of wire. Subdivision should be planned to go via tree areas so that they can be protected.

Eroding areas can be fenced to exclude animals and allow grasses to re-establish.

Goats are notoriously good fence negotiators and also have a strong wander lust - partly because of their browsing nature, and partly because their early development was in arid areas where they had to roam for miles to get enough to sustain themselves. There is no reason why goats should escape with today's high-power fencing.

Goats are possibly the animal which was first domesticated, being referred to since the earliest Egyptian, Greek and Roman times. This may account for their tameness and intelligence.

They are easy to herd and even today are still tended this way in many countries, including in their country of origin, Turkey. In New Zealand where we have no surplus labour on farms to herd animals, and where there can be valuable crops on one side of the fence and goats on the other, fences have to give 100% control. Electrified offset wires have been a boon in making conventional fences goat proof, and in extending their life, for as little as 20¢ a metre.

Goats are naturally well insulated with their long dry hair, dry skin and long bone hooves, so they need a more powerful energiser to give them a good shock to maintain control. Dogs, on the other hand, are the opposite, in that many have short hair and soft flat feet, which give good contact with the soil. To keep control of hard to control animals like goats, all rules of power fencing must be carried out and at least 3,000 volts kept on all fences. The recommendation of keeping all fences electrified applies especially to goats, because, if they do crawl under a fence without touching the wire, they should not be allowed to get through the next one without a shock.

Unlike cows, goats notice if another gets a shock and they also notice if they don't, so if one goes through without a shock others will follow, wires will be stretched (not to mention human tempers) and control can be lost.

With goats, sheep and pigs, the bottom wire should be no more than 150 mm (6”) from the ground, and it should follow the contour of the ground.

During kidding, stock pressure on the fence is usually not high because ample feed should be available. Newly born kids should not be subjected to unnecessary shocks, so bottom wires should be disconnected with flexible connectors.

Netting fences have entangled goats when they have tried to reach through to graze on the other side of the fence, especially when goats have horns. Electrified offsets can prevent them from doing this.

Some bucks can jump over a normal height fence from a standing start. The way to prevent this is to have an electrified wire on an offset bracket 300 mm (1’) out from the fence, so that the buck has to stand back from the fence. One on the other side too will keep the attractive doe or aggressive buck a little further away and so discourage contact, fighting and jumping.

It is also advisable to increase the height of fences where bucks are to be kept against their will. An insulated extension or fibreglass nailed or tied to the top of a fence to support more wires is easy and effective.

Horses

Horses can be silly and run around like maniacs into fences and become entangled in wires, especially in new and small paddocks. To reduce this happening, use rails around very small paddocks, and walk them along the fences of new paddocks that don’t have rails before letting them loose. To help train them to power fencing place an electrified wire on rail fences and an offset electrified wire on conventional fences. Always give them time and space.

If you have valuable horses you should make high (to discourage jumping) and good visible fences (so they see them) of at least 2.5 mm (12.5 gauge) high tensile wire with close to 5,000 volts high energy (10 or more joules), and have an energiser which monitors the system and warns you of problems, so if the voltage drops because a horse is entangled you can get there quickly to free it. Modern electrified fences have this advantage. Horses, if spooked, can become entangled in non-electrified fences, but there is no warning system to alert owners. Also always have wire cutting pliers handy to cut animals free and a

remote fence controller to switch the energiser off from wherever you are.

Pigs

As is known, these animals are intelligent so plan their movements. Farmers have seen some stand and look at a fence erected to keep them out of a crop, start screaming, then charge the fence and get through - almost always underneath, However, this is usually with low power chargers and is seldom done by pigs trained to high-power low impedance energisers. Once trained to a good shock they are easier to control, but if temptation in the form of attractive feed is just through the fence they will be continually tempted to try and get through, especially if they have tasted the crop. This is again a case of avoiding having to break bad habits which can be caused by pigs getting into the crop before the fence has been erected, the power being off, low power, bad fence design, crop temptingly close, etc.

Sowing tempting crops a few metres back from the fence helps and the bottom wire should be no more than 150 mm (6”) from the ground and follow its contour exactly. If piglets are being controlled, the bottom wire may have to be lower.

When confined to small areas pigs are inclined to kill the pasture. If the soil then becomes dry and/or is non-conductive, it can be so insulating that even 4,000 volts at the fence when measured to a good earth, can be only about 1,000 to the dry soil, so pigs get through.

Solutions to the killing pasture are to use an offset wire to make the fence wider and prevent the pasture under the real fence from being killed, to keep the area moist, to have a movable temporary fence to allow resowing of pasture under the fence, and to rotate the pigs between paddocks so that they don’t kill the pasture.

Rabbits

Four electrified wires spaced at 80, 90, 100 and 110 mm from the ground on vertical supports achieve control. Angle fences were used in the beginning with the slope facing the infestation, but it has been found that a vertical fence does just as well and is easier to erect and maintain. As with other wild life, high-power and at least 4,000 volts are necessary.

Wild Dogs, Wolves, Dingoes & Coyotes

The recurring problem these can cause can be reduced or even eliminated by erecting five wire high-power electrified boundary fences. Where fences already exist, adding an offset bracket with a live wire 150 mm (6”) above the ground can do the trick.

In 1984 I developed an 18 hectare demonstration drystock farm for Gallagher Electronics Ltd behind their factory on Hamilton's western boundary and initially had town dog problems every few months. After constructing a five wire electrified fence around the whole property we achieved 99% dog control. The only dog to get through the fence must have received the 5,000 volt shock, because it went no further than into the first paddock and then (going by the tracks) spent the night walking the fence trying to get back out. It had to be called and let out through a gate.

Dogs with their four soft padded feet are excellent conductors so are easier to control than hooved animals.

In USA two reasons for the decline in sheep numbers from 30 million a few decades ago to 13 million, are fencing costs and coyotes. Lambs in the USA fetch US$100 each, net to the farmer, so high-power fences are viable.

Floating fences

When an electrified wire or wires need to be run across water, either as a lead-out or to control animals, plastic drums can be used as floats. Ballast may have to set in the bottoms to stop them rotating. Wet concrete poured in and allowed to set should do this.

Not all plastic is insulating, so screw a good insulator to the top.

When the water level drops the drums will go down and still give a lead-out or fence. If the fence needs to be higher, use an extension which can be fibreglass bolted to the drum. Seal the bolt holes to avoid water entering.

Allow enough slack for high and low water. A long spring may be necessary on one or both ends to keep tension on the wire or wires.

Block grazing

Block grazing is the term now used to get away from the term ‘strip’ because the squarer the area the better. It reduces animal walking, gives more even grazing, reduces pasture damage, keeps animals warmer in cold windy weather and uses shorter lengths of temporary or portable fencing with reduced likelihood of breakthroughs. Temporary fencing allows:

- Fast and thorough grazing of each paddock giving more rapid regrowth, increased plant tillering and pasture density, enabling more animals to be grazed on the same size farm.
- Returning of the animal manure evenly over the whole grazing area, rather than in camping areas.
- Grazing pastures at the most nutritious stage for maximum animal production.
- Allocating the best feed to the highest producing animals, or those being finished for market.
- Extra pasture for flushing ewes and increasing lambing percentages.
- Rationing pastures to build up reserves (stockpiling) for anticipated lean periods.
- Identifying surpluses and conserving them as hay or silage.
- Confining pasture damage during wet periods to small areas or sacrifice areas, which can be regrassed if necessary.
- The use of animals' hoof action to improve sod-bound pastures.
- Preventing the formation of footpaths.
- Keeping most weeds under control.
- Eliminating back grazing with back fences.
- Improving stock management because of earlier and easier observation of any health problems when animals are grouped.
- Rotationally grazing lambs, which then yield more meat and less fat.
- Regular moving of animals which quietens them.

Temporary fencing is the only way to economically achieve the many benefits mentioned above.

Before starting to temporary fence animals new to it, train them in an area where they can learn with lots of time and space. When temporary fencing goats and deer, use a reasonably high-powered energiser of ten joules or more and maintain at least 3,000 volts on all fences. If you have mains power on all fences around the farm it is ideal, provided you have good connections and adequate power, otherwise use a one joule or higher battery energiser. Goats especially, are naturally well insulated with their long dry hair, dry skin and long bone hooves, so need a powerful energiser to give them a sufficient shock for good control.

Block grazing tips

Rather than have an insulator at the end of the polywire, remove the stainless steel strands at the end of the polywire and make a loop to attach to the non electrified fence. If power has to flow down the polywire from the far end, then, holding the insulated bared end, wrap the conductive part around the live wire twice for a good contact, and tie the end to a post or make a bow.

Don't roll in polywire with a large insulator on the end, because its snagging in the grass will stretch the polywire and shorten its life.

Don't wind the wire in through pigtails or treadins, because doing so will cut through the insulation.

Don't allow polywire to short on to steel, because doing so melts the stainless steel strands.

Don't leave polywire anywhere stock can get at it when not electrified, or they'll chew and ruin it - I'll bet you all knew that one.

Don’t leave polywire where the sun can damage it.

Measuring pasture dry matter essential

With controlled grazing under-feeding animals can be a problem. One may look at the poor areas and think that they have about half as much grass as the good areas, and they sometimes do, but frequently the dry matter available may be only a quarter, after allowing for a residual of 1,500 kg of dry matter per hectare. To clarify this, let's assume the best paddock has 2,600 kg/ha so a yield of 1,100 kg/ha, and the worst has 2,000, which is more than half as much, but a yield of only 500 or less than half as much. The only way to find out is to measure or eye assess the pasture figures before and after grazing.

Temporary fencing

No dairy farmer questions the necessity to strip or block graze cows on pasture, especially during pasture shortages, but fewer cattle, sheep, goat, horse and deer farmers use this management system. The reason dairy farmers lead in this and other grazing techniques is because they see their milk production figures every day. These go up and down daily depending on the amount fed.

Fence easily

There are right and wrong ways of erecting temporary fencing for block grazing. The correct way is to take the reel in one hand, and the treadins in a carry bag or under the other arm, and go to the appropriate fence. Tie the bared polywire to the wire or post or use an insulated grip which doesn't catch in grass when being rolled in.

Then walk across the paddock unwinding the reel to the opposite fence. As you go, position the treadins, preferably on high places and in low places to stop jumping over low wires or crawling under high wires. Hang the reel on the fence, wind up to the correct tension, avoiding stretching the polywire. Electrify the reel with a power connector.

When rolling up the temporary fence, go to the reel end, disconnect the power, take the reel and walk as you wind in the polywire, placing the treadins under your arm as you go.

If you happen to go to the insulgrip end first, disconnect it and drop it on the ground, but remember that the polywire will be live. Collect the treadins as you walk or ride on your Japanese quarter horse (farm bike) towards the reel.

Winding in the polywire with an insulgrip on the end is easier than if there is a large insulator and wire hook on the end. Also, the insulgrip doesn't catch on the grass and weeds, which stretches the polywire.

There are mechanised labour savers which mount on ATVs to hold treadins and reels, and even wind in the polywire.

Improving soil fertility & pastures

When animals are not controlled they graze selectively, transfer fertility to camping areas, create foot paths, back graze regrowth and allow pastures to deteriorate. When controlled they improve pastures. The back grazing of young fresh regrowth is bad for the pasture because it depletes root reserves, and bad for animals because of scouring from the yellow immature feed. Intensive subdivision reduces back grazing, without having the extra work of using temporary back fencing. If block grazing is necessary and all fences are PF it is easy to hook onto them.

Why block graze cattle, sheep, goats, deer, pigs & horses?

No dairy farmers question the necessity for block grazing their cows because they see the increased milk production, while fewer cattle, sheep, horse and deer farmers use this management system, which is easily achieved by having sufficient paddocks or using temporary fencing.

Block grazing improves pastures, fertility and profit by -

- Grazing pastures at the most nutritious stage for maximum animal production.
- Allocating the best feed to the highest producing animals, or those being finished for market.
- Reducing the cost of weed control.
- Saving labour when checking animals which are grouped.
- Improving stock management because of earlier and easier observation of any health problems when animals are grouped.
- Saving pasture for flushing ewes and increasing lambing percentages.
- Identifying surpluses and conserving them for hay or silage.
- Rotationally grazing lambs, which then yield more meat and less fat.
- Rationing pastures to build up reserves for anticipated lean periods.
- Regularly moving animals to new pasture, which quietens them.
- Conserving animal energy by reducing their aimless walking.
- Preventing the formation of footpaths.
- Making mustering easier.
- Using animals' hoof action to improve sod-bound pastures.
- Reducing parasite infestation by providing fresh pasture and reducing infested camping areas. The increased carrying capacity can negate this.

- Confining pasture damage during wet periods to small areas or sacrifice paddocks, which can be regrassed if necessary.
- Protecting crops, trees, eroding areas etc., from damage.
- Reducing ear tag losses because animals don't put their heads through electric fencing.
- Thorough and fast grazing of each paddock, which gives more rapid regrowth, enabling more animals to be grazed on the same number of hectares.
- Shortening the grazing and lengthening the growing periods.
- Eliminating having to back fence.
- Increasing plant tillering and pasture density.
- Returning the animal manure evenly over the whole grazing area, rather than in camping areas.
- Reducing or even eliminating weeds.
- Helping maintain the optimum grass/clover balance by lengthening the rotation for more grass, or shortening it for more clover.
- Preventing the grazing out of clovers.
- Preventing the smothering of clovers by long grass.
- Identifying surpluses and conserving them for hay or silage.
- Using short duration grazing to minimise pasture damage.
- The bottom line is that users make more profit.

Power fencing (PF)

The old term “electric” fence refers to the original low power fences charged by high impedance chargers (rapid flow of current from the charger is impeded so a high-power shock is not possible). Since the 60s, high-power, low impedance energisers have changed fencing, hence the name Power Fencing which differentiates it.

These days almost every dairy farmer uses PF in one form or another (temporary or permanent fencing). It allows the grazing of animals on mostly, or all grass farming year round (except where deep snow and droughts prevent this), by building up surpluses and then rationing them through the lean periods.

Reasons for Using High-Power Fencing

- It is an economical way of intensifying controlled grazing with minimum effort and cost.
- It enables grazing to be more flexible and profitable, with the addition of temporary electric fences for further seasonal subdivision where necessary.
- It is very easy to put up and take down.
- Maintenance is minimal - provided quality components and construction are used.
- Its low cost and the returns it gives means that it soon pays for itself.

Energisers

These are now built for every purpose, and include ones which can be operated from a wide variety of power sources, including solar and wind power. The energisers for the latter two power systems have been developed with economy in mind, and yet they still have a power output greater than many mains energisers. Battery energisers have been developed to the stage where some have more power than some mains energisers. They were developed for the vast areas of Malaysia, Kenya, Argentina and Australia where mains power was not available, and where large wild animals need a severe shock to control them. These high-powered battery energisers drain the batteries fairly rapidly, and so are best used where lighting plants or other regular battery charging facilities are available. In the 80s 200 km of PF were erected in Malaysia each year, to keep elephants out of rubber and palm oil plantations. Low powered energisers, trenches and log barricades had all previously failed to keep the elephants out. If these cunning animals can be controlled, then most can.

Safety standards require that energisers are installed as follows -

1. Under cover away from driving rain, and away from moisture.
2. Away from combustible material.
3. No more than one energiser may be connected to any one fence at a time.
4. If an overhead leadout wire is used it should be clearly marked and local aerial operators should be notified of it presence.
5. Electrified wires should avoid coming in contact with other fences and overhead transmission

lines.

6. Local body approval must be obtained before using their poles as supports and before constructing any electrified fences near or across any public areas or thoroughfares.

7. Telephone and power supply authorities must be contacted before constructing electrified fences parallel with their lines.

Gates

These can be the most expensive part of fencing and can require the most maintenance, however there is a strong, highly visible 45 mm (1.75”) wide 12 stainless steel strand tape gate which has adjustable buckles expanding to any width up to 5 metres (17 feet). Longer tape is available for crossing lanes, etc. The high tensile galvanised spring in the handle keeps the gate tensioned. There are also multi-tape sheep gates.

As herds get larger, gates and gateways become muddy restrictive problem areas. The easiest solution is to do away with them - don’t fix things which can be done without. Fences can be lifted up on a pivoting post to allow animals and machinery to walk under, or uncoupled from pinlock insulators and attached to ones at ground level for animals to walk over. Different parts of the fence can be used if one area becomes boggy.

Cut-out switches

Use these for ease of maintenance and fault finding. Every time you have to do something to the fence, you don't want to have to go back to the energiser to switch it off. Remote energiser on/off controllers are available. They turn the energiser off and on again through the live wire.

To trace a short in the fence, it is far easier to switch off sections at a time, and test the voltage, thereby isolating the fault to a small section of fence which can then be checked more easily than looking for a short over the whole farm.

The latest cut-out switch is fully enclosed, has stainless steel contacts, nuts and bolts, for long life, and has been designed so that it can easily be switched on and off from a bike or a horse without getting a shock. Being sealed, spiders and bird droppings don't cause leakage and corrosion. Some switches can be locked in on or off positions to prevent strangers from changing them, or the knobs of some can be removed, leaving the switch live to reduce the likelihood of tampering.

Use only top quality line insulators to prevent the loss of power. They should be attached with two staples, a smooth surface, a tracking distance of about 25 mm (1”) and a straight distance of about 10 mm to any mounting or potential leakage point. A long tracking distance eliminates arcing problem with high-powered energisers. Small insulators which allow leakage through and around them are expensive disasters and nullify the effect of high-power. Use top quality insulators of close to permanent materials from reputable companies. Some companies have sold garbage. Small insulators held on with only one vertical staple are the worst at leaking, especially after bird droppings, spider webs or sea spray cover them. The saving in using them is only a fraction of a cent per metre of fence, while the loss of production and your time could add up to thousands of dollars. I’ve seen these replaced three times with similar new ones - the old three still hanging on the fence. How much does it take for some people to learn. I’ve seen 300 metres of new five wire all live sheep fence going down to the sea reduce the voltage to a useless low level even when a 12 joule energiser was used, through salt leakage. After a shower of rain the voltage was almost zero. Proper insulators (good pinlocks) would have lost little.

Sea air and its salt on a live/earth high-power fence using fibreglass lowered voltage excessively. Fibreglass is an excellent insulator, but when covered with salt and with live and earth wires about 150 mm (6 inches) apart, it still has difficulty. Good insulators with 25 mm tracking distance would increase the total tracking distance to nearly 200 mm (30% more) and give a broken surface which helps reduce tracking. Don’t confuse a broken track with a corrugated one as on some insulators. The corrugations can fill with dirt and then when wet, short badly.

Pinlock insulators eliminate the arcing possibilities of high-powered energisers, and there is no possibility of metal to metal shorting even after many years, or because of being over-strained, or after the wind chatter effects which wear through tubes. Shocks in milking parlors are aggravated by current flows from poor insulation.

Insulators should allow the fence wire to move through it easily so that an animal or machine hitting the wire doesn't pull the insulator off or break the wire, because it can't stretch over a long distance.

End or strain insulators used to be porcelain, but under today's costs and manufacturing, plastic and fibreglass compounds are more popular and better, because good ones don't crack. When tying them leave the knot loose enough to untwist under excessive strain if an animal bursts through, rather than have the wire break, and/or cut through the end insulator. It is easier to re-tie the wire back on to the insulator than to repair a broken wire. Also a wire that has broken through stretching has lost its spring so is damaged and will break again more easily and rust sooner because the galvanising fractures and lifts from the steel.

Fit wire offsets with pinlock insulators to all conventional fences because they will make non-electrified fences last longer and be more stock proof, and give power to connect to when block grazing. Use ones which attach to the fence wires (NOT to posts) because wires are more flexible and offsets are less likely to be torn off by machinery and don't fall off the post after it dries and staples pop out. The wire can be disconnected and attached to a pinlock insulator under tension without removing the bracket, and when in position the wire can't come out. Being flexible they don't injure animals crashing into them or rubbing on them if there is no power on the fence. Offsets stop animals "walking" the fence and making footpaths which grow weeds and erode. The most economical way of doing this is to take an existing wire off the fence and place it on offsets. Separate insulators on offsets can be easily replaced 20 years later if necessary. While a particular item may cost 10% less, the percentage saving on the whole job may be only 0.1%, but the inferior product could mean earlier and frequent maintenance, leading to frustration with the system.

Use double insulated underground and leadout cables to increase their life and reduce plastic cracking and leaking which occur more with single insulated cable. To allow power to continue down the farm when a gate is open, undergate cable should be laid in 12 mm plastic water piping under the gateways, at the same time as burying the water stake. To thread it through the plastic piping push high tensile wire (with end folded back tightly) through first and then use it to pull the cable through.

Bottom wires which are low should have flexible connectors for disconnecting them during floods and heavy pasture growth to reduce the drain on the fence, and during calving, lambing, kidding and fawning. During these periods, stock pressure on the fence is not high and newly born animals should not be subjected to unnecessary shocks. With sheep, goats and pigs, the bottom wire should be no more than 150 mm (6") from the ground, and it should follow the contour of the ground. In some cases, once stock are trained, the bottom wires of multi-wire fences can be left disconnected most of the time, but the option should be there, so they can be connected if necessary.

Use permanent wire strainers and the best, not the first one you see or those you've used for years. There are new improved simple low cost ones which allow the tensioning of existing wires without having to cut them, joining broken wires by unwinding them and providing enough wire for the join before tightening the permanent wire strainer again, and to save time doing the above and re-tensioning fences after a decade or so. Don't wind them up too tight. Power fencing wires must be only tight enough to not sag too low in the heat. When erecting an electric fence you are putting up a flexible psychological barrier, not a physical barrier, therefore the tension need only be sufficient to look neat. In fact, stock have greater difficulty getting through a correctly tightened power fence because the wires move with the animal and give them the shock which occurs every second, whereas wires with over 90 kg (200 lb) tension may allow the animal to slip through before getting a shock. Correctly tensioned wires will also last longer. Much of the rusting of non-electrified galvanised wires is caused by over tensioning to achieve animal control, and by animal pressure stretching wires, causing the galvanising to lift from the steel core because their stretch rates are different. There is no need for this to happen with correctly tensioned PF. Tie the end insulators so that the knot undoes, rather than break the wire or insulator if animals or machinery hits wires or ice pushes the fence to the ground.

Use permanent tension springs to allow snow and freeze load to occur without over-stretching and damaging the wires or use let down fences, especially where snow drifts could occur.

Use let-down fences where snow drifts are likely. They are made by attaching the wires to a dropper (batten) which is tied to a post and can be easily untied and lowered prior to heavy snow. The wide gateway principle using pinlock insulators can allow snow drifts to run over the lowered wires.

Visibility important

Many animals don't have good eyesight and horses in particular need to be trained slowly and

carefully by having the wide predominantly white tape along rails. Once they know about the shocks from the tape, walk them around new paddocks next to the electrified fence which must also have a predominantly white tape on it.

Animals soon learn that electric fences are things to be avoided - provided they can see them. To improve visibility and reduce breakthroughs, use predominantly white polywire or tape (wide ones for horses), the benefits of which really show at night when most breakthroughs occur, many times just because some animals can't see the fence.

To improve visibility and reduce break-throughs, use 2.5 mm galvanised wire for permanent fencing and high conductivity predominantly white polywire for temporary. Both give most benefit at night when most break-throughs occur, many times just because some animals can't see the fence. Some use 1.6 mm (16 gauge) galvanised wire to save money. It is not as visible and only half as conductive as 2.5 mm, so sometimes okay for cross fences, but not for lanes where the power is being conducted to the back of a big farm.

Have a training paddock to train animals to power fencing, allowing time and space. Placing offsets on existing fences around a paddock helps train animals to electric fences. Allow time and space to train any new animals thoroughly.

Maintenance

Regular maintenance saves work, so spend a little time regularly on maintenance, and remember that maintenance starts with the correct installation as described above. Remember that short cuts in fence design and construction can mean more work in the future fault finding. PF saves and earns thousands of dollars, but don't skimp on it or it will end up being more expensive in time and maintenance.

Check the energiser, mains switchboard, earth and fence wire connections (live and earth return) every year for corrosion, and replace rusty wire, especially on the earth system, because rust is a poor conductor.

Don’t switch off the energiser or any sections of the fence for long periods or browning off of the grass will cease, and because, if the animals get a shock every time they touch a wire, they learn to respect fences, and control becomes easier.

Voltage Monitors first developed in 1980 enable farmers to see from their energiser the voltage they have at remote areas on their farm. This system gives electric fence owners a considerable advantage over those with non-electrified fences, in that warnings are given of slips, fallen trees and broken fences. New monitoring systems are superior to the earlier ones. Some indicate where the short is.

Other accessories

There are a host of accessories made to go with the modern PF, which, these days are near permanent, so use those which are of a permanent nature.

Other fencing layouts

Some will ask about the Wagon Wheel, Cell or Savory system of fencing. It originated in South Africa pre 1900 when herd boys would herd the animals in a rotating V around laagers (ox wagons put in a circle as a defence against attack). At night the animals were put into the centre of the laager. This pattern continued until peace and fencing allowed animals to be left out at night. Lions took a few, but not enough to discontinue grazing, except in some areas where they were still herded by guards with guns and locked in 2 metre high yards at night. A lion can jump over less than that height with an animal in its mouth.

The wagon wheels were built around watering points which were dams or windmill pumps with up to 30 paddocks in one cell. The cell centres had minerals, handling races, crush pens (lassoing, still done in North America to handle cattle, was never done in South Africa) and perhaps a dip, which had to be used weekly in summer and fortnightly in winter against flies and tick born diseases, which killed domesticated (European) animals in large numbers.

