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50 YEARS OF POWER FENCING

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Abstract

The history of high power fencing shows how this New Zealand idea contributed extensively to the profitability of pastoral farming by improving animal control, pasture utilisation and weed control.

The development of electrified fencing is traced with examples of Incidents, starling in America in the thirties where it has improved only slightly, while in New Zealand development started in 1936 to become a world leader thanks to the Phillips (Ruakura) low impedance fence.

Examples of its benefits are described by quoting farm profitability competition winners.

Power fencing continues to become more sophisticated, with items like voltage alarms, shock stops and tumblewheels.

Keywords: power fencing, pasture improvement, weed control.

INTRODUCTION

Power fencing can be given credit for having helped 'make' New Zealand grasslands, so it is appropriate that its 50 years of development is recorded for this Grasslands Conference.

Fences are used mainly to contain animals and control their grazing, and to control weeds and improve pastures.

The first animal control was the tether, followed by stone walls, wooden rails, plain wire, barbed wire, and, for the last 50 years, electric fencing.

Controlled grazing has more than doubled the productivity of many areas and has helped New Zealand and other farmers produce low cost animal products.

GOOD FENCING

Historical photographs show that most New Zealand farmers have made good fences from the beginning.

Some of the reasons could be because:-'

a) Until recently New Zealand has had no surplus labour to herd livestock as is still done in many countries.
b) The difficulty of retrieving animals which escaped into the bush.
c) New Zealand's poor soils, which are more inclined to grow weeds than pasture unless they're grazed correctly.
d) Ample supplies of timber.
e) New Zealand's distance from markets, making low cost farming imperative.

Conventional fencing

New Zealand's thousands of kilometres of conventional fencing have been renowned for about 50 years and its high power fencing for about 20. In recent years, the length of power fencing erected annually has passed that of conventional fencing, and power fencing has become so effective with its high powered shock that some animals, once trained, avoid all wires. This results in reduced pressure and maintenance on conventional fences, but only on farms which have more than half the fences electrified.

Many conventional fences now have an offset wire to protect them, and to allow block grazing without having to carry a battery energiser with the reel and treadins.

However, many farmers still like to see nine wire heavily battened fences around their farms.

Those who over capitalised on conventional fencing later had to spend vast amounts on maintaining it, and after twenty to thirty years had to replace much of it.

There is, however, still a place for conventional fences, such as along railway lines and around homes with young children, but even these would benefit from an electrified offset wire.

The need for protection with an electrified wire has increased in recent years as heavier and more concentrated stocking has increased.

Electrified fences

The change to using electric fencing, like most changes, has been slow and still has a long way to go, although the current reduced profitability of farming is speeding it up. The dairy farmers who used power fencing to full advantage from its inception became more profitable. They achieved two to three times as much subdivision, which in turn reduced the time they had to spend moving temporary fences. They earned more income which could then be spent on fertiliser, drainage, contouring and the purchase of more land.

Bay Farms of Te Aroha, who won the Dairy Section of the Gallagher Farms Competition with an economic surplus of $1,727 per hectare, have 70 paddocks, all with at least one electrified wire. Stuart Bay during his interview stated "The use of electric fencing for pasture management is the A.B.C. of farming".

Lornie Brothers of Orini, last year's beef winners, have 150 two and a half hectare paddocks, all electrified, and in winter they move 40 electric fences daily, one in front of and one behind 20 mobs of 50 bulls. Their economic surplus was $1,000 per hectare on developing peat — more than that of many dairy farmers on improved land.

Sheep farmers like Gerald Hargreaves of Fairlie, who in 1976 subdivided his farm with Insultimber into 100 four hectare paddocks, are now buying more land to keep their farming profitable. Those who didn't use the benefits of power fencing during the profitable years can now hardly afford to subdivide the land they already own, let alone buy more.

The adoption of temporary electric fencing and permanent power fencing has been going on for 50 and 30 years respectively. There is still a long way to go before it could be said that the benefits they give are being fully utilised.

Unfortunately there have been a few problems which have slowed the acceptance of electric fencing. These include shoddy products, poor construction and inadequate earthing.

The importance of earthing is not always appreciated because not many people understand electricity. The easiest way to explain it is to relate it to water, which most understand because they use it and can see it. If a pump has no suction pipe, it can't deliver water, and if its pipe is small and has leaking joints the volume of water will be low.

The development of high powered energisers provided the ability to electrify long lengths of fencing, and made permanent electric fencing more attractive at about a quarter the cost, and with a quarter the construction time, of conventional fencing. Maintenance is also reduced.

One single electrified wire on a dairy farm can control cows at a sixth the cost per kilometre of a five wire non-electrified fence, which would be necessary. Sheep fences vary from a fifth to a third, and deer from an eighth to a quarter the cost of conventional fencing.

