AN EXPERIMENT IN CONTROL OF BRACKEN FERN AT TUTAKI, MURCHISON

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The Murchison district has only a small area of flat land along its river valleys and at their confluence. Steep hills cover the remainder of the country. Rainfall is approximately 60 in. per year. When the land was originally cleared bracken fern *(Pteridium esculentum)* became a menace. The struggle over the years to control this invasion has been long and strenuous and, except on land that can be cultivated, largely unrewarded. Some degree of control has been achieved on the closer hills, but generally results have not been good. Murchison Federated Farmers in 1958 asked the Department of Agriculture to conduct some experimental work to find out how this weed could be handled economically.

Bracken fern has been controlled in other places in New Zealand for many years usually by fencing areas into small blocks, burning, and crushing the new growth with heavy concentrations of cattle. Trampling by the hooves of the cattle helped to kill the young fern fronds and possibly did as much good- (or more) as did the grazing. The restricted diet, however, was not good for the animals, which suffered from impaction, fern poisoning, and near starvation. Deaths were not uncommon.

When cattle were cheap and plentiful they could be used as animated cultivators to do such work economically. With today's values it is different; every sick or dead beast means an appreciable loss.

Beef cattle are not numerous on Murchison dairy farms, as any good grazing is required for the dairy herd. Most farms carry a few sheep and beef cattle on the hill country and rough gullies. Under these circumstances fern control is not easy.

One of the first experiments carried out by us attempted to replace heavy stocking with cattle by use of weed killers. Hormone sprays were well publicised in 1958 and we decided to try them on some small-scale trials on bracken, The experiments were only partially successful, and fern growth was just as strong again the following year. It was then decided to conduct a larger experiment on a paddock scale, using fire, oversowing with pasture seeds, topdressing, and heavy stocking to control the invasion.

To do this it was first necessary to find a suitable area on a a farm where there was also sufficient stock to control growth at the correct time, and where there was other better feed where the animals could be moved between grazings of the fern. An area of 57 acres was chosen on the property of Mr K. G. Rouse, Tutaki Valley. Mr Rouse is a dairy farmer who also runs a small beef herd and a flock of sheep. He is assisted on the property by his son Mr Henry Rouse, who is now taking over the burden of management from his father.

The area selected, a Matiri soil type, is a steep gully in Black-water Valley with one face damp and shady, and the other sunny and dry. A secondary spur runs off the shady side, making a good line for subdivision and enabling Mr Rouse to fence the area into paddocks of 15 acres and 42 acres respectively. This was a great help in managing the grazing later on in the flush of the growing season.

When our proposition was placed before the farmers there was considerable consternation at the expenditure involved. (Super-phosphate is approximately £15 per ton delivered at Murchison.) Even Mr Rouse, who had previously been applying super to an area at 1 cwt per acre, was a little doubtful. There were others whose views were not so moderate, but we decided to carry on.

Seeds and Fertilisers

At the beginning the fern was dense and much of it up to 6 ft high. This was burnt in April 1959. Except for odd patches of fern on the shady soils which were too short to carry the fire at the time, it was a good, clean burn. The small patches left were cleaned up later. The area was sown by aeroplane on 1 August with (per acre):

3 lb of white clover
3 lb of Montgomery red clover
3 cwt of molybdic super
5 cwt of lime

The clover seed was inoculated, but ndt pelleted. At the end of the next February (February 1960) a further application of seed and fertiliser was spread over the area as follows:

5 lb of cocksfoot
2 lb of dogstail
1 lb of Tallarook subterranean clover
1 lb of Mt. Barker subterranean clover
2 cwt of aerial super.

Seed mixtures were definitely experimental as we had no precedent in this district to guide us. Twelve months later (March 1961) another dressing of superphosphate at 3 cwt per acre was sown. It was our intention to stop at that and see what happened during the next 12 months before deciding on further action. Mr Rouse, who was somewhat sceptical when our proposition was placed before him and had been watching progress very closely, was now convinced that we were working on the right lines and was following our fertiliser programme elsewhere on the farm. In August 1961 while topdressing another area he sowed a further 2 cwt of super per acre on our experimental block as well. This was followed by an insurance dressing of 2 cwt of DDT super in April of this year.

Pasture Establishment and Stock Management

Clover establishment was not fast. In early December plants were 2 to 3 in. in diameter. By February the white clover was 6 to 8 in. high where it was protected by short fern, and by April it was well rooted and providing an appreciable amount of feed. Right throughout the trial white clover has been superior to both Montgomery red clover and subterranean clover, both of which are present but contribute comparatively little to the welfare of the sward.

Under the system of grazing necessary to control fern, white clover has suffered from severe defoliation, but has recovered and improved. It is possible that subterranean clover will still improve; I believe that it is yet too early to be definite about it. At present we have a dominant white clover pasture with some red and subterranean clover and thriving browntop, Yorkshire fog, danthonia, cocksfoot, and a little perennial ryegrass. The last was not sown.

Grazing has at all times been managed with the view of controlling fern growth. That it was also necessary in the initial stages to control the improved grass growth and so prevent smothering of clovers was incidental. There were other times when shortage of feed elsewhere made it necessary to graze the experimental blocks longer than desirable. This happens on every farm.