Stockmen would plan to be at the cell centre at the time animals came to drink. They would then open a gate opposite the section the animals were in and they would go to the new V shaped paddock, or camp as they called them. As they moved across they could be counted to check for theft, predator killings and disease deaths.

Allan Savory went from Rhodesia to USA and took the idea which works well in low stocked dry

areas like some of Rhodesia (now Zimbabwe) and where reticulating (distributing water by pipes to troughs around the farm) water is impossible. In wet areas it is far from satisfactory, as was found in the moist areas of Hawaii.

When I first went to Hawaii in 1980 and saw them, I pointed out the problems which would develop and were already occurring, i.e., a quagmire in the centre unless gravelled, pasture damage towards the centre of each triangle, fertility transfer to the areas near the centre, under-grazing at the back and timid animals sometimes suffering because they follow the mob back to grazing without having had a drink. Mob movement for water is bad for everything - pasture damage, animals and water flow.

I suggested to Parker and Kahua ranches on the Big Island that they aim for as near as possible to square paddocks. Prior to cells there were about 20 paddocks on Kahua's 2,000 hectares, with animals seldom being moved, low weight gains and timid animals. Increasing from 20 to 200 near square paddocks and laying water to them over 6 years allowed beef cattle numbers on the ranch to be doubled. All controlled grazing quietens animals so they settle to feedlots more quickly, and, in the case of some, taking a few weeks off expensive feedlot fattening time which is worth a lot.

I write about cells to credit Allan Savory and the fact that the cells in Hawaii did some good, because they got controlled grazing started there and in other parts of USA, and to warn people not to use them unless in arid areas with no other options.

As in most things, there are times when using the cell system is useful. We used it on our first farm we bought in 1955. It was 40 hectares (100 a) with no lane and only two 20 ha paddocks and only one water trough at the parlor so I used two temporary fences of 1.6 mm (16 gauge) galvanised wire (no polywire or high tensile wire in those days). One was in front and one behind the cows to make a long narrow triangle from the parlor to the boundary. The front one was moved as the cows were brought in for milking and the back when going to get them for the next milking. It worked well for the first year until a lane and square paddocks were made.

I should point out that the term "cell" is also used to refer to a group of paddocks of any shape and layout operated as one unit. A large farm or ranch can have several cells.

Fencing & milking in the future

Farmers are having to run larger and larger farms to retain their financial positions, and they are having to do it with less help. This means that they are going to need more labour-saving systems.

Those who for one reason or another can't expand will have to work off the farm to supplement their income. In all cases labour saving devices are assured of a bright future - look at our kitchens.

Automatic gates

A survey of 600 dairy farmers in February 1987 showed that it takes some farmers (on medium to large farms) well over an hour a day fetching and closing in their cows. Many of these same farmers can spend $300,000 on rotary milking parlours to achieve faster milking, which only takes an average of one and a quarter hours per milking.

Dogs can move the cows but someone has to open and close the gates. Automatic gates obviously have a place in these situations.

Ruakura has also shown the benefits of using an automatic gate to ration pasture to animals at preset times.

Helping control bloat by frequent rationing of pasture rather than the present hunger/gorge situation calls for an automatic gate. A good one could sell in hundreds for this purpose alone. Our present one, given free to a farmer who was plagued with bloat, was discarded because of its unreliability.

The first step is to have a reliable, easily portable automatic gate that farmers can carry around and set up. The average farmer could easily end up with two or more of these.

Many farmers have said to me that they would like a pocket unit and that modern technology should help in achieving this. I've replied that if we could get orders for thousands we could produce what is required. It is a chicken and egg situation.

To achieve a smaller unit will mean doing without the present large batteries. Hand winding shouldn't be a problem because the farmer has to set it up anyway. A 24 hour clock would suffice in most cases. A seven day one would only be used on very large dry stock operations and when going on holiday - both minimal uses so very low volume sales.

If small it could hang on a fence, instead of requiring a stand as at present.

A special spring gate would need to be made like a measuring tape and be separate from the unit.

Many farms have swinging gates, so an automatic gate release for those would require a strong mechanical releaser and a spring to pull the gate open.

Once farmers were using these gates extensively, then the next step would be a more comprehensive system with remote controlled gates.

It would be nice to have these radio controlled with solar panels charging the batteries to operate the receivers and open and close the gates, but this is in the distant future.

Mark One could be mechanically operated from wound up springs. Mark Two could have the gates opened and closed using water pressure, which is adjacent to most gates on dairy farms but not on many dry stock farms.

Being able to automatically open the gate is more important than closing it, because animals usually look for a fresh paddock and the farmer can close open gates when next in the area.

However there is a requirement for being able to close the milkers in after milking.

Closing gates

A responder could be attached to the last cow out of the shed to close the herd in. A half hour time delay may be necessary and a battery would be needed to the pick up the signal. The distance between the cow and the receiver could be a problem if the gateway was wide and the cow ran through - being last and held back it could run to its mates.

Opening gates

The farm dog could have a responder attached to it to open a permanently programmed gate (or one set up during the day when the farmer was passing), but the dog would have to be trained to go to the gate where the cows were and wait while it opened.

In all cases a problem will be making a catch strong enough to hold the gate and yet able to release from this tension.

Using cantilevers or springs to keep the tension to a minimum on the gates would help.

Gates may have to be electrified with a lead while set, to prevent damage to the automatic release controls. A Mini Energiser could be used where power is not adjacent to the gate.

The above is very much part of animal containment so fits into our programme.

Dairy farm of the future

Completely automatic milking (cups applied and removed without manpower) is already operating. A responder beeps the cow when it is time for her to go in to be milked. The cow is rewarded with concentrates in the small automatic milking parlour, as well as the relieving of milk pressure in the udder. However, automatic milkers will have to apply the clusters more quickly and cost a lot less than ones in 2007.

The financial justification for a fully automatic milking machine doesn't exist in Europe because farmers have to have large buildings to house their cows, and have to have plenty of staff for the work involved in feeding their animals through their long frozen winters. Milking for these people gives the same enjoyment that some people get out of taking their money to the bank for depositing.

In New Zealand, however, there could be justification for automatic milking to -

1. Save building a massive rotary milking shed with a large concrete yard for $400,000 plus.

2. Save labour - many farms employ an extra staff unit just to help with the milking. Under our system there is frequently insufficient work to keep both occupied between milkings, especially when contractors are used for silage, hay, etc.

3. Fast milking (300 cows per hour) requires a tremendous volume of water to cool the milk. Continuous milking with a smaller plant over a longer period wouldn't require such large flows over a short period.

Automatic monitoring of the milk quality (mastitis, etc.) and the cows (electronic identification) would warn the farmer of problems in a more efficient way than is done at present. This technology is already available.

Farm layouts would have to be a bit different from present, to allow cows to come and go from the paddocks. Two races may be necessary, or two new small parlours may have to be built in the centre of the

farm to allow cows to come in one way and go out the other, because the reward encouraging them to come to the parlour would be the knowledge that they would then go to a fresh paddock. In early lactation they would come in to have their milk removed, and would learn the routine of going to a fresh paddock.

A flavoured mineral mixture with a bloat control additive could be used to encourage cows to milking.

For the above system to operate, it would be necessary to have one way gates and the whole operation computerised, so that, after all the cows have been milked, the gates change to allow the first cows to re-enter, be milked, and go to another fresh paddock.

Three times a day milking which would increase production would be a possibility.

All the above may sound intricate and expensive, but I am sure would cost a lot less than current 60 cow rotaries and pumping and cooling systems.

Fully automatic continuous milking would also allow for the on farm concentration (reverse osmosis or ultrafiltration) of milk which contains 87% water. Under New Zealand conditions this is now cost prohibitive because of the large unit required to handle up to 2,000 litres/hour. Being able to do this would halve dairy company transport costs and reduce milk handling and evaporating costs. Waste disposal and water pollution problems would also be reduced and the product left on the farm would be put to use as a stock supplement. It could be flavoured and used as an added incentive in encouraging the cows to come to the parlour.

This section repeats the message that automatic animal control is necessary.

Parlors built in the centre of farms would allow cows to go away in the opposite direction.

Conclusion

Power fencing helps make animal farming profitable and sustainable, so the effort required to achieve the above suggestions is well worthwhile. If installation is good and monitoring is done, the labour required is less than with any other fencing system and the profit is greater.

If you have problems, read all the above again - there is a lot to take in, but once you understand it, it becomes second nature.

Take pride in your fencing and enjoy your animals.