The first electric fences

The manufacture and sale of electric fence "chargers" as they were called in the U.S.A., began there in the early 1930's, and by 1938 there were an estimated seventy thousand in operation.

They consisted mainly of two types —

a) Interrupted A.C., mains powered, using a transformer and a current interrupter which allowed the transformer to be energised at regular intervals. One side of the transformer secondary winding was connected to ground and the other through a high value series resistance to the fence wire. High output impedance was used to limit output current for perceived safety reasons.

b) Inductive discharge, battery powered, using a step-up transformer with a quick make and break mechanism connected to the primary circuit. These also had a high output impedance.

In the early thirties some units were made by having continuous current flowing through transformers with their primary winding connected to the AC. power supply. The secondary winding had one side connected to ground and the other to the fence. Current went through a series inductor to limit output for safety reasons. Like the others, these had high output impedance. Home made models of this type caused some fatal accidents.

High impedance

A high impedance energiser on a short well insulated fence can build up voltage equal to that of the open circuit voltage because of the pulse reflecting. However, with a long fence line, or one with the normal leakage encountered on a farm, the voltage is generally insufficient to control even quiet dairy cows.

In 1936 Bill Gallagher Senior read about the development of energisers in the U.S.A., and made one to control the dairy cows on his farm at Horotiu. It worked well, and before long he was making them for his neighbours. In 1938 he sold the farm, and started manufacturing them. World War II brought a halt to this, until 1944.

Energisers were developed in other countries along similar lines.

Old Ford ignition coils were used, but the limiting factor was their high impedance which wouldn't allow high current flow. Specialised induction coils developed later overcame this.

ROTATIONAL GRAZING

In the late 1950s rotational grazing in dairy herds became popular. The increase in the number of fences at the Ruakura Agricultural Research Centre made Mrs Doris McMeekan, wife of Dr McMeekan the Director, complain about them from an aesthetic point of view. At a Ruakura party one night she suggested that animal control could possibly by achieved by more effective means than the conventional fence, which was merely a "barricade". Doug Phillips of Ruakura tried various ideas, including wires underground, but found the power requirement to be far too high, and within the danger region. While working on this possibility, he developed a method of producing a safe, high energy, low output impedance energiser, and so discovered the principle used today.

Because he demonstrated the energiser on uninsulated supports it became known as "unshortable".

The concept was offered to the Department to patent, but after six months Wellington rejected it, saying it had no future, and that Doug Phillips could if he wished patent it himself. He did this in 1963.

One commercial manufacturer, who is no longer in business, wrote to the Director of Ruakura saying that the theory was impossible, and that anyone suggesting that such an energiser could be made was a fool. He visited Ruakura and seeing the fence supported on nine steel posts, knelt down and held the wire — but only once, after which he drove away furious, and no doubt embarrassed.

He then tried unsuccessfully to have the standards regulations changed to ban low impedance energisers. Some countries still have regulations prohibiting them.

Doug Phillips had difficulty finding a manufacturer, until Morty Foreman, who later formed Plastic Products, took up the project.

Initially the energiser was known as the Phillips Fence, but objections that this name gave it an unfair advantage (Phillips of Ruakura was a well respected scientist), caused it to be renamed the Waikato, although many farmers had started referring to it as the Ruakura Fence.

With the rotational grazing of dairy cows increasing rapidly, the comparatively high powered Waikato energiser was a boon. At that time conventional fencing cost about £800 a

mile, whereas the single electrified wire cost only f 100 per mile. In Doug Phillips's words, it was a revolution in grassland farming, making intensive grazing possible.

It also allowed the fencing of gullies and rough areas for animals to improve, and made possible the break feeding of crops like chou moellier. Doug's telephone kept ringing with enthusiastic farmers expressing their surprise and delight at the effectiveness of the fence.

The Waikato energiser, putting out 2,500 volts and about two joules, was low powered compared with today's 6,000 volt 20 joule energisers.

Modern capacitors and electronic switching devices now allow high energy, low impedance energisers to charge hundreds of kilometres of fence.

New Zealand leads

Manufacturers of "chargers" in the U.S.A. and in many other countries are still producing low powered high impedance energisers, so New Zealand exporters have taken the initiative and are now supplying over 100 countries around the world with high power energisers.

Pulse shape is important because the international standard prohibits the width (time on) from exceeding 0.0003 of a second and the voltage from exceeding 5,000 volts at 500 ohms. In that short time sufficient energy has to be sent along the fence line to counter leakage and electrify sometimes hundreds of kilometres of multiwire fence.

Safe

It still surprises those with electrical knowledge that such high power is possible and not lethal, but the technology of releasing a high charge in only 0.0003 of a second makes it safe.

This New Zealand technology is still not being used by manufacturers in America. Some of their low powered energisers there are still "on" for half a second, giving a long tingle (rather than a sharp severe shock) and a spark which can cause fires.

The frustrations which slowed Doug Phillips are still slowing entrepreneurs when they try to market power fencing in some countries with thirty year old regulations, and, in some cases, local manufacturer hindrance, through regulations aimed at keeping competition away.

Gates

Early electric fencing suffered from not having electrified gates. The spring gate was developed in 1979 and the drive through gate soon after. Now there are a number of electrified swinging gates available but there is room for improvement in this area. Our ingenious farmers are likely to invent improved gates to fill this gap.

MORE INTENSIVE GRAZING AND INCREASED PROFITS

All grass wintering could not have developed without power fencing. Back fencing, a real grass grower, would hardly be possible without it.

Farmers who have used power fencing to full advantage are doing very well financially.

The Gallagher demonstration farm on Waikato peat, developed in three years from gorse, blackberry and weeds carrying no stock, to highly productive pasture carrying 20 su/ha has had the weeds controlled with only dairy calves and heifers. No sprays have been used except under fence lines and fenced off trees. There are 35 small paddocks, so gorse and all weeds are eaten. As a demonstration, one of the paddocks is double the size of the others — it has a weed problem and poorer pasture.

Power fencing for livestock control is one of New Zealand's most important assets. It has helped achieve a substantial increase in the low cost production of animal products, has improved pastures, has controlled and even eliminated weeds, and has saved millions of dollars in fertilisers, weed sprays and capital expenditure.

The exports of energisers, accessories and fencing materials have earned overseas exchange in excess of that earned from either the deer or Kiwifruit industries.

MODERN DEVELOPMENTS

Power fencing now includes sophisticated fence voltage alarms to warn users of voltage drops caused by faults, damage from trees, etc. The alarm can be used for security purposes to protect valuable animals and property like bales of fibre.

Some alarms are connected to telephones to alert owners of voltage drops, allowing a high degree of security.

Modern cutout switches are sealed to keep out moisture and spider webs, so as not to leak or give operators a shock. Flexible connectors allow bottom wires of fences to be easily disconnected when grass growth covers them, thus helping maintain high voltage on long fences and allowing the grazing of grass touching the bottom wires.

Self insulating hardwoods outlast steel posts, and give easily erected and maintained permanent fences. Insulators with tracking distances of 25 mm and insulation thickness of 10 mm are available to cope with 6,000 volts and high energy. Unfortunately many inferior insulators and tubing are still made. purchased, and complained about by unsuspecting users.

The development of the digital volt meter was a giant step forward, in that it saved time in fault finding, and gave a tool to measure the efficiency of earth systems,

Temporary fencing has been made easier with light polywire (the latest of which has more highly conductive metal strands), fully insulated multiwire tread-ins, geared reels and tumblewheels. The latter allow the movement of temporary fences from one end of the paddock by pulling the tumblewheels along. A disc keeps power flowing to the top four legs and disconnects the bottom two (which are on the ground) so they don't short out the fence. A long central hub on the polywire prevents the tumblewheel from falling over.

The components of permanent fencing continue to improve and become easier to use, with products like shockstops which send a message back to the energiser to turn it off, and on again, as required.

FENCING IN THE FUTURE

The quality of power fencing equipment should continue to improve (there are still cheap, short lived products on the market). The operation of electrified gates is likely to improve just by using current technology. They can be remotely controlled from wherever the farmer is. Thinner but more visible and more conductive wires are likely. Rays or beams are unlikely to be used, because they would have to be visible to give stock control.

Power fencing use will increase further — most farms aren't yet fenced sufficiently to give weed control and optimum pasture growth with a minimum of labour and fertiliser.

Paddocks will be smaller to save moving fences, and farmers who use power fencing to the full should thrive in the future likely economic climate, which will require food to be produced by fewer farmers at relatively lower prices. More farmers will have to work off the farm and will set stock their beef, sheep or goats in smaller mobs in smaller paddocks, to reduce walking, pasture damage, bloat, animal competition and stress.

Automatic gates will be used more, to save the farmer going to the back of the farm just to open a gate.

The more intensive grazing of pasture, as practised in the Waikato and Southland, is likely to spread for the same reasons it did in those two places — because no more adjacent land is available for purchase.

The use of power fencing to control disease and parasite spread, as is being used in other countries, is likely to increase here as the demand for un-polluted foods increases.

The control of disease spreading opposums will increase, as will the breaking of parasite cycles like that of the liver fluke, because using power fencing is a low cost means of achieving results.

References

Gallagher Power Fencing Manual.