During the first six months, while growth was moderate, both blocks, that is, the 15 and the 42 acres, were grazed as one. From then on it was more convenient to graze them separately. All classes of stock on the farm except the dairy cows were used for fern control. Dry beef cows, cows and calves, ewes and lambs, hoggets, steers, and yearling cattle were all used as convenient. Sometimes cattle or sheep were grazing together and sometimes separately, depending on need or convenience at the time.

Effects of Treatment

The experiment is situated on a Matiri soil. This, although not the poorest soil in the Murchison area, is still fairly acid and fairly low in phosphate. Little work has been done with fertiliser experiments and the pattern of this one was taken from work in other areas. We have found elsewhere that superphosphate and molybdenum have given far better results when used in conjunction with lime. Five hundredweight of lime is little enough, but the effect does appear to last for about three years.

Where soil phosphate is naturally low it is essential to apply heavy dressings in the early stages if strong clovers are to be established. There is not much use in controlling any weed if no attempt is made to replace it with something useful. Browntop, danthonia and fog are poor producers under low fertility. When combined with clovers and topdressed, however, they can become very useful species and provide a large amount of feed. In the past we have not had any great success in establishing better grasses before the fertility was raised by healthy clover. Cocksfoot may have established better if sown a year later. Here again I believe it is too early to be definite. Cocksfoot is present and should improve with age.

It will be noted that the area was stocked during the month of sowing. We have found from past experience that clovers establish better if overshadowing by grasses is kept to a minimum. During the first six months most of the grazing came from the fern and from extra growth of existing grasses. It was only then that clovers, especially white clover, gave any appreciable amount of feed. Better grasses will thrive only after fertility has been built up by the clovers and topdressing.

Despite the necessity for raising fertility the most important aspect of fern control is management of the stock. I think that it is important-very important-that the fertility level should be raised so that clovers can thrive, but even so, if the stock are not managed well enough to control the fern when it is growing strongly in the springtime, all that trouble and expense can be wasted. Stock will readily eat fern in the curler stage, but few enjoy it once it unrolls and hardens. No stock troubles were apparent under the management in this experiment, where heavy concentrations of stock were carried on a system of mob stocking or rotational grazing. When the fern is growing strongly it is more important to graze that than to study the health of clovers. At least 10 sheep equivalents per acre, preferably more, are required at any one time, and provision for alternative grazing must be provided. After New Year, grazing can be relaxed to allow the clover to strengthen up before winter.

Fern was noticeably less vigorous in the second spring, although even then it could not be taken lightly. An abnormal dry spell last December followed by good rains created a false spring in the area, and fern made unusual growth for that time of year. This was noted and the stock managed accordingly. Grazing records have been kept consistently throughout the period of the trial.

With mixed stocking it is difficult to assess the grazing with any exactitude, but by keeping a tally of the number of animals grazed at any one time, and the number of days *each* mob *or* flock was grazing, it has been possible to arrive at an arbitrary figure for comparative purposes. To do this it was first necessary to convert all animals to ewe equivalents. For instance, the first mob of 250 hoggets grazed the 57 acres for 14 days in the first month (August 1959). If we concede that one hogget is equivalent to 0.7 of a ewe, we find that by multiplying 250 hoggets by 14 days, and then by 0.7 ewe equivalents we arrive at the figure of 2,450 grazing days from 57 acres for August. To carry it further we can then divide 2,450 by 57 acres and then by 31 days, reaching the simple answer of 1.39 ewe equivalents per day. By doing this our grazing, it has been possible to arrive at an arbitrary figure for

	Ewe equiv. per acre	Ewe equiv. per acre per year
1st period, 1 Aug 1959 to 31 Jan 1960	2.83	—
2nd period, 1 Feb 1960 to 31 July 1960	3.94	3.38
3rd period, 1 Aug 1960 to 31 Jan 1961	3.09	—
4th period, 1 Feb 1961 to 31 July 1961	1.94	2.5
5th period, 1 Aug 1961 to 31 Ian 1962	4.9	—
6th period, 1 Feb 1962 to 31 July 1962	3.86	4.38

Costs and Returns

Costs are always important, but only in so far as they determine the amount of profit or loss. Naturally they should be kept as low as possible, but not to the stage where they cause diminishing returns.

In this experiment our costs were high. From the initial top-dressing and oversowing (in August 1959) to March 1961, total costs, including 27 chains of fencing, cartage, and application of seeds and fertilisers, were £14 2s. per acre, The last two dressings cost another £4 3s., a total of £18 5s. per acre to the present.

This is the cost, What have we gained? That is the critical point. For the purpose of this experiment I have assumed that I can convert cows and calves to ewe equivalents and quote income on the price of wool and mutton. I have also assumed an arbitrary

figure of £2 10s. profit per ewe each 12 months. That is possibly a little low for 1959, but should average out reasonably well. By using these methods we reach the following:

	£	s.	d.
1st year, 3.38 ewe equivalents per acre @ £2 10s.	8	9	0
2nd year, 2.5 ewe equivalents per acre @ £2 10s.	6	5	0
3rd year, 4.38 ewe equivalents per acre @ £2 10s.	10	19	0
	£25	13	0

There is a further grazing period of six months before any further expense will be incurred and then only maintenance topdressing is required.

The area that was dense fern four years ago is now carrying a good white clover-dominant pasture. There is fern there still. It is sparse, short, and weak. It could possibly be as bad as ever if neglected for a couple of years, but at present is well under control and is becoming weaker each year.

While the results obtained here may not necessarily be the same as what may be expected on other soil types, they show that fern can be controlled economically.

Acknowledgements